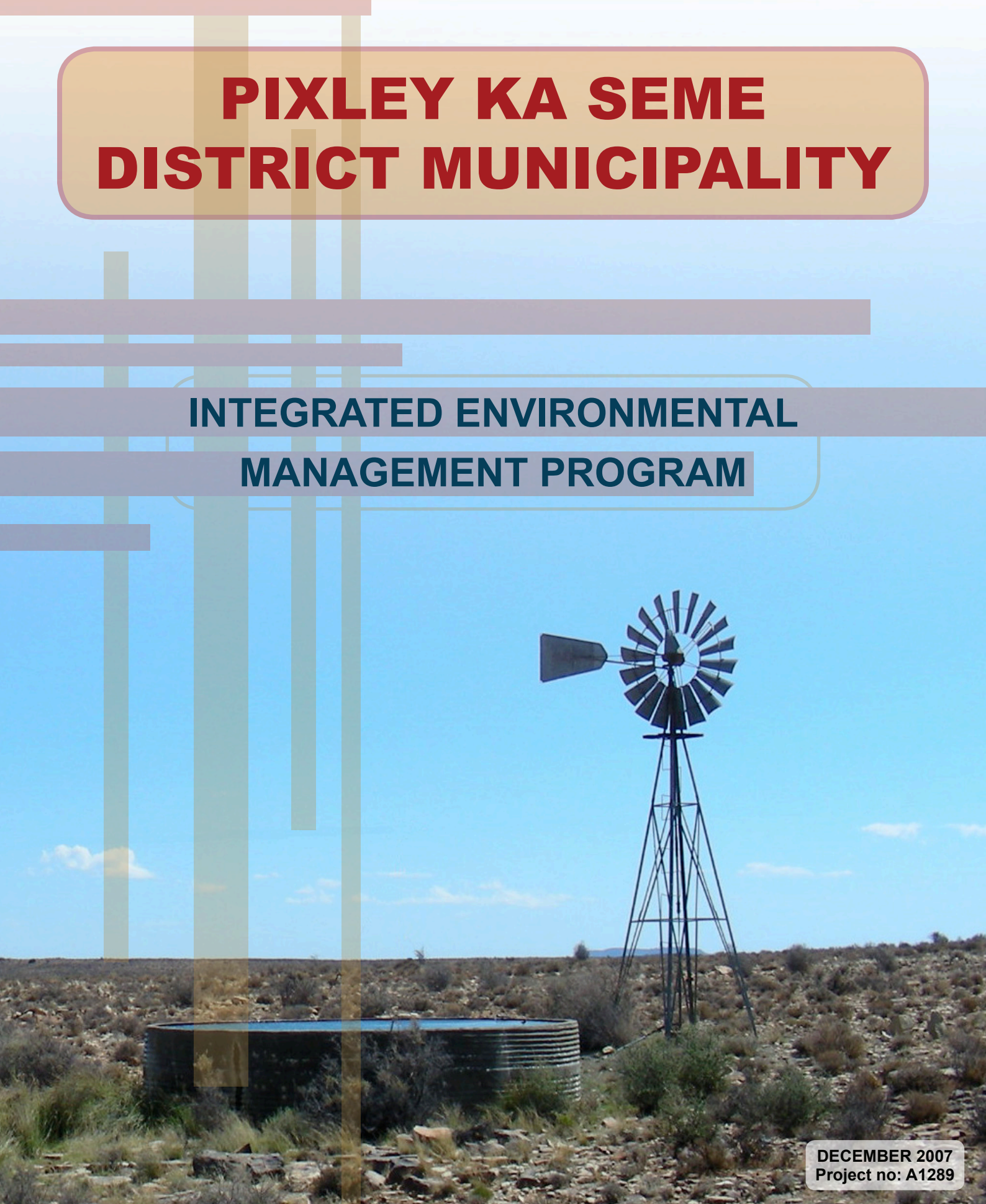


PIXLEY KA SEME DISTRICT MUNICIPALITY

INTEGRATED ENVIRONMENTAL MANAGEMENT PROGRAM



DECEMBER 2007
Project no: A1289



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INDEX

INTEGRATED ENVIRONMENTAL MANAGEMENT PROGRAM

PIXLEY KA SEME DISTRICT MUNICIPALITY

- 1. Executive Summary**
- 2. Final Status Quo Report**
 - Annexure 1 – Vegetation Types
 - Annexure 2 - Maps
 - Annexure 3 - MeerKAT / SKA Telescope Project Information
 - Annexure 4 – Mokala National Park Information
- 3. Sustainability indicators**
- 4. Institutional and Legal framework**
- 5. Local Municipality Issues, Strategies & Opportunities**
 - o Emthanjeni
 - o Kareeberg
 - o Renosterberg
 - o Siyancuma
 - o Siyathemba & DMA
 - o Ubuntu
 - o Umsobomvu
 - o Thembelihle
 - o Generic Issues & Opportunities (for local municipalities)
 - o Pixley Ka Seme IDP Projects
- 6. Urban Renewal Guideline Document**
- 7. Civil Works - Impacts & Mitigation Measures Matrix**
- 8. Stakeholder Participation Report**
- 9. Reference Table of Documents**

- 1 -

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

OVERVIEW

The Pixley Ka Seme District lies in the Northern Cape Province, shares its boundaries with Free State, Eastern and Western Cape. It covers an area of 102 727 km². Approximately 80% of the study area falls within the Nama Karoo Biome, 15% in the Kalahari and 5% in Grasslands Biome.

KEY OPPORTUNITIES

MeerKAT/SKA Telescope Projects

This project is of national and potentially international importance. With the current Karoo Array Telescope (MeerKAT) project at more than R800 million, and the potential Square Kilometre Array Telescope (SKA) at R12 billion, such investment can have tremendous off spins for the region as a whole. The SALT Telescope in Sutherland is such an example, as it has helped put Sutherland on the tourism map. Stargazing as a tourism activity can very well link to such projects.

Mokala National Park Establishment

This project is of national importance. It is the latest National Park to be proclaimed, and is situated approximately 60km north of Hopetown in the Siyancuma Municipality. on the N12 to Kimberley. Mokala is a Setswana name for a Camel Thorn (Kameeldoring). These trees occur in dry woodland and arid, sandy areas and are one of the major tree species of the desert regions of Southern Africa. This immensely important species has a great range over the Northern Cape. The Mokala National Park will also draw visitors from national and international origin.

Mineral Resources Exploitation

The study area is rich on mineral resources including alluvial diamonds, uranium, salt & tiger's eye semi-precious stone. Opportunity exists to exploit these resources, especially uranium for its specific value for nuclear power. The little amount of water, long distance to major ports, and low resilience of the land is however factors that count against this

developments. Great care should be taken when mining in the area for these reasons, to ensure sustainability.

Tourism

The study area is a rich landscape of historic events & architecture, unique (endemic) plant and animal species, the best stargazing in the country, friendly towns and people. Although great efforts have been made in tourism for the area, it remains one of the core opportunities and requires more investigation and implementation still. Example of this is the development of specific tourism routes, such as Heritage or Unique Plants (as per Midlands Meander in KwaZulu Natal).

KEY ISSUES & THREATS

Land degradation

Land use in the Karoo currently consists of sheep farming, some ostrich farming, game farming (that is currently on the increase), as well as crops farming that include lucerne, onions, garlic etc. Mining and development activities are likely to expand in the future.

One of the major threats to biodiversity in the Karoo is the long-term overgrazing by small livestock. This vast and open, semi arid rangeland covers a large part of South Africa and is impressively adapted to its climatic extremes. Evidence of degradation in these parts of the Karoo is clearly visible, mainly as a result of environmental (low and erratic rainfall) and anthropogenic factors (poor management practices).

The degradation is characterized by large bare and denuded areas and it seems these areas will not recover by natural succession processes alone. Some sort of **active intervention has therefore inevitably become necessary in order to avoid aridification and possibly also desertification.**

(Source: Endangered Wildlife Trust, 2007)

Loss of riverine habitat

Only 5% of terrestrial ecosystems in South Africa are critically endangered, while 44% of river ecosystems are critically endangered. These river courses together with the riparian zones have an important biodiversity function as well as an economic value in the Karoo. These denser structures of vegetation are high in productivity and are extremely important refuges for many animal species. The riparian zones are also very important to stock farmers as it provides grazing, especially during dryer seasons.

The flagship species for this habitat is the Riverine Rabbit (*Bunolagus monticularis*), which is Critically Endangered. Today the population size is estimated to be just a view hundred animals. At present, none of the Riverine Rabbit habitat is protected within a provincial nature reserve or national park and the species only occurs on private Karoo farmland (Ahlmann, Collins & Seal, 2000). In response to the rapidly declining populations, landowners in the Karoo have established Riverine Rabbit conservancies covering an area of approximately 350 000 ha of private farmland (*pers. comm.* Ahlmann, 2007¹).

(Source: Endangered Wildlife Trust, 2007)

Unrehabilitated Asbestos Mines

In the Northern Cape asbestos is still perceived as an important issue because of the many unrehabilitated mine dumps that still have the potential to pollute the environment, and therefore cause asbestosis or mesothelioma. The public still has access to some of these dumps, and some individuals recover the asbestos for resale as there is apparently still a market for it (Du Plooy, pers comm., 2003). **In Prieska about 5 new cases (out of a population of about 15 000) of mesothelioma are diagnosed annually although the mines in the area have been closed since 1979 (Smith, pers comm., 2004).**

Need for Urban Renewal of Apartheid-Era Townships

National Routes (or the main route through a town) was used in the previous regime to sever the townships from the white suburbs. There is a great lack of integration still today in many of the Karoo towns. Additional to this, many areas still have bucket

¹ Dr Vicky Ahlmann, Riverine Rabbit Working Group, PO Box 172, Loxton, 6985.

system toilets or French drains, which prove a risk for the ground water source of the towns. Refuse and Landfill sites close to these areas also prove a human health risk. Lack of storm water systems means the occasional rain storms causes heavy erosion and flash floods. Most of these areas also do not have trees and open space and therefore the quality of life is perceived as low.

KEY SOLUTIONS

Funding

Although some funding such as MIG is available to the municipalities and departments, it is crucial to source more funding to speed up the progress of sustainable development for human settlements in the study area. Training is also required to improve the business plans which are being put forward to large funding agencies. Identification of specific projects are crucial.

Participation & Communication

In an area with little resources and people, co-operative governance and community participation in projects are crucial. As local municipalities does not have much capacity, they are largely dependent upon the District Municipality and State Departments. These relationships must be built and strengthened.

Training & Education

Municipal and government officials can benefit enormously from training in their respective fields, and specifically regarding the environment. Environmental Awareness Training to land owners (farmers) and communities also become crucial for the sustainable management of the land.

Strategies / Initiatives / Projects

- Environmental Education of Farmers and Communities
- Compliance & Enforcement of Illegal Water Uses
- Conservation Mapping & Initiatives
- Environmentally Responsible Development
- Urban Renewal Programmes

- 2 -
FINAL STATUS
QUO REPORT

TABLE OF CONTENTS

1	INTRODUCTION.....	1
2	ENVIRONMENT	3
2.1	GEOLOGY	3
2.2	MINERAL RESOURCES	3
2.3	MORPHOLOGY & TOPOGRAPHY.....	5
2.4	SOIL.....	5
2.5	CLIMATE	6
2.6	VEGETATION.....	7
2.7	RED DATA PLANTS & HABITAT	9
2.8	RED DATA FAUNA & HABITAT	13
2.9	BIODIVERSITY.....	41
2.10	HYDROLOGY (RIVERS, DAMS, WETLANDS, PANS & GROUNDWATER)	44
2.11	AGRICULTURAL POTENTIAL & IRRIGATION ALONG RIVERS.....	50
2.12	GAME MANAGEMENT CAPACITY	53
2.13	ALIEN INVADER PLANT SPECIES	56
2.14	TOURISM.....	58
2.15	INDUSTRIAL POLLUTION	59
2.16	AIR QUALITY	61
2.17	ENVIRONMENTAL HEALTH.....	62
3	TOWN AND REGIONAL DATA.....	65
3.1	MUNICIPAL AREAS	65
3.2	POPULATION & DEMOGRAPHICS:	65
4	CULTURAL AND HERITAGE DATA.....	67
4.1	CULTURAL AND HISTORIC SITES.....	67
4.2	HERITAGE SITES	70
4.3	POTENTIAL HERITAGE SITES	70
4.4	GRADING CRITERIA	71
5	INSTITUTIONAL AND LEGAL DATA	73
5.1	LEGISLATIVE FRAMEWORK	73
5.2	GOVERNMENTAL STRUCTURES.....	73
6	CONCLUSION	76

ANNEXURE 1 VEGMAP VEGETATION UNITS

ANNEXURE 2 MAPS

MAP 1	GEOLOGY
MAP 1A	MINERAL DEPOSITS
MAP 2	MORPHOLOGY
MAP 2A	SLOPE ANALYSIS
MAP 3	SOIL POTENTIAL (ENPAT)
MAP 3A	LAND CAPABILITY (SANBI)
MAP 4	BIOREGIONS (VEGMAP)
MAP 5	VEGETATION UNITS (VEGMAP)
MAP 5A	CENTRES OF ENDEMISM (VEGMAP)
MAP 5B	ALIEN VEGETATION (SANBI)
MAP 5C	TERRESTRIAL AND RIVERINE CONSERVATION STATUS (SANBI)
MAP 6	BIODIVERSITY (ENPAT)
MAP 7	EVAPORATION
MAP 8	HYDROLOGY
MAP 9	LAND COVER
MAP 10	INFRASTRUCTURE
MAP 11	NATURE BASED TOURISM POTENTIAL

ANNEXURE 3 MeerKAT / SKA Telescope Project Information

ANNEXURE 4 MOKALA NATIONAL PARK INFORMATION

ANNEXURE 5 ENDANGERED WILDLIFE TRUST - RIVERINE HABITAT REHABILITATION PROJECT

1 INTRODUCTION

African EPA was appointed by the Pixley Ka Seme District Municipality (PKDM) to embark on the process of compiling an Integrated Environmental Management Program (IEMP) for the District.

Although not clearly stipulated, both the National Environmental Management Act (NEMA) and the Integrated Development Plan (IDP) require that the environmental factors of an area must be included in the land-use decision-making process. Pixley Ka Seme District Municipality (PKDM) is acting responsibly to require the completion of an Integrated Environmental Management Program (IEMP). The African EPA team assisted the Pixley Ka Seme District Authorities in developing a data base for decision making. Land use decision making must be taken with adequate environmental resource information available to ensure sustainable and appropriate environmental management to the benefit of the residents of PKDM.

African EPA recognises that the Pixley Ka Seme District Municipality set the goals of an IEMP to include the following:

- Ensure all environmental issues are appropriately addressed.
- Minimize potential negative impact of all envisaged projects
- Ensure the integrated development planning process complies with environmental legislation
- Provide guidelines to investors in terms of environmental considerations
- Demonstrate municipalities commitment to the promotion of local biodiversity
- Identify development opportunities and threats to the environment.
- Provide a framework for sustainable development.

As was discussed and explained in the project proposal, three distinct phases can be identified in compiling a strategic IEMP for the District Municipality:

Phase one: Status quo and environmental profile for the district.

Phase two: The analyses of data and issues identification.

Phase three: District environmental strategy, indicators and opportunities.

African EPA now presents the Draft Status Quo Report (SQR) Sustainable development is only

possible if all relevant environmental issues are known and the complexity and cross cutting nature of the environment understood. Protection of the environment and promotion of economic development are not separate challenges. Development cannot subsist on a deteriorating environmental resource and the environment cannot be protected when projects or development plans consistently fail to consider the cost of environmental destruction. The IEMP provides the preferred development strategies for each municipality based on the principle of sustainable development. This ensures that each development proposal can be screened to establish its suitability and what possible environmental threats it poses. Mitigation measures will ensure that the environment is protected and development sustainable without compromising scarce resources.

The objective of the SQR is to enhance the understanding of environmental issues and the impacts of various activities.

The focus was to collect and assess the relevant existing information available for the study area and in so doing identify where there were gaps which necessitate additional information or studies.

This project is seen as both a process and as a product that was developed to include land use and environmental resource considerations as both identified from a status quo investigation.

The project team sourced information from various institutions and individuals. This was a difficult and tedious process in that information is scattered between national to local levels. Information was also not always reliable and the team had to do a terrain verification exercise. This SQ report was updated as soon as other information became available. The municipality has a comprehensive data base upon which sound decisions can be made.

The SQR addresses the following:

- Brief description of each field of speciality;
- Overview and identification of trends;
- Identification and “red flagging” data not available but of importance;
- GIS maps illustrating all basic data.

2 ENVIRONMENT

The results are discussed within four subsections:

Status quo- Current status or knowledge available

Gaps – Information required to compile a successful integrated environmental management plan

Issues – Those aspects or sectors within the environment which requires urgent attention to prevent, mitigate, control current and future environmental degradation (loss of capacity/potential)

Strategies – Those steps or actions required to address identified issues.

2.1 GEOLOGY

Status quo

The dominant lithological units within study area are shown in Map 1. Table 1 provides an overview of the geology in the study area ordered according to chronological and stratigraphic units (SACS 1980).

Issues

The north of the study area (Siyancuma & DMA) hosts some dolomitic geological formations (**See Map 1**). This must be taken into account with any new developments.

2.2 MINERAL RESOURCES

Status quo

Based on the information from Department of Minerals and Energy¹, the most prominent mineral resources are diamonds, tiger's eye & salt mining. The emphasis is clearly on diamond mining as indicated on the mineral map of the Northern Cape. (**Refer to Map 1A**)

[<http://www.geoscience.org.za/samindaba/maps/northerncape.htm>]

The first diamonds were found in alluvial gravels along the Vaal and Orange Rivers in what is now the Northern Cape Province, in the late 1860s. The only significant primary source of diamonds in South Africa is kimberlite, an unusual ultrabasic igneous rock that occurs as small

¹ List of active [mines](#) and [new](#) applications – Support CD: B_Data, Government, DME

volcanic pipes, dykes and sills (Viljoen & Reimold 1999).

Limited quantities of Silicified asbestos, known as tiger's eye, is obtained from near surface occurrences in the Niekerkshoop-Griquatown area and sold as a very popular semiprecious stone.

Salt is beneficiated from some 24 saltpans scattered over a large part of the Province; there are two salt workings in the Britstown area, two near Calvinia, three near Herbert, four near the Hopetown, one in the Jacobsdal, one in the Kimberley, nien in the Gordonia, one in the Douglas and one in the Vryburg Districts.

Ceramic clay is produced in the Calvinia and Hopetown Districts, while kieselguhr, used principally as a filtering agent, is exploited from pans in the Hay District.

Although the Prieska Mine at Copperton has closed down and the Areachap orebody is too small to be mined, the rocks of the Areachap Group constitute a sulphide-rich province, the true potential of which has yet to be fully evaluated.

Gaps

- Location of active mines and mining applications

Issues

As the climate within the Northern Cape Province tends to be arid, the availability of water becomes a major factor in the establishment of mining ventures at any scale (<http://www.geoscience.org.za/samindaba/maps/northerncape.htm>).

2.3 MORPHOLOGY & TOPOGRAPHY

Status Quo

Landforms associated with plains, hills and lowlands cover approximately 80% of the study area (**Map 2**). Plains have slopes of less than 5° (8%) and result in a gradual change of climate conditions (Institute for Soil Climate and Water (ISCW) Memoir Climate zones). Ridges have slopes of more than 5° and more variable climate conditions.

The ridges and escarpment have significant potential in terms of aesthetic appeal as well as habitat for rare and endangered plants and animals. These features occur mainly in the north, and on the borders of the study area. A slope analysis was also done in GIS (**Map 2A**), to indicate all the areas classified as ridges.

Issues

Ridges and Koppies must be conserved and kept clear of transformation or development of any kind.

Strategies

- A no-development buffer of 50m is proposed around areas steeper than 5 degrees (1 in 11).
- These buffers must be written into the IDP's of each local municipality.

2.4 SOIL

Status Quo

Four broad soil patterns¹ (Institute for Soil, Climate and Water – Land Type Series) have been identified within the study area (**Map 3**). The study area's soil potential was calculated using the soil conditions recorded in the Land Type inventories. The results of the algorithm indicated that the study area's soil potential range from low to moderate to high, with the low category covering the bulk of the study area.

The South African National Biodiversity Institute (**SANBI**) conducted a Land Capability Assessment by following method:

¹ These soil patterns are divide into [land types](#) – Support CD: B_Data, GIS, D_Agric Potential

“Land capability is modelled based on the soil and terrain features and climate of an area. The capability classification system applies only on rain-fed agriculture. Land suited to crop production is also suited to other less intensive uses such as pasture, natural grazing, forest and wildlife. The results were used to calculate the capability class of land types. Each land type has a land capability index which ranges from I (good) to VIII (poor).” (Map 3A)

Issues

- Although the soil potential is high in some areas, land capability takes into account climate as well, and the land capability of the study area is generally poor.
- This means the land is prone to erosion, degradation and rehabilitates slowly – veld management and land use policies are therefore crucial.

2.5 CLIMATE

Status Quo

The basic climatic attributes of the PKDM is as follows:

Rainfall:	approximately 300mm per annum
Lowest minimum temperature:	minus 10°C
Highest maximum temperature:	40°C
Average summer temperature:	24
Average winter temperature:	14
Humidity:	43%

Issues

- Low rainfall and frosts limits agricultural potential.
- Access to irrigation water will be crucial for any cultivation to occur due to the overall arid conditions and the risk of wilting under the influence of very high temperatures, while frost limits the type of crops than can be cultivated in the study area.
- The distribution of cultivated fields along the major perennial rivers and in association with extensive irrigation schemes supports this statement.

2.6 VEGETATION

STATUS QUO

Biomes

The study area is located within three Biomes, namely the Savanna Biome (approx. 15%), the Grassland Biome (approx. 5%) and mainly the Nama-Karoo Biome (approx. 80%)

The Nama-Karoo Biome makes up 19,5% of South Africa's surface area.

Bioregions

This is a classification level between Biomes and Vegetation Types (**See map 4**). Each of the Biomes in the study area contains the following Bioregions, as an approximate percentage of that Biome in the study area:

Savanna Biome (15%):	Eastern Kalahari Bushveld (90%) Kalahari Duneveld (10%)
Grassland Biome (5%):	Dry Highveld Grassland (90%) Sub-Escarpment Grassland (10%)
Nama-Karoo Biome (80%):	Upper Karoo (70%) Bushmanland (29%) Lower Karoo (1%)

Vegetation Types

There are 28 vegetation types in the study area (**See map 5**). Refer to **Annexure 1** for detailed descriptions of each vegetation unit.

GAPS

As the VEGMAP Classification System is so comprehensive and detailed, no gaps have been identified.

ISSUES

1. Transformation & degradation

2. Low resilience of the veld.
3. Exploitation close to human settlement (wood, medicinal plants, grazing)

2.7 RED DATA PLANTS & HABITAT

STATUS QUO

Centres of Endemism

A centre of endemism referred to as the Griqualand West Centre occurs within the northern area of the study area. Centres of endemism represent areas in which plants and associated animals occur which have a limited distribution within the region (Van Wyk & Smit 2001). The limited distribution is generally attributed to specific environmental factors, which in the case of the Griqualand West Centre is adaptation to lime-rich substrates.

The centre represents approximately 1800 taxa (species and subspecies); of which more than 40 (2.2%) are considered endemic. Of the 40 endemic species at least 32% are succulents.

According to VEGMAP the following vegetation types within the study area contain endemic plant species (**See Map 5A**):

Code	Vegetation Name	Endemic Taxa
Azi 10	Highveld Salt Pans	Gnaphalium simii (Herb)
Azi 10	Southern Karoo	Isolepsis expallescens (grasslike herb)
Gh1	Karoo Escarpment Grassland	Graminoid: Schoenoxiphium rufum var. dreegeanum. Herbs: Lithospermum diversifolium, Wahlenbergia sphaerica. Geophytic Herbs: Kniphofia acraea, Syringodeo pulchella. Low Shrubs: Euryops dentatus, E. trilobus, Helichrysum scitulum, Selago bolusii. Succulent Shrub: Delosperma gramineum.
Gh3	Xhariep Karroid Grassland	Herb: Manulea flanganii Succulent shrubs: Phyllobolus rabiei, Ruschia calcarea.
Gh4	Besemkaree Koppies Schrubland	Small tree: Cussonia sp. Nov. (PJ du Preez 3666 BLFU)

Code	Vegetation Name	Endemic Taxa
		Succulent Shrubs: Euphorbia crassipes, Neohenricia sibbetti, N. spiculata.
Nkb1	Lower Gariep Broken Veld	Succulent Shrub: Ruschia pungens
Nkb3	Bushmanland Arid Grassland	Succulent shrubs: Dinteranthus pole-evansii, Larryleachia dinteri, L. marlothii, Ruschia kenhardtensis Herbs: Lotonis oligocephala, Nemesia maxi
Nkb6	Bushmanland Basin Shrubland	Herb: Cromidon minutum. Geophytic Herbs: Ornithogalum bicornutum, O. ovatum subsp. Oliverorum
Nkl1	Gamka Karoo	Succulent Shrubs: Chasmatophyllum stanleyi, Hereroa incurve, Hoodia dregei, Ruschia beaufortensis. Low Shrubs: Jamesbrittenia tenuifolia Herb: Manulea karrooica. Succulent Herb: Piaranthus comptus
Nku1	Western Upper Karoo	Succulent Shrub: Stomatium villetii Herb: Zaluzianskya bella
Nku2	Upper Karoo Hardeveld	Succulent Shrubs: Aloe chlorantha, Crassula barbata subsp. Broomii, Delosperma robustum, Sceletium expansum, Stomatium suaveolens Low Shrubs: Cineraria polycephala, Euryops petraeus, Lotononis azureoides, Selago magnakakarooica Tall Shrub: Anisodonteia malvastroides Herbs: Cineraria arctotideia, Vellereophyton niveum. Succulent Herbs: Adromischus fallax, A. humilis Geophytic Herbs: Gethyllis longistyla, Lachenalia auriolae, Ornithogalum paucifolium subspl karooparkense
Nku3	Northern Upper Karoo	Succulent Shrubs: Lithops hookeri,

Code	Vegetation Name	Endemic Taxa
		Stomatium pluridens. Low Shrubs: Atriplex spongiosa, Galenia exigua Herb: Manuleo deserticola
Nku4	Eastern Upper Karoo	Succulent Shrubs: Chasmatophyllum rouxii, Hertia cluytiifolia, Rabiea albinota, Salsola tetrandra Tall Shrub: Phymaspermum scoparium Low Shrubs: Aspalathus acicularis subsp. Planifolia, Selago persimili, S. walpersii.
Svk10	Kuruman Mountain Bushveld	Succulent Shrub: Euphorbia planiceps
Svk13	Olifantshoek Plains Thornveld	Low Shrub: Amphiglossa tecta

Red Data Lists

No official list exists of current Red Data flora for the province but the 1995 list contained a total of 2693 species for the Cape Provinces, which since then had been divided into the Eastern Cape, Western Cape and Northern Cape. Within PRECIS list, twenty-three (23) species were listed as Red Data. These 23 species are representative of 14 plant families. The Red Data Flora list of southern Africa is being revised per province. A preliminary Southern Africa Red Data list had been released during April 2004, 685 species are listed, of which 111 species are considered threatened (Vulnerable, Endangered, Critically Endangered)

The same apply to the fauna in the region, regional experts in botany and zoology had been approached for assistance regarding the location of known Red Data species or species, which should be considered to be under threat of extinction.

Protection Status

The main protected areas / nature reserves are as follows:

1. Mokala National Park
2. Rolfontein Nature Reserve
3. Doornkloof Nature Reserve

Smaller nature reserves include the following:

1. Aloe Nature Reserve (Campbell)

2. Carnarvon Nature Reserve (Carnarvon)
3. Kokerboom Forest (Marydale)
4. Die Bos Nature Reserve (Prieska)
5. Victoria West Nature Reserve

GAPS

- The centre of endemism located within the area is under surveyed
- Information on Red Data plants are incomprehensive.

ISSUES

1. Absence of a database on provincial and private nature reserves
2. Destruction of habitat.

STRATEGIES

DTEC is busy compiling a Conservation Plan (**C-Plan**) for the province. Namakwaland / Succulent Karoo is the first part of the program, which will be followed by the rest of the province.

2.8 RED DATA FAUNA & HABITAT

STATUS QUO

Mammals

DTEC provided the following information on the mammals of PKSDM in the table below:

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
Afrosoricida	<i>Chlorotalpa sclateri</i>	Sclater's golden mole	Data Deficient	Endemic	Fragmented		Habitat loss (timber plantations)			One of four subspecies endemic to South Africa occurs in the NC, C. s. <i>shortridgei</i> (Bronner 1995b)	South Africa
Macroscelidea	<i>Macroscelides proboscideus</i>	Round-eared elephant-shrew	Least Concern	Near-endemic	Fragmented	Stable	Habitat loss (grazing) - small impact, localised	Monitoring Monitoring Monitoring	Monitoring	One of two subspecies in southern Africa occurs in the NC, namely <i>M. p. proboscideus</i> from Nama-Karoo and Succulent Karoo biomes.	South Africa
	<i>Elephantulus rupestris</i>	Western rock elephant-shrew	Least Concern	Near-endemic	Fragmented	Stable	None	Survey studies Taxonomic research Taxonomy for identification of species	Monitoring	None recognised until further revision is undertaken.	South Africa
Tubulidentata	<i>Orycteropus afer</i>	Aardvark	Least Concern	Endemic	Contiguous		Agriculture (arable farming) - low risk	Survey studies Life history	Habitat management	Only <i>O. a. afer</i> occurs in s Africa.	Africa
Hyracoidea	<i>Procavia capensis</i>	Rock hyrax	Least Concern	Not endemic	Contiguous	Decrease	None	Taxonomic research	Sustainable utilisation	Only one subspecies is recognised in South Africa, <i>P. c. capensis</i>	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
Lagomorpha	<i>Lepus capensis</i>	Cape hare	Least Concern	Not endemic	Contiguous	Decrease	Habitat loss (arable farming) Hunting	Survey studies Taxonomic research	Sustainable utilisation	Several subspecies listed for Africa, but many may be invalid. No particular subspecies are listed for the NC.	Africa
	<i>Lepus saxatilis</i>	Scrub hare	Least Concern	Endemic	Fragmented	Decrease	Habitat loss (agriculture) Habitat loss (development) Habitat loss (fragmentation) Hunting	Survey studies Genetic research Taxonomic research Life history Limiting factor research	Sustainable utilisation	A provisional list of 10 subspecies for s Africa is provided by Meester et al. 1986; no particular subspecies are recognised for the NC.	Africa
	<i>Pronolagus rupestris</i>	Smith's red rock rabbit	Least Concern	Endemic	Fragmented	Decrease	Habitat loss (human settlement) Hunting (sport and food)	Survey studies Life history	Sustainable utilisation	The taxonomic status of these species is not yet clear, although a genetically distinct population (<i>P. r. curryi</i>) occurs in the Kuruman region.	Africa
	<i>Pronolagus saundersiae</i>	Hewitt's red rock rabbit	Least Concern	Endemic	Fragmented	Decrease	Habitat loss (agriculture) Habitat loss (timber populations)	Survey studies Life history	Sustainable utilisation	No subspecies; this species was recently confirmed to be separate from <i>P. rupestris</i> .	South Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	Bunolagus monticularis	Riverine rabbit	Critically Endangered	Endemic	Fragmented	Decrease	Habitat loss (overgrazing) Habitat loss (crop plantations) Hunting Accidental mortality (trapping)	Life history Genetic research	Habitat management Wild population management Public awareness Limiting factor Captive breeding (cultivation) Management plan workshop recommended	No subspecies have been described.	South Africa
Rodentia	Cryptomys hottentotus	African mole-rat	Least Concern	Endemic	Contiguous		None	None	None	Uncertainty prevails regarding the distinctiveness of the five subspecies identified.	Southern Africa
	Hystrix africaeaustralis	Cape porcupine	Least Concern	Endemic	Contiguous		Hunting	Survey studies	None	Three subspecies have been described for southern Africa, but none have been accepted by Meester et al. (1986).	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	<i>Petromus typicus</i>	Dassie rat	Near Threatened	Endemic	Contiguous		None	Survey studies Genetic research Taxonomic research Life history	Monitoring	As many as 14 forms have been described by meester et al. (1986), but it is unlikely that there should be so many considering the restricted distribution range of the species.	Southern Africa
	<i>Pedetes capensis</i>	Springhare	Least Concern	Endemic	Contiguous	Stable	Habitat loss (Human settlement) Hunting (popular food source) Accidental mortality (poisoning)	Survey studies Limiting factor research	Monitoring Sustainable utilisation	No subspecies are recognised by Meester et al. (1986).	Africa
	<i>Xerus inauris</i>	South African ground squirrel	Least Concern	Endemic	Contiguous	Decrease		Survey studies Limiting factor research	Habitat management Monitoring	No subspecies are recognised.	Southern Africa
	<i>Graphiurus ocularis</i>	Spectacled dormouse	Least Concern	Endemic	Fragmented	Unknown	None	Survey studies Life history	None	No subspecies have been described.	South Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	<i>Rhabdomys pumilio</i>	Four-striped grass mouse	Least Concern	Endemic	Contiguous	Unknown	Human-induced habitat loss (unspecified) Human interference	Taxonomic research	None	Three of seven subspecies recognised in Southern Africa occur in the NC, namely <i>R. p. cinereous</i> , <i>R. p. intermediacy</i> , and <i>R. p. graduate</i> from parts of the NC. The limits of distribution of these subspecies is poorly known.	Africa
	<i>Mus minutoides</i>	Pygmy mouse	Least Concern	Endemic	Fragmented		May be affected by plantations and development	Survey studies Life history Species thought to never be a common species and warrants further research	Monitoring	One of four subspecies recognised in southern Africa occurs in the NC, namely <i>M. m. minutoides</i> (Meester et al. 1986).	Africa
	<i>Mastomys coucha</i>	Southern multimammate mouse	Least Concern	Endemic			None	Survey studies Genetic research Taxonomic research Life history Distributions of <i>M. natalensis</i> and <i>M. coucha</i> need to be determined in s	None	Four subspecies are listed by Meester et al. (1986) for southern Africa, but their validity is doubtful.	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
								Africa Species has been implicated in causing epidemiological and agricultural problems			
	<i>Aethomys chrysophilus</i>	Red veld rat	Least Concern	Endemic						One of two subspecies recognised in southern Africa occurs in the NC, namely <i>A. c. imago</i> .	Africa
	<i>Micaelamys namaquensis</i>	Namaqua rock mouse	Least Concern	Endemic	Contiguous	Unknown	Habitat loss (development) Ecological imbalance (habitat loss)	Survey studies Genetic research Taxonomic research Life history Epidemiology Carriers of bubonic plague	Habitat management	Two of four subspecies recognised in southern Africa occur in the NC (Chimimba 2001b), namely <i>M. n. namaquensis</i> from the succulent Karoo, and <i>M. n. monticularis</i> from the eastern NC.	Africa
	<i>Micaelamys granti</i>	Grant's rock mouse	Least Concern	Endemic	Contiguous	Unknown	None	Survey studies	None	No subspecies are recognised.	South Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	<i>Parotomys brantsii</i>	Brant's whistling rat	Least Concern	Endemic	Contiguous	Unknown	Pathogens/parasites cause plagues	Survey studies	None	Three subspecies are described for southern Africa, all of which occur in the NC although the limits of their distributions are not known: <i>P. b. brantsii</i> , <i>P. b. rufifrons</i> , and <i>P. b. deserti</i> .	Southern Africa
	<i>Parotomys littledalei</i>	Littledale's whistling rat	Near Threatened	Near-endemic	Fragmented	Unknown	Natural disasters (storms/flooding)	Survey studies Genetic research Life history Limiting factor research	None	Two of three subspecies described for southern Africa occur in the NC, namely <i>P. l. littledalei</i> and <i>P. l. molopensisby</i> (Meester et al. 1986).	South Africa
	<i>Otomys irroratus</i>	Vlei rat	Least Concern	Endemic	Contiguous	Decrease	Habitat loss (grazing) Mining Drainage/filling in of wetlands/coastline Habitat loss (exotic plants)	Survey studies	None	Eight subspecies were originally described for southern Africa, but recently only four chromosomal races have been identified in South Africa, of which one occurs in the NC.	Southern Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	<i>Otomys unisulcatus</i>	Bush vlei rat	Least Concern	Endemic	Not known	Unknown	None	Survey studies Genetic research Life history	None	Recognition of five subspecies previously listed is considered doubtful.	South Africa
	<i>Desmodillus auricularis</i>	Cape short-tailed gerbil	Least Concern	Endemic	Contiguous	Unknown	None	None	None	No subspecies are recognised.	Southern Africa
	<i>Gerbillurus paeba</i>	Hairy-footed gerbil	Least Concern	Endemic	Contiguous		None	Survey studies Limiting factor research	None	One of four subspecies recognised in southern Africa occurs in the NC (Meester et al. 1986), namely <i>G.p. paeba</i> .	Southern Africa
	<i>Tatera leucogaster</i>	Bushveld gerbil	Data Deficient	Endemic	Contiguous	Unknown	None	Survey studies	None	At least 17 subspecies have been described from southern Africa, but due to little discontinuity in distribution, and even integration of populations throughout their range, the determination of valid subspecies is impossible.	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	Tatera brantsii	Highveld gerbil	Least Concern	Endemic	Contiguous	Unknown	Habitat loss	None	None	Two of the three subspecies recognised in southern Africa occur in the NC, <i>T. b. brantsii</i> from the east of the NC westwards to the edge of the Kalahari sands, and <i>T. b. griquae</i> in the Kalahari north of the Orange River.	Southern Africa
	Mystromys albicaudatus	White-tailed mouse	Endangered	Endemic	Fragmented	Decrease	Habitat loss (grazing) Habitat loss (timber plantations) Habitat loss (crop plantations) Mining	Survey studies Life history Limiting factor research	Habitat management Public awareness	No subspecies are recognised.	South Africa
	Saccostomus campestris	Pouched mouse	Least Concern	Endemic	Fragmented		None	Survey studies Life history Species thought to never be a common species and warrants further research	Monitoring	Pending a clear understanding of the nature and extent of geographical variation, it is currently regarded as monotypic.	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	<i>Malacothrix typica</i>	Gerbil mouse	Least Concern	Endemic	Fragmented	Decrease	Habitat loss (livestock ranching)	Genetic research Taxonomic research Life history	None	Six subspecies are listed for southern Africa by Meester et al. (1986), but their statuses warrant investigation.	Southern Africa
Primates	<i>Papio hamadryas</i>	Chacma baboon	Least Concern	Endemic	Contiguous	Unknown	Hunting Traditional medicine	Survey studies Important model for behavioural research, human origins etc	Wild population management Captive breeding/cultivation Need to monitor more closely their use in medical research	Only one subspecies occurs in southern Africa, namely <i>P. h. ursinus</i> .	Africa
	<i>Cercopithecus pygerythrus</i>	Vervet monkey	Least Concern	Endemic		Stable	None, although heavily persecuted in some areas	Survey studies General biology	Wild population management Reduce risk of species becoming a problem	One of six subspecies listed for southern Africa occurs in the NC (Meester et al. 1986), namely <i>C. p. pygerythrus</i> .	Africa
Eulipotyphla	<i>Crocidura cyanea</i>	Reddish-grey musk shrew	Data Deficient	Endemic	Not known		None	None	None	One of two subspecies in southern Africa occurs in the NC, namely <i>C. c. cyanea</i> .	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	<i>Atelerix frontalis</i>	Southern African hedgehog	Near Threatened	Endemic	Not known	Decrease	Habitat loss (timber plantations) Habitat loss (crop plantations) Hunting (traditional medicine) Illegal trade (traditional medicine) Road kills Pesticide/chemical pollution (affects prey populations)	Survey studies Life history Limiting factor research	Sustainable utilisation Public awareness Captive breeding/cultivation Work in local communities	One of two subspecies listed for southern Africa occurs in the NC (Meester et al. 1986), namely <i>A. f. frontalis</i> .	Southern Africa
Chiroptera	<i>Tadarida aegyptiaca</i>	Egyptian free-tailed bat	Least Concern	Not endemic	Fragmented	Unknown	Habitat loss (Human induced, unspecified) Intentional poisoning Loss of prey base	Survey studies Genetic research Taxonomic research Life history Limiting factor research	Habitat Management Wild population management Monitoring Public awareness Genome resource Limiting factor	One of two subspecies in southern Africa occurs in the NC, <i>T. a. bocagei</i> .	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	Miniopterus schreibersii	Schreiber's long-fingered bat	Near Threatened	Endemic	Fragmented	Unknown	Agriculture (loss of insect populations) Groundwater extraction (affects cave formation) Human settlement and disturbance Tourism (disturbance of maternity and wintering caves) Recreation/tourism Loss of prey base Pesticide/chemical pollution	Survey studies Genetic research Taxonomic research Life history Limiting factor research Identification, genetic analysis and subsequent protection of as many roosts as possible	Habitat Management Wild population management Monitoring Public awareness Genome resource Limiting factor The three subpopulations are sufficiently distinct to warrant recognition as discrete management units	Only one subspecies occurs in the subregion, <i>M. s. natalensis</i> .	Africa
	Neoromicia capensis	Cape serotine bat	Least Concern	Not endemic	Fragmented	Unknown	Pesticide/chemical pollution	Survey studies Genetic research Taxonomic research Life history Limiting factor research	Habitat Management Wild population management Monitoring Public awareness Genome resource Limiting factor Work in local communities	No subspecies are accepted by Skinner and Chimimba (2005) as the taxonomic status is uncertain.	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

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Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	Cistugo lesueuri	Lesueur's hairy bat	Near Threatened	Endemic	Fragmented	Unknown	Habitat loss (unspecified causes) Loss of prey base	Survey studies Genetic research Taxonomic research Life history Limiting factor research Distinction from C. seabrai needs to be confirmed	Habitat Management Wild population management Monitoring Public awareness Genome resource Limiting factor Work in local communities	No subspecies are recognised, although it is very similar to the Angolan hairy bat.	South Africa
	Nycteris thebaica	Egyptian slit-faced bat	Least Concern	Not endemic	Fragmented	Unknown	Habitat loss (Human induced, unspecified) Loss of prey base	Survey studies Genetic research Taxonomic research Life history Limiting factor research	Habitat Management Wild population management Monitoring Public awareness Genome resource Limiting factor Work in local communities	A number of subspecies have been described, but their validity remains uncertain. Two subspecies are recognised in southern Africa (Meester et al. 1986), of which one occurs in the NC, <i>N. t. capensis</i> .	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	Rhinolophus clivosus	Geoffroy's horseshoe bat	Near Threatened	Not endemic	Fragmented	Unknown	Decrease in food supply (because of agriculture) Arable farming Grazing Ground water extraction (affects cave stability) Human settlement and disturbance Tourism (disturbance of maternity and wintering caves) Recreation/tourism Ecological imbalance Loss of prey base Pesticide/chemical pollution	Survey studies Genetic research Taxonomic research Life history Limiting factor research Identification, genetic analysis and subsequent protection of as many roosts as possible	Habitat Management Wild population management Monitoring Public awareness Genome resource Limiting factor Work in local communities	One of two subspecies in southern Africa (Meester et al. 1986) occurs in the NC, namely <i>R. c. augur</i> .	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	Rhinolophus darlingi	Darling's horseshoe bat	Near Threatened	Endemic	Fragmented	Unknown	Decrease in food supply (because of agriculture) Ground water extraction (affects cave stability) Human settlement and disturbance Tourism (disturbance of maternity and wintering caves) Loss of prey base Pesticide/chemical pollution Poor recruitment	Survey studies Genetic research Taxonomic research Life history Limiting factor research Identification, genetic analysis and subsequent protection of as many roosts as possible	Habitat Management Wild population management Monitoring Public awareness Genome resource Limiting factor Work in local communities	One of two subspecies in southern Africa (Meester et al. 1986) occurs in the NC, namely <i>R. d. damarensis</i> .	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
Pholidota	<i>Manis temminckii</i>	Ground pangolin	Vulnerable	Endemic	Contiguous	Increase	Habitat loss (agriculture) Exploitation (cultural use) Exploitation (traditional medicine) Illegal trade (traditional medicine) Accidental mortality (poisoning) Accidental mortality (electric fences) Pesticide/chemical pollution (locust control)	Survey studies Life history Trade	Monitoring Sustainable utilisation	No subspecies are recognised.	Africa
Carnivora	<i>Proteles cristatus</i>	Aardwolf	Least Concern	Endemic	Contiguous	Stable	Localised subsistence hunting, low intensity but widespread 'vermin' control Accidental mortality (trapping) Road kills Chemical pollution via locust spraying	Survey studies Life history	Monitoring Public awareness	Only one subspecies is listed for southern Africa, <i>P. c. cristatus</i> .	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

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Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	<i>Parahyaena brunnea</i>	Brown hyena	Near Threatened	Endemic	Contiguous		Persecution Traditional medicine Intentional poisoning Accidental mortality (trapping)	Survey studies Life history Limiting factor research	Monitoring Public awareness	No subspecies are recognised.	Southern Africa
	<i>Panthera pardus</i>	Leopard	Least Concern	Not endemic	Fragmented	Unknown		Survey studies Life history	Sustainable utilisation Public awareness Sustainable utilisation (trophy hunting)	All leopards in African are proposed to constitute one subspecies, <i>P. p. pardus</i> .	Africa
	<i>Caracal caracal</i>	Caracal	Least Concern	Not endemic			Hunting/trapping/poison	Survey studies Life history	Public awareness	Two subspecies are recognised in southern Africa by Meester et al. (1986), with both probably occurring in the NC, <i>C. c. damarensis</i> and <i>C. c. caracal</i> .	Africa
	<i>Felis silvestris</i>	African wild cat	Least Concern	Not endemic	Not known	Unknown	Hybridisation	Survey studies Genetic research Life history	None	Two subspecies are recognised in southern Africa by Meester et al. (1986), of which one occurs in the NC, <i>F. s.</i>	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
										<i>griselda</i> .	
	<i>Felis nigripes</i>	Black-footed cat	Least Concern	Endemic	Contiguous		Habitat loss (livestock ranching) Accidental persecution (hunting, poisoned bait) Accidental mortality (poisoned by locust spraying)	Survey studies Genetic research Taxonomic research Life history Clarify sub-species in E Cape	Public awareness Education to reduce accidental mortality	Two subspecies are recognised by Meester et al. (1986) in Southern Africa, but not by Olbricht & Sliva (1997), with the range of <i>F. n. nigripes</i> falling into much of the NC.	Southern Africa
	<i>Genetta genetta</i>	Small-spotted genet	Least Concern	Not endemic	Contiguous	Stable	Persecution (response to poultry predation)	Survey studies Life history	Public awareness	One of two subspecies in southern Africa occurs in the NC according to Coetzee (1977a), namely <i>G. g. felina</i>	Africa
	<i>Suricata suricatta</i>	Suricate	Least Concern	Endemic	Contiguous	Stable	None	Survey studies Taxonomic research Life history Investigate species status in E Cape	Monitoring	Two subspecies are recognised in southern Africa (Meester et al. 1986), of which one occurs in the NC, <i>S. s. suricatta</i> .	Southern Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

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Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	<i>Cynictis penicillata</i>	Yellow mongoose	Least Concern	Endemic	Contiguous	Stable	None	Survey studies Life history	Monitoring	Two of four subspecies recognised in southern Africa by Taylor (1990) occur in the NC, namely <i>C. p. penicillata</i> , and <i>C. p. bradfieldi</i> .	Southern Africa
	<i>Galerella sanguinea</i>	Slender mongoose	Least Concern	Endemic	Contiguous	Stable	None	Survey studies Life history Taxonomic research	Monitoring	Only one subspecies is recognised in southern Africa (Taylor & Goldman 1993), <i>G. s. cauui</i> .	Africa
	<i>Galerella pulverulenta</i>	Cape grey mongoose	Least Concern	Near-endemic	Contiguous	Stable	None	Survey studies Life history	Monitoring	Two of six subspecies recognised in southern Africa by Meester et al. (1986) occur in the NC, namely <i>G. p. pulverulenta</i> and <i>G. p. ruddi</i> (Little Namaqualand).	South Africa
	<i>Atilax paludinosus</i>	Marsh mongoose	Least Concern	Endemic		Stable	None	Survey studies Life history	None	The nominate subspecies, <i>A. p. paludinosus</i> , occurs in southern Africa.	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

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Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	Otocyon megalotis	Bat-eared fox	Least Concern	Endemic	Contiguous	Stable	Road kills	Survey studies Life history	Public awareness	No subspecies are recognised.	Africa
	Vulpes chama	Cape fox	Least Concern	Endemic	Contiguous	Stable	Persecution (trapping, poison, hunting, dogs) Accidental mortality (poisoning)	Survey studies Life history	Public awareness	No subspecies have been described.	Southern Africa
	Canis mesomelas	Black-backed jackal	Least Concern	Endemic	Contiguous	Stable	Hunting/trapping/poison	Survey studies Life history Epidemiology (important because they are vectors for rabies, and are susceptible to a range of diseases)	Public awareness	Only one subspecies occurs in southern Africa, <i>C. m. mesomelas</i> (Meester et al. 1986).	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

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Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	<i>Aonyx capensis</i>	African clawless otter	Least Concern	Endemic	Contiguous	Decrease	Habitat loss (transforming riverbanks, damming of rivers) Drainage/filling in of wetlands Hunting (trapping & shooting)	Survey studies Genetic research Life history Genetic research in different river systems	Habitat management Public awareness	Only one subspecies, <i>A. c. capensis</i> , occurs in southern Africa (Meester et al. 1986).	Africa
	<i>Mellivora capensis</i>	Honey badger	Near Threatened	Not endemic	Contiguous	Unknown	Persecution (trapping, poison) Accidental mortality (poisoning) Poor recruitment (high cub mortality)	Survey studies Taxonomic research Life history Population monitoring and surveys Taxonomic resolution	Monitoring Public awareness Work in local communities Education etc for reducing persecution	Only one subspecies occurs in southern Africa, <i>M. c. capensis</i> .	Africa
	<i>Ictonyx striatus</i>	Striped polecat	Least Concern	Endemic	Contiguous	Stable	Road kills	Survey studies Life history		There is still uncertaining regarding the number of valid subspecies.	Africa
Suiformes	<i>Phacochoerus africanus</i>	Common warthog	Least Concern	Endemic	Contiguous	Stable	None	Taxonomic research Clarification of distinction between <i>P. aethiopicus</i> and <i>P. africanus</i>	Sustainable utilisation	Only one subspecies occurs in southern Africa, <i>P. a. sundevallii</i> .	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

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Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
Ruminantia	<i>Tragelaphus strepsiceros</i>	Greater kudu	Least Concern	Endemic	Contiguous		Habitat loss (livestock ranching) Hunting		Sustainable utilisation	Only one subspecies occurs in southern Africa, namely <i>T. s. strepsiceros</i> .	Africa
	<i>Connochaetes gnou</i>	Black wildebeest	Least Concern	Endemic	Fragmented		Arable farming Fragmentation Hybridisation Drought	Survey studies Genetic research Limiting factor research Impacts of establishment of this species outside former range	Habitat management Wild population management Monitoring Limiting factor	No subspecies are recognised.	South Africa
	<i>Damaliscus pygargus phillipsi</i>	Blesbok	Least Concern	Endemic	Fragmented	Stable	Habitat loss (timber & crop plantations) Human settlement Fragmentation Hybridisation Genetic Inbreeding	Genetic research Taxonomic research	Wild population management Monitoring Sustainable utilisation	Considered as a subspecies of <i>D. pygargus</i> , the other subspecies being the bontebok <i>D. p. pygargus</i> .	South Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

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Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	<i>Sylvicapra grimmia</i>	Common duiker	Least Concern	Endemic	Contiguous	Stable	Hunting (food & trade) Trade (illegal bush meat)			Two of six subspecies recognised in southern Africa by Meester et al. (1986) occur in the NC, namely <i>S. g. grimmia</i> and <i>S. g. steinhardtii</i> . However, it is likely that with the collection on more material and data, the current number of subspecies may be reduced.	Africa
	<i>Redunca fulvorufula</i>	Mountain reedbuck	Least Concern	Endemic	Fragmented	Unknown	None	Survey studies Taxonomic research	Monitoring Sustainable utilisation	Only one subspecies occurs in southern Africa, namely <i>R. f. fulvorufula</i> .	Africa
	<i>Pelea capreolus</i>	Grey rhebok	Least Concern	Endemic	Fragmented	Decrease	Habitat loss (Arable farming) Hunting	Survey studies Genetic research Taxonomic research Studies on population status critical	Monitoring Sustainable utilisation (as a trophy species)	No subspecies are recognised.	South Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District

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Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	<i>Antidorcas marsupialis</i>	Springbok	Least Concern	Endemic	Contiguous		Hibridisation	Survey studies Limiting factor research Address local population declines	Sustainable utilisation Wild population management Monitoring	Two subspecies occur in southern Africa, of which <i>A. m. hofmeyri</i> is widespread in the NC.	Southern Africa
	<i>Raphicerus campestris</i>	Steenbok	Least Concern	Endemic	Contiguous	Decrease	Habitat loss (Livestock ranching) Hunting	Survey studies	Habitat management Sustainable utilisation	Up to five subspecies are listed for southern Africa, but there are wide areas of intergradation of these subspecies, and a review of the taxonomy is needed to resolve this.	Africa
	<i>Oreotragus oreotragus</i>	Klipspringer	Least Concern	Endemic	Fragmented		None	Survey studies	Sustainable utilisation	One of four subspecies in southern Africa occurs in the NC, namely <i>O. o. oreotragus</i> .	Africa

Checklist of the terrestrial mammals of the Pixley Ka Seme District
Source: DTEC 2007

Order	Scientific name	Common name	Red Data Book	Endemism	State of habitat	Habitat quality change	Threats	Recommended research	Management recommendations	Subspecies	Region
	Species marked with orange indicate those that will require special attention										

The only known critically endangered species is the Riverine Rabbit. Riverine Areas have already been transformed to large degree because of impoundments (dams) which in turn reduces the ecological reserve of these systems.

Birds (Avifauna)

No data available.

Reptiles & Amphibians (Herpetofauna)

This category collectively represents reptiles and amphibians, of which only the Giant Bullfrog (*Pyxicephalus adspersus*) is listed as threatened. Bullfrogs can potentially occur within pan and seepage areas (Kamffer 2004).

Invertebrates

No lepidoptera (butterflies) are listed as threatened in the area. This seems very strange for an area in which a centre of plant endemism occurs, as it would be expected that plants adapted to a specific area would have pollinators specifically adapted to them. This discrepancy is attributed to a gap in the available information.

GAPS

No provincial (regional) Red Data list available for birds, invertebrates & Reptiles & Amphibians

ISSUES**Mammals**

- Destruction of habitat
- Insufficient distribution data and poorly compiled EIA's contribute to lack of knowledge

Birds (Avifauna)

- Power lines
- Destruction of habitat
- Indiscriminate use of pesticide
- Intolerance towards raptors
- Poorly compiled EIA's contribute to lack of knowledge

Reptiles & Amphibians (Herpetofauna)

- Insufficient knowledge and habitat destruction

Invertebrates

- Insufficient knowledge and habitat destruction

STRATEGIES

- DTEC is busy compiling a Conservation Plan (**C-Plan**) for the province. Namakwaland / Succulent Karoo is the first part of the program, which will be followed by the rest of the province.
- Endangered Wildlife Trust (EWT) is busy with a Rehabilitation Programme for Riverine Habitat from Loxton.
- Conservancy Stewardship Programmes
- Community and farmer awareness.

2.9 BIODIVERSITY

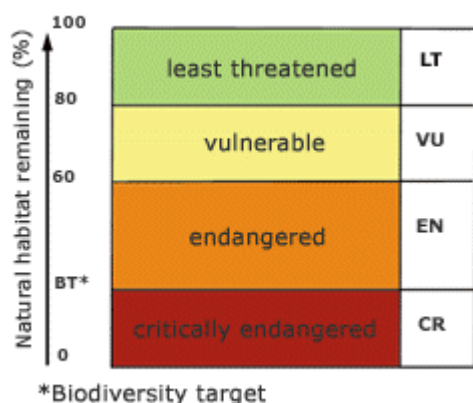
STATUS QUO

Flora

Following information from SANBI Website (**Refer Map 5C**):

“Terrestrial Ecosystem Status

The status of terrestrial ecosystems was assessed using the SANBI vegetation map together with irreversible loss of natural habitat based on the 1996 National Land Cover. Ecosystem status is based on how much of an ecosystem's original area remains intact, relative to three different thresholds. The thresholds are shown in the diagram below, and are based on best available science. Note that the threshold beyond which an ecosystem becomes critically endangered varies from 16% to 36%, depending on the ecosystem. The more species-rich the ecosystem, the higher the threshold. This threshold is also known as the biodiversity target. It represents the proportion of each ecosystem one would ideally like to see included in a formal protected area.



The results shown in this map show how intact and well functioning our ecosystems are. Least threatened ecosystems are still largely intact; vulnerable ecosystems are reasonably intact, but are nearing the threshold beyond which they will start to lose ecosystem functioning; endangered ecosystems have lost significant amounts of their natural habitat, impairing their functioning; critically endangered ecosystems have so little natural habitat left that not only has their functioning been severely impaired, but species associated with the ecosystem are also being lost.

Because the assessment of terrestrial ecosystem status is based on the 1996 National Land Cover, we know it is out of date.”

Most of the natural habitat of the study area is still intact (**least threatened**), and small portions **vulnerable**. No areas have as yet been classified as **endangered** or **critically endangered**.

Fauna

The only available indication of total animal biodiversity was available from National Department of Environmental Affairs and Tourism's ENPAT data series (**Map 6**). This index considers distribution and density of animals on a regional scale as well as their global Red Data status. It aims to raise awareness for the less flamboyant species for example small mammals, birds and insects. The higher the value of the index the more species are likely to occur in the area.

Rivers

GAPS

- Conservation Plan for the province have not yet been completed.
- SANBI Conservation Status is based on 1996 Landcover, thus 11 years old.

ISSUES

- Requires to be managed in terms of the Biodiversity Act.
- Because South Africa is a Water Scarce country, our river ecosystems are under much greater pressure than our terrestrial ecosystems.

STRATEGIES

1. A natural resource audit to facilitate decision making at 1:10 000 scale (Residential areas) and 1:50 000 (Rural areas)
2. Implementation of Biodiversity Act objectives:
 - “the management and conservation of biological diversity within the Republic and of the components of such biological diversity;
 - the use of indigenous biological resources in a sustainable manner; and
 - the fair and equitable sharing of benefits arising from bioprospecting of genetic material derived from indigenous biological resources;
 - to give effect to ratified international agreements relating to biodiversity which are binding on the Republic;
 - **to provide for co-operative governance in biodiversity management and conservation; and**
 - to provide for a South African National Biodiversity Institute to assist in achieving the

objectives of this Act.”

2.10 HYDROLOGY (RIVERS, DAMS, WETLANDS, PANS & GROUNDWATER)

STATUS QUO

Water is a life giving substance of which the study area does not have large quantities being located within the arid region of South Africa. The arid region's annual rainfall is less than 400 mm (Bothma 1995).

River Ecosystems

Following information from SANBI Website (**Refer Map 5C**):

“River Ecosystem Status

The status of river ecosystems was assessed based on the river signatures and the integrity of main stream rivers. Of South Africa's 120 river signatures, 82% are threatened. A disturbing 44% are critically endangered, 27% are endangered, 11% are vulnerable and 18% are least threatened. A critically endangered river signature is one for which there are few remaining intact examples, thus putting the biodiversity patterns and ecological processes associated with that river signature at risk.

Comparing the status of terrestrial ecosystems with the status of river ecosystems, we see that only 5% of terrestrial ecosystems are critically endangered, while 44% of river ecosystems are critically endangered. Thirty-three percent of terrestrial ecosystems are threatened, compared with the 82% of river ecosystems. Our river ecosystems are in a much poorer state overall than our terrestrial ecosystems. This reflects the fact that South Africa is a water-scarce country, with multiple demands from urban settlements, agriculture and industry, on our limited water resources. Many of the main stream rivers are heavily utilised and our river ecosystems are under more pressure than our terrestrial ecosystems.”

Primary Catchments

The study area is located within three primary catchments, namely:

Vaal River

Gamtoos River

Orange River

Rivers

The most significant perennial rivers is the Vaal and Orange Rivers. Smaller rivers include the

Modder, Ongeers & Seekoei Rivers.

Pans

Pans are mostly endorheic systems, (without surface or subsurface outflow, where the inflow water is lost by evaporation). This is the main difference between pans and wetlands (which has outflow). pans act as an important wildlife habitat, especially for birds, mammal species and invertebrates. (especially migratory birds)

Pans further have the following characteristics:

- circular to oval in shape, sometimes kidney-shaped or lobed;
- flat basin floor;
- less than 3 m deep when fully inundated; and
- closed drainage (lacking any outlet).
- The major way of water loss is through evaporation, which in part, results in their saline nature (Cowan and Van Riet, 1998)

The conservation of pans, therefore is a high priority. Pans mostly occur in the west of the study area.

Wetlands

No detailed mapping has been done for wetlands in the area. SANBI completed a national database beginning 2008 – but has no classification or attribute (description) data, only polygons (Many pans might be included into this classification). Many of the non-perennial tributaries and river beds function as wetlands and riparian zones, providing important habitat in the arid region.

People have a long and intimate association with wetlands. It's a relationship that's easy to understand when one considers the benefits, or ecosystem services, that wetlands provide to humanity. In addition to contributing to the life-support services that sustain us, wetlands also provide many people with a livelihood, or a means of earning a living. Often it is poor people, especially in rural areas, who are most directly dependent on wetlands for their livelihoods.

People have sustainable livelihoods if they can use available resources to earn a living without irreversibly depleting those resources. If the livelihoods benefits that wetlands provide are to be sustainable, they must be used wisely. On a subsistence level, these benefits range from wild food and grazing to materials for building and crafts. Purification and provision of clean water

have enormous health benefits which in turn have economic and social impacts. On a mainstream economic level, several key tourism industries are based on wetlands, in some cases being the backbone of local economies. As the interest in indigenous fibre products grows, craft sales are becoming more important as a means for rural households to earn hard cash. (Source: SANBI) More information can be found on the Working for Wetlands Website: <http://wetlands.sanbi.org/resource.php?id=142> (Refer to Map 9 – Land Cover)

Dams

The main dams in the study area are the following:

- Gariep Dam
- Van der Kloof Dam
- Smartt Syndicate Dam

Smaller Dams include:

- Van Wyksvlei Dam
- Boegoeberg Dam
- Killowen Dam

Water Management Areas

The conservation and management of water resources in this region are of utmost importance. Until such time as Catchment Management Agencies are set in place, the Northern Cape Regional Office of the Department of Water Affairs and Forestry (DWAF) is responsible for managing water resources in the Province. The management of water resources in South Africa takes place within catchments which are called Water Management Areas (WMAs). (North Cape SOE Report 2004)

The study area is divided into the following WMA's:

- Lower Orange – Orange (approx 20% surface area)
- Lower Orange – Orange Tributaries (approx. 60% surface area)
- Upper Orange – Vanderkloof (approx 20% surface area)

Water Quality

Due to the lack of water availability in certain parts of the Northern Cape, surface and groundwater quality is an important issue. Potable water is required to sustain the needs of a growing urban population and ecosystems require a certain quality of water in order to function.

Where there are areas of naturally poor quality water, special management techniques may be applied to improve water quality to appropriate standards for particular uses (DWAF, 2002a).

Major water quality problems stem from sewage pollution, the intensive agricultural use of fertilisers and pesticides, industrial wastes, mining and soil erosion (CSD, 2001). Typical pollutants from the agricultural sector include high salt loads, pesticides and nitrates and phosphates from fertilisers. These contribute to algal growth and lead to eutrophication of water courses and heightened risk to human health if ingested. Land disturbances from agricultural practices may lead to soil erosion and siltation of rivers. (North Cape SOE Report 2004)

Salinity (determined by measuring Total Dissolved Solids or TDS) provides a measure of the saltiness of water. Water is saline over large areas of the Province, especially within the Kalahari and Karoo, where the salt content tends to be so high that the water is regarded as unacceptable for human consumption (DWAF, undated). (North Cape SOE Report 2004). Salinity in the Lower Orange WMA is especially high and in many areas not fit for human consumption.

Water samples from the Vanderkloof, Lower Orange and Molopo areas indicate exceedances of irrigation guidelines over 35% of the time for levels of electrical conductivity (EC) and TDS. High levels of EC and TDS indicate increasing levels of salts, accumulation of salts in the soil, resulting in reduced yields of crops that are sensitive to soil salinity (DWAF, 1996b). (North Cape SOE Report 2004)

Groundwater

Groundwater levels are related to infiltration, infiltration is a function of soil texture, slope and surface conditions. Infiltration rates are higher in areas with sandy topsoils, gentle slopes and irregular surfaces. Areas where groundwater levels are close to the surface are at risk of becoming oversaturated, which would be detrimental to crop production and infrastructure (buildings and roads).

Groundwater is the main source of water for about 60% of both rural and urban residents throughout southern Africa (UNEP, 2002). Groundwater resources are particularly important in the Northern Cape, which has a high evaporation potential, low and variable rainfall. Groundwater quality is one of the main factors affecting the development of available groundwater resources. Management and protection of groundwater quality is of concern as the resource is vulnerable to salinisation (through seepage of seawater or irrigation water), seepage

from agricultural runoff, industrial and domestic discharges and consequently high nitrate and phosphate levels. (North Cape SOE Report 2004)

According to a recent groundwater survey of the Lower Orange Catchment Management Area, nitrates are the contaminant of most concern since they are highly soluble and do not bind to soils, resulting in their migration into groundwater (Pretorius and Dennis, 2003). Increased nitrate levels may arise from anthropogenic influences or may be naturally present and can cause diarrhoea and vomiting if ingested by humans. Nitrate levels above 6mg/l can cause significant health effects while levels below this value will have negligible effects on human health if ingested (WRC, 1998). (North Cape SOE Report 2004)

Although some areas in the study area have high nitrate levels, none are currently above 6,5mg/l. The area is however very vulnerable to this parameter and the DWAF monitoring thereof is crucial.

GAPS

Need to intensify interaction with DWAF

Detailed mapping exercise for wetlands in the area.

ISSUES

- Irrigation, mining and urbanisation contribute to point and diffuse pollution.
- Drainage lines (riparian wetlands) and wetlands (pans, marshes) are biodiversity hotspots and Red Data habitat.
- Alluvia diamond mine impacts on riparian zones.
- Wetlands in arid areas are less resilient
- Salinity of water resources
- Groundwater Quality (nitrate levels)

STRATEGIES

1. It is proposed that a buffer of 150m be set for all major rivers, and 50m for all minor rivers and tributaries for no-development.
 2. Illegal Water Uses (National Water Act), such as dams, weirs, alluvial diamond mining and illegal actions within the floodplain of rivers must be reported and stopped. Co-operative governance from specifically DWAF, DME and Local Municipalities are required.
-

2.11 AGRICULTURAL POTENTIAL & IRRIGATION ALONG RIVERS

STATUS QUO

The study area is located in the arid region of South Africa, without the use of irrigation; its agricultural potential is mainly low (**Map 3 & 3A**).

Orange/Vaal Irrigation Scheme

As a result of the 1984 drought, the farmers at Douglas, with the financial support of the local farmers' co-operative, initiated an emergency scheme on the bank of the Vaal River near its confluence with the Orange River, to transfer Orange River water to the existing Douglas Weir on the Vaal River. In addition to problems of chronic water shortage, the water quality in the lower Vaal River also deteriorated greatly resulting in an unacceptably high level of salinity for irrigation water.

The emergency scheme involved the construction of a pumping station at Marksdrift on the Orange River, with a pump head of 39 m and an emergency earth canal of 22 km. With the completion of the scheme approximately 8 100 ha of drought stricken irrigation land is now assured of an adequate supply of high quality water.

In 1986 the emergency scheme was incorporated into the Orange-Douglas Government Water Scheme, with the potential of expanding the existing irrigation development in the Douglas area by a further 4 000 ha. This scheme involved lining the canal to transform the emergency canal into a permanent structure and increasing the capacity along the first portion to 12 m³/s, as well as the upgrading of the extensive water distribution network. The scheme was started in 1987 and completed in 1994. (DWAF)

Vanderkloof Dam

Vanderkloof Dam (previously the PK le Roux Dam) is situated 130km downstream of Gariep dam on the Orange River. It forms the second largest storage reservoir in South Africa with a capacity of over 3 200 million m³. The dam forms an integral component of the Orange River Project (together with Gariep Dam) and supplies water to the Riet River catchment as well as to the various users along the remaining 1 400 km of the Orange River.

The Vanderkloof Dam is currently the highest dam in South Africa with a wall height of 107m and a crest length of 765m. Similar to Gariep Dam, it is a composite gravity arch dam containing 1.1 million m³ of concrete and has a central arch which transitions into a gravity flank on the left bank.

Four gates installed in the wall can discharge up to 8 500 m³/s in total through the flood sluices which are positioned on the left flank of the dam. Water released from the Gariep Dam flows into Vanderkloof Dam where it is either transferred through the [Orange/Riet Canal](#) to the Riet River basin or released downstream through two hydro-power generators. The generators can each produce 120 MW of electricity at a discharge of approximately 200 m³/s. The hydro-power plant can therefore provide up to 240 MW of electricity at a flow rate of 400 m³/s.

It was originally envisaged that the right bank canal would extend to the Brak River Valley in the Prieska-Britstown area as well as the Carnarvon-Leegte, the Beervlei area, the Sak River Valley and the Koa River Valley. Due to economic factors concerning the financial viability of the developments required, however, it was decided not to proceed with the extensions of the right bank canal which now stops near Hopetown. Similarly, it was originally intended to construct a left bank canal from the dam to Hopetown in order to supply irrigation along the left bank of the Orange River. This canal was not constructed and all irrigation along the left bank between Vanderkloof Dam and Hopetown is supplied directly from the river using pumps. (DWAF)

DWAF is currently busy with a study for the water provision of Pixley Ka Seme – the outcomes of this study should also be incorporated into the IEMP.

Salinity

The Lower Orange Water Management Area (WMA) is located in an arid region with limited rainfall that is characterized by high evaporation losses. The tributary inflows in the area are intermittent, and only contribute to the river flows during periods of unusually high precipitation in the Lower Orange River basin.

With the implementation of the Lesotho Highlands Water Project substantial volumes of low salinity water from the Orange River is being diverted to the Vaal River Catchment, leading to increased salt levels in the Gariep and Vanderkloof dams. At the same time, expansion of the table grape industry in the upper part of the Lower Orange River system could put additional pressure on the system by decreasing the available volume of water and increasing irrigation return flow to the river.

GAPS**ISSUES**

1. Water quality and quantity (especially salinity)
2. Ecological reserve
3. Groundwater reserves

STRATEGIES

1. The cultivation of crops less dependent on herbicides, fertilisers and frequent irrigation
(Genetically Modified or local cultivars and plants)

2.12 GAME MANAGEMENT CAPACITY

STATUS QUO

According to Prof Bothma of the Wildlife Management Centre at the University of Pretoria, the average size of an exempted game farm in the Northern Cape is 5000 ha, and generates 54% of their gross income from local hunters, 21% from live animal sales, 18% from foreign trophy hunters, 5% from ecotourism and 2% from meat production.

In terms of number of hunters per province the Northern Cape falls second only to the Limpopo Province, with the province at 23.4% and 24.9% respectively. The same scenario applies to the number of animals hunted per province, with Limpopo Province taking the lead at 33.9% and the Northern Cape following at 20%. Percentage live animals sold at all auctions per province is 2.2% for the Northern Cape, the second lowest for the country.

The number of animals which can be managed sustainable within a specific area depends on its grazing capacity if only grazers are involved or carrying capacity if both grazers and browsers are involved. Grazing capacity is expressed in terms of hectares per large stock unit (ha/l su), the higher an area's capacity to sustain animals, the fewer hectares per large stock unit is required.

It is standard practices to increase the number of hectares required to sustain game with a percentage of up to 30% to compensate for:

- The selective grazing preferences of game
- The difficulty of implementing rotational grazing in camps with game.

In the absence of effective veld management, veld degradation occurs. Effective veld management should be a high priority in areas prone to erosion (which is especially in the Nama-Karoo Biome, which is the largest percentage of the study area).

The following herbivores can potentially be sustained in each of the three game management regions of the study area (Bothma 2002):

Herbivore	Nama Karoo	Bushmanland*	Kalahari	Central Highveld Grassland
Blesbok				
Bushbuck				
Duiker				
Eland				
Gemsbok				
Giraffe				
Grey Rhebok				
Red Hartbeest				
Impala				
Hippopotamus				
Klipspringer				
Kudu				
Cape Mountain Zebra				
Oribi				
Ostrich				
Reedbuck				
White Rhino				
Black Rhino				
Roan Antelope				
Springbok				
Steenbok				
Tsessebe				
Warthog				
Blue Wildebeest				
Black Wildebeest				
Burchell's Zebra				

(*) The Bushmanland grazing unit is part of the Nama Karoo Biome.

It is important to note that the Nama Karoo (which makes up 80% of the study area) has a low vegetation diversity and also a low carrying capacity. Mainly the smaller game species are suited to this area. Bigger animals such as the Rhino should only be introduced to large areas (e.g. 20 000 ha – Bothma 2002)

GAPS

A proper inventory of game farms (including size, location, vegetation type) in the study area is lacking.

ISSUES

1. Selective breeding
2. Canned hunting
3. Alien species
4. Irresponsible bush encroachment control
5. Overgrazing leading to veld degradation and erosion
6. Slow recovery of veld after erosion or overgrazing

STRATEGIES

1. Should consider a wider spectrum of wildlife management strategies:
 - Breeding of rare/ endangered animals
 - Meat production
 - Game birds
2. Bush control activities and methods should be scientifically based.

2.13 ALIEN INVADER PLANT SPECIES

STATUS QUO

Alien Invaders mainly occur along the riverine habitat (**Refer to Map 5B**), and also more so from the north east of the study region. At most the study area is **moderately affected** by alien species.

Twenty-two (22) species recorded within the PRECIS list are declared weeds or invaders in terms of the Conservation of Agricultural Resources Act No 43 of 1983, they are:

Botanical Name	Type	Description
Argemone ochroleuca Sweet subsp. ochroleuca	Weed	Category 1 plants are weeds and serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment.
Cirsium vulgare (Savi) Ten.		
Datura ferox L.		
Datura innoxia Mill.		
Datura stramonium L.		
Myriophyllum spicatum L.		
Nicotiana glauca Graham		
Passiflora coerulea L.		
Sesbania punicea (Cav.) Benth.		
Xanthium spinosum L.		
Xanthium strumarium L.		
Atriplex nummularia Lindl. subsp. nummularia	Invader	Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.
Eucalyptus camaldulensis Dehnh.		
Gleditsia triacanthos L.		
Populus deltoides Bartram ex Marsh subsp. deltoides forma deltoides		
Prosopis glandulosa Torr. var. glandulosa		
Prosopis glandulosa Torr. var. torreyana (Benson) Johnst.		
Prosopis velutina Wooton		

Atriplex lindleyi Moq. subsp. inflata (F.Muell.) Paul G.Wilson		Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.
Melia azedarach L.		
Salix babylonica L. var. babylonica		
Tamarix ramosissima Ledeb.		

The following nine species have to be controlled in terms of the Act, when they start encroaching:

Acacia hebeclada DC. subsp. hebeclada, *Acacia karroo* Hayne, *Acacia mellifera* (Vahl) Benth. subsp. detinens (Burch.) Brenan, *Acacia tortilis* (Forssk.) Hayne subsp. heteracantha (Burch.) Brenan, *Rhamnus prinoides* L'Hér., *Rhigozum trichotomum* Burch., *Rhus ciliata* Licht. ex Schult., *Tarchonanthus camphoratus* L. and *Terminalia sericea* Burch. ex DC.

GAPS

The detail mapping of the extent of stands of alien invader plants have not yet been done.

ISSUES

1. Bush encroachment of indigenous species due to exploitation (grazing).
2. Invasive species noted along perennial rivers and roads and in association with farmsteads.
3. Large stands of alien invasives also consume surface and groundwater (either directly off shallow water tables or indirectly through recharge water not reaching the aquifer)

STRATEGIES

1. Working for Water (DWAF Initiative) must be contacted to assist with the removal of aliens in riverine areas.
2. Working for Water information and resources should be used by local municipalities as source for community projects. For more resources go to <http://www.dwaf.gov.za/wfw>

2.14 TOURISM

STATUS QUO

Eco-tourism is generally associated with any tourist related activity, which occurs in the environment irrespective of the adverse effects it might have on the environment. True eco-tourism objectives are to have no or minimal impact on the environment, with sustainable benefits to the communities depending on these environments¹. In terms of the general eco-tourism perception, the study area has ample potential for eco-tourism. **(See map 11)**

In **nature based tourism potential**, the more diverse a landscape type, the more opportunity for tourism it holds, as more uses can take place in a close vicinity. An escarpment typically has a high nature based tourism potential as opposed to a plain which will have a low potential. Unique natural features also have potential (e.g. Kokerboom Forest close to Marydale, Witsand near Griekwastad, or Centres of Endemism).

The recently established **Mokala National Park** is bound to bring tourists from over the country and overseas to the area. It also has the benefit that SANPARKS is promoting and marketing the park, with no cost or effort from PKSDM.

The MeerKAT and SKA Telescope Projects have enormous potential for tourism in the area, as it will draw people across the globe to the study area. The site is located close to Carnarvon. For more details refer to website: <http://www.ska.ac.za/> or A

Route based tourism potential refers to tourists moving through an area because of a primary destination (such as people traveling on the National Routes through the area). The route based tourism potential of the area is well-documented and will not be discussed in this report.

GAPS

- Documents like the “Karoo Travel Guide” are crucial to the tourism industry in the study area.
- These documents should be improved and expanded where possible, and marketed better in the rest of the country.

¹ Support CD: B_Data, Internet info – [Definition](#) (What is ecotourism)

ISSUES

1. Does it benefit the community, as the true definition of eco-tourism requires.
2. Marketing and accessibility of information is limited.
3. Different Stakeholders in the tourism industry is not well linked up to one another.

STRATEGIES

1. Development of Tourism Routes such as the Crocodile Ramble (<http://www.theramble.co.za/>) or the Midlands Meander (<http://www.midlandsmeander.co.za/midlands/index.html>)
2. These tourism routes provide maps and information, and links all the different persons and organizations together, and generates funding for marketing through membership to the Route.
3. Tourism development and implementation strategies should be developed by qualified specialists in the field.

2.15 INDUSTRIAL POLLUTION

STATUS QUO

Industrial pollution is both a source of point and diffuse pollution. Internationally it is recognised that diffuse pollution (non-point) is the most difficult to calculate and regulate, but has a significant impact on the environment.

In the study area, industrial pollution is mainly associated with agricultural (commercial cultivation). Very little mining activity takes place in the study area.

Mining and agriculture are the most obvious areas for both point and diffuse pollution. It should be noted that the study area is located within the Lower Orange Water Management Area (WMA)², this implies that it is exposed to poor water (quality and quantity) from large industrial areas upstream (Middle - to Upper Vaal WMA's), especially the Vaal River section, which are further aggravated by pollutants from the Hartswater area.

GAPS

The nature of pollutants is only available on national level, no area specific information

² Support CD, B_Data, Internet Info – [More information](#)

available.

ISSUES

1. Compliance with relevant legislation and policy documents³ must be ensured.
2. Potential transgressors should be identified.

STRATEGIES

1. Pixley Ka Seme should have representatives on the boards of the Water Management Agency of its neighbouring Water Management Areas (WMA's), as it receives water from upstream WMA's and influence the water of downstream WMA's

³ Support CD, B_Data, Internet Info – [More information](#)

2.16 AIR QUALITY

STATUS QUO

In the absence of significant industrial areas within the study area, sources of air pollution are very localised and limited to certain areas or activities:

- Mining areas – dust and processing plants
- Medical facilities – coal powered heating systems and/ or incinerators.
- Agricultural areas – burning of crop residues, veld management or accidental fires
- Urban Areas – dust

GAPS

No proper base data exist.

ISSUES

- Unrehabilitated asbestos mines (see environmental health below).
- Dust in urban areas (especially townships)

STRATEGIES

1. Education of officials regarding the legal requirements of air control legislation
2. Each municipality must designate an air quality officer from its administration to be responsible for co-ordinating matters pertaining to air quality management in the municipality
3. Air quality officers must co-ordinate their activities in such a manner as may be set out in the national framework or prescribed by the Minister.

2.17 ENVIRONMENTAL HEALTH

STATUS QUO

Environmental health does not concern the health of the environment but whether the environment is healthy enough for humans to live in it. Environmental health is measured and monitored in terms of criteria of which their quantities will have a negative impact on the life expectancy or quality of humans. *[A typical example would be the concentration of chemicals within water, above certain levels of concentration, the water would be considered poisonous and declared unfit for human and animal consumption.]*

Within the study area, two major activities, which could have an impact on environmental health are:

- Waste management in human settlements (sewage, refuse, medical waste, hazardous waste)
- Asbestos mines which are still unrehabilitated
- Agriculture (extensive commercial cultivation negatively affecting water quality)

Based on the field trip, potential sources of environmental health are the commercial irrigation and diamond mining, no significant areas of industrial activity was observed. Diffuse pollution sources from residential, industrial and agricultural areas

Asbestos

Asbestos is the collective mineralogical term given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite and anthophyllite) that occur naturally in the environment. Asbestos minerals have long, separable fibres that are strong, flexible enough to be spun and woven, and are heat resistant. Because of these characteristics, asbestos has been used for a wide range of products, including building materials, automobile parts and heat resistant fabrics (ACGIH, 2001; ATSDR, 2001). Asbestos fibres enter the air from the breakdown of natural deposits or man-made asbestos products. Fibres may remain suspended in the air for a long time, and can be carried a fair distance by the wind before settling. Asbestos fibres are not able to move through soil, are not broken down to other compounds, and will remain virtually unchanged over long periods of time (ATSDR, 2001).

Inhalation of high levels of asbestos fibres over several years may result in scar-like tissue in the lungs and pleural membrane. This disease is called asbestosis and is usually found in workers exposed to asbestos. People with asbestosis have difficulty breathing, often have a cough, and in severe cases the heart may be enlarged. It is a serious disease and can eventually lead to disability and death. Mesothelioma, associated with asbestos, is cancer of the pleural membrane (ATSDR, 2001).

There are currently no operational asbestos mines in the Northern Cape. Asbestos mines flourished in the 1970's because of the demand for asbestos, the rich deposits of crocidolite in particular (blue asbestos), and the availability of labour. At the time asbestos mining was still active in South Africa, five percent of asbestos used in the United States was imported from South Africa (ACGIH, 2001). The 'Cape Crocidolite Field' extends about 400 kilometres in a northerly direction from just south of Prieska, through Kuruman to the Botswana border (DME, 2004).

In the Northern Cape asbestos is still perceived as an important issue because of the many unrehabilitated mine dumps that still have the potential to pollute the environment, and therefore cause asbestosis or mesothelioma. The public still has access to some of these dumps, and some individuals recover the asbestos for resale as there is apparently still a market for it (Du Plooy, pers comm., 2003). In Prieska about 5 new cases (out of a population of about 15 000) of mesothelioma are diagnosed annually although the mines in the area have been closed since 1979 (Smith, pers comm., 2004).

Secondary impacts of asbestos pollution are likely to occur in the Northern Cape, considering the use of materials contaminated with asbestos for a variety of purposes, including school playgrounds and sports fields (e.g. long jump pit), roads and buildings (Brown University, 2001). Rehabilitation of some roads around the Kuruman area will take place in the near future (Olivier, pers comm., 2004). (North Cape SOE Report, 2004)

GAPS

- A proper inventory of the unrehabilitated asbestos mines (and specifically the responsibility of rehabilitation).
- No comprehensive list of what constitutes Environmental Health threats and how to address. It would need to be derived. **Location of incinerators and landfill sites**

ISSUES

- Irresponsible or excessive use of fertiliser and pesticides in commercial irrigation areas which consists of hazardous waste lead to health problems,
- Relatively high occurrence of asbestosis or mesothelioma in specifically Prieska area.

STRATEGIES

Environmental health requires an integrated holistic approach; a committee should be established with representatives from the different disciplines/ departments monitoring air and water quality within the area.

3 TOWN AND REGIONAL DATA

3.1 MUNICIPAL AREAS

The Pixley Ka Seme District Municipality (PKDM) is situated in the Northern Cape Province, and borders on the Free State, Eastern Cape and Western Cape. The Pixley Ka Seme District Municipality comprises the following local municipalities **(See Map 10)**:

- Emthanjeni
- Siyancuma
- Siyathemba
- Kareeberg
- Renosterberg
- Thembelihle
- Ubuntu
- Umsobomvu
- District Management Area (DMA).

The locality and context of each of these local municipalities is well documented in the various IDPs and District Growth and Development Strategy 2007.

3.2 POPULATION & DEMOGRAPHICS:

Demographics in general has been adequately addressed in other strategic documentation such as IDP's. Urbanization is the most obvious tendency in the area, which in turn places greater pressure on the infrastructure of the towns.

ISSUES

- Informal settlements' environmental impact.
- Water requirement for towns.
- Town Planning / Urban issues as described in generic issues tables.
- Typical environmental challenges for local municipalities is summarised in that table

in **Section 5** of the main report. This list is based on other similar projects and specific workshops with the local municipalities.

4 CULTURAL AND HERITAGE DATA

4.1 CULTURAL AND HISTORIC SITES

According to the National Heritage Resources Act of 1999 historic/cultural sites are all classified under the term heritage: 'heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations.' Many resources are associated with a site/place or places. The Act and current global practice focuses on the significance of place, and the objects, buildings, practices, uses and associations contained in it over time and in layers. It also encompasses the notion of an integrated cultural and natural landscape or the 'holistic approach to nature, society and social relationships'.

It is important to note the shift from the term 'monument' in previous Acts to 'heritage resource'. The latter implies active use of heritage and moves the focus on heritage from preservation to use and outward looking, inclusive activities. Use includes education and tourism. The definition of the national estate is very wide and moves beyond buildings. It takes into account our rich cultural and political heritage. Heritage also has an important internal function in building and rebuilding communities, regions and even a nation. (Note Provincial 'healing ceremonies' conducted prior to December 16 2003.)

According to the Act, the resources making up the National Estate include-

- (a) places, buildings, structures and equipment of cultural significance;
- (b) places to which oral traditions are attached or which are associated with living heritage (*see below for a definition*);
- (c) historical settlements and townscapes;
- (d) landscapes and natural features of cultural significance;
- (e) geological sites of scientific or cultural importance;
- (f) archaeological and palaeontological sites;
- (g) graves and burial grounds, including
- (h) sites of significance relating to the history of slavery in South Africa;
- (i) movable objects, including-

-
- i. objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
 - ii. objects to which oral traditions are attached or which are associated with living heritage;
 - iii. ethnographic art and objects;
 - iv. military objects;
 - v. objects of decorative or fine art;
 - vi. objects of scientific or technological interest; and
 - vii. books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

"Living heritage" means the intangible aspects of inherited culture, and includes

- (a) cultural tradition;
- (b) oral history;
- (c) performance;
- (d) ritual;
- (e) popular memory;
- (f) skills and techniques;
- (g) indigenous knowledge systems; and
- (h) the holistic approach to nature, society and social relationships:

Section 3.3 of the Act gives overall criteria for assessing 'cultural significance or other special value'

- (a) Its importance in the community, or pattern of South Africa's history;
 - (b) its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
 - (c) its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
 - (d) its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
 - (e) its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
 - (f) its importance in demonstrating a high degree of creative or technical
-

-
- achievement at a particular period;
 - (g) its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
 - (h) its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
 - (i) sites of significance relating to the history of slavery in South Africa.

Heritage redress is at the centre of the spirit of the Act. Much of our present visible heritage is Eurocentric. There is a need to recover heritage that has been lost, forgotten, destroyed or silenced. The preamble of the Act says:

Our heritage celebrates our achievements and contributes to redressing past inequities. It educates, it deepens our understanding of society and encourages us to empathise with the experience of others. It facilitates healing and material and symbolic restitution and it promotes new and previously neglected research into our rich oral traditions and customs.

(Note 'living heritage' above)

Section 8 of the Act requires that significant heritage resources be graded as Local (Grade III), Provincial (Grade II) or National Significance (Grade I). Grade III resources will be managed by local authorities, Grade II by Provincial and Grade I by National. This has important implications for Pixley Ka Seme Municipality.

Who is responsible for the grading of heritage resources? In Section 7(1) of the Act, SAHRA and the MEC of every province must establish a system of the grading of places and objects which form part of the National Estate.... (c) ...and prescribes heritage assessment criteria.... which must be used by a heritage resources authority or a local authority to assess the significance of a heritage resource.... So that the appropriate level of grading.... may be allocated in terms of Section 8.'

Section 8(2) notes that the South African Heritage Resources Authority set up by the Act is 'responsible for the identification and management of Grade I heritage resources' and Section 8(3) that a 'provincial heritage resources authority (PHRA) is responsible for the identification and management of Grade II heritage resources'.

Section 24-(1) (c) of the Act that a PHRA must 'promote the systematic identification, recording and assessment of heritage resources ... which form part of the national estate in the provinces. Section 7 (2) notes that a heritage resources authority [such as a PHRA] may [also] prescribe detailed heritage assessment criteria ...beyond those set down in the system of grading, as long as they are consistent with Section 3.3. Former monuments will be assessed by the PHRAs.

However, the Act seems unclear of the power of local authorities in this regard. Section 7(1)(c) makes mention the power of local authorities to assess significance and decide on grading. However, Section 31 requires consultation with the PHRA.

In deciding whether a local government authority can effectively manage a heritage resource as identified under Grade III, both the Heritage Act and Acts related to local government would require a plan to be furnished detailing the process of managing a heritage resource

A PHRA exists in the Northern Cape. However, very few detailed guidelines have been provided by SAHRA for grading. See Section 5.4

4.2 HERITAGE SITES

A separate project is necessary to map all sites according to proper GPS information.

The following types of heritage sites are documented:

- architecture (buildings in towns, Corbelled Houses),
- war related structures such as memorials, cemeteries, blockhouses
- Palaeontological and archaeological sites e.g fossils
- Khoi and San history, and Rock Art

4.3 POTENTIAL HERITAGE SITES

A separate study should be commissioned to properly investigate further heritage

potential. A lot of farm houses have heritage value but have never been documented, and needs to be preserved.

4.4 GRADING CRITERIA

No official grading process has taken place, though provinces are beginning to develop a provincial heritage register. New or at risk heritage sites are protected by protection orders if they are brought to the attention of office the Northern Cape Heritage Resource Agency or the Provincial Heritage Resource Authority. The latter has relinquished its power to issue permits to research and access palaeontological and archaeological sites, to SAHRA National. In a province where there are many such sites, this is an issue for concern.

In MAY 2003, Regulation 43 to the Regulation Gazette no 6820 added short clauses to Section 7 (1) on grading.

“Grading system and criteria

43. The criteria to be applied in assessing the significance of a heritage resource are as follows:

- (1) Grade 1 : [NATIONAL]Heritage resources with qualities so exceptional that they are of special national significance should be applied to any heritage resource which is -
 - (a) Of outstanding significance in terms of one or more of the criteria set out in section 3(3) of the Act; and
 - (b) authentic in terms design, materials, workmanship or setting; and such universal value and symbolic importance that it can promote human understanding and contribute to nation building, and its loss would significantly diminish the national heritage.
- (2) Grade 2 : [PROVINCIAL]Heritage resources with special qualities which make significant in the context of a province or region should be applied to any heritage resource which –
 - (a) is of great significance in terms of one or more of the criteria set out in section 3(3) of the Act; and

- (b) enriches understanding of cultural, historical, social and scientific development in the province or region in which it is situated, but that does fulfil the criteria for Grade 1 status.
- (3) Grade 3 : [DISTRICT/LOCAL] Heritage resources worthy of conservation should be applied to any heritage resource which –
 - (a) fulfils one or more of the criteria set out in section 3(3) of the Act; or
 - (b) in the case of a site, contributes to the environmental quality or cultural significance of a larger area which fulfills one of the above criteria, but that does not fulfil the criteria for Grade 11 status.”

Such a grading process is essential for conservation management plans, statements of significance and overall redress; and a proper heritage register with clear lines of management responsibility, local or provincial. In terms of mapping of cultural resources, such grading is essential for integrating heritage in a meaningful way in the PKDM, for example Spatial Programmes and development nodes.

5 INSTITUTIONAL AND LEGAL DATA

5.1 LEGISLATIVE FRAMEWORK

Legislation relevant to the environment is listed in this document under the **Section 4: Institutional and Legal Framework**. The objective and principle of the legislation is also briefly described. The idea behind this part of the program is to identify all relevant legislation that might be applicable to activities taking place within the district municipality. Also important is the identification of local level responsibility for the environment. The issue of waste management illustrates this point. General waste management has been identified as a function of local government. Industrial and hazardous waste however is a function of provincial government.

Responsibility for the environment is not clearly defined in one particular act of government. It is therefore necessary to scrutinise and analyse all legislation to establish the role and responsibility of all tiers of government for the activities and environmental issues within local government. The Palmer Development Group was commissioned by the Department of Environmental affairs and Tourism to do a situation analyses. The report, dated March 2004, is also included into the Institutional and Legal framework section of the IEMP.

5.2 GOVERNMENTAL STRUCTURES

With a legislative framework and responsibilities identified at each level of government, the capacity within the Pixley Ka Seme District Municipality can be evaluated against the background of all environmental issues and activities taking place within its area of jurisdiction.

In summary governments, locations and functions:

Regional Offices of National & Provincial Government	City/Town	Environmental functions
Agriculture & Land Reform	Kimberley	Land Use & Agricultural

		Practices
Housing	Kimberley	Impacts of human settlements
Transport	Kimberley	Impacts of transportation infrastructure
Public Works	Kimberley	Impacts of infrastructure
ESKOM	Kimberley	Impacts of infrastructure
Transnet	Kimberley	Impacts of infrastructure
Environmental Affairs, Conservation & Tourism	Kimberley	Weather Bureau
Land Affairs	Kimberley	Registrar of Deeds
Minerals & Energy	Kimberley	Mineral Development / Quarrying for road material
Provincial Administration	Hopetown	Social Services & Population Development
	Kimberley	Economic Affairs & Tourism
DWAF	Kimberley	Water Affairs

Local Government	City/Town	Environmental function
<i>Pixley Ka Seme District Municipality</i>	De Aar	Environmental Health Officer
<i>Emthanjeni Municipality</i>	De Aar	Environmental Health Officer
<i>Kareeberg Municipality</i>	De Aar	Environmental Health Officer
<i>Renosterberg Municipality</i>	De Aar	Environmental Health Officer
<i>Siyancuma Municipality</i>	Douglas	Environmental Health Officer

<i>Siyathemba Municipality</i>	Prieska	Environmental Health Officer
<i>Thembelihle Municipality</i>	Hopetown	Environmental Health Officer
<i>Ubuntu Municipality</i>	De Aar	Environmental Health Officer
<i>Umsobomvu Municipality</i>	Colesberg	Environmental Health Officer
<i>District Management Area (DMA)</i>	De Aar	Environmental Health Officer

6 CONCLUSION

Key Opportunities includes the MeerKAT/SKA telescope projects, Mokala National Park establishment, mineral resources exploitation and tourism

Key Issues & Threats includes land degradation, loss of riverine habitat, unrehabilitated asbestos mines & the need for Urban Renewal of apartheid-era townships

Key Solutions include successful sourcing of funding & management thereof, participation and communication on all levels & training & education regarding the environment.

Strategies / Initiatives / Projects:

- Environmental Education of Farmers and Communities
- Compliance & Enforcement of Illegal Water Uses
- Conservation Mapping & Initiatives
- Environmentally Responsible Development
- Urban Renewal Programmes

Areas that need further studies were highlighted in the individual sections. Among them the following is note worthy:

- Water quality & monitoring.
- Red data species lists and mapping
- Areas of endemism, more work need to be done in this field.
- Mapping of relevant cultural and historic sites through the whole PKDM.
- Sources of surface water pollution.
- Waste handling throughout the District.

ANNEXURE 1 – VEGETATION TYPES

AZa 3 Lower Gariep Alluvial Vegetation

Name of vegetation type	Lower Gariep Alluvial Vegetation
Code as used in the Book - contains space	AZa3
Conservation Target (percent of area) from NSBA	31%
Protected (percent of area) from NSBA	5.8%
Remaining (percent of area) from NSBA	50.3%
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	751.53
Name of the Biome	Azonal Vegetation
Name of Group (only differs from Bioregion in Fynbos)	Alluvial Vegetation
Name of Bioregion (only differs from Group in Fynbos)	Alluvial Vegetation

Distribution

Northern Cape Province: Broad alluvium (floodplains and islands) of the Orange (Gariep) River between Groblershoop and the mouth into the Atlantic Ocean at Oranjemund (Namibia). This river stretch is embedded within Desert (Oranjemund to roughly Pofadder) and Nama-Karoo (further upstream as far as Groblershoop). Altitude ranging from 0–1 000 m.

Conservation

Endangered. Target 31%. About 6% statutorily conserved in the Richtersveld and Augrabies Falls National Parks. Some 50% transformed for agricultural purposes (vegetables and grapes) or alluvial diamond mining. *Prosopis* species, *Nicotiana glauca* and *Argemone ochroleuca* can invade the alluvia in places.

AZa 4 Upper Gariep Alluvial Vegetation

Name of vegetation type	Upper Gariep Alluvial Vegetation
Code as used in the Book - contains space	AZa4
Conservation Target (percent of area) from NSBA	31%
Protected (percent of area) from NSBA	2.3%
Remaining (percent of area) from NSBA	77.9%
Description of conservation status from NSBA	Vulnerable
Description of the Protection Status from NSBA	Poorly protected
Area (sqkm) of the full extent of the Vegetation Type	1785.29
Name of the Biome	Azonal Vegetation
Name of Group (only differs from Bioregion in Fynbos)	Alluvial Vegetation
Name of Bioregion (only differs from Group in Fynbos)	Alluvial Vegetation

Distribution

Free State and Northern Cape Provinces: Broad alluvia of the Orange River, lower Caledon as well as lower stretches of the Vaal, Riet and Modder Rivers as far as Groblershoop. These river stretches are surrounded by vegetation units of broad transitional regions between the dry facies of the Savanna and Grassland and northern regions of the Nama-Karoo Biome. Altitude ranging from 1 000–1 500 m.

Conservation

Vulnerable. Target 31%. Only about 3% statutorily conserved in Tussen Die Riviere, Gariep Dam and Oviston Nature Reserves. More than 20% transformed for cultivation (vegetables, grapes) and building of dams. Exotic woody species such as *Salix babylonica*, *Eucalyptus camaldulensis*, *E. sidero-xylon*, *Prosopis* and *Populus* species have become common dominants in patches of heavily disturbed alluvial vegetation.

AZi 10 Highveld Salt Pans

Name of vegetation type	Highveld Salt Pans
Code as used in the Book - contains space	AZi10
Conservation Target (percent of area) from NSBA	24%
Protected (percent of area) from NSBA	0.2%
Remaining (percent of area) from NSBA	96.5%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Hardly protected
Area (sqkm) of the full extent of the Vegetation Type	1160.87
Name of the Biome	Azonal Vegetation
Name of Group (only differs from Bioregion in Fynbos)	Inland Saline Vegetation
Name of Bioregion (only differs from Group in Fynbos)	Inland Saline Vegetation

Distribution

Northern Cape, Eastern Cape, North-West, Free State and Gauteng Provinces: Pans scattered on broad Grassland/Karoo and Grassland/Savanna interface roughly between Mafikeng/Koster in the north and Britstown/Middelburg in the south. The highest concentrations of pans are found around Dealesville, Bultfontein, Wesselsbron, Delareyville and Petrusburg. The average size of the playas in the western Free State is 0.2 km², with a number of the largest ones (e.g. Florisbad Pan and Annaspan) measuring several kilometres across (Goudie & Thomas 1985). Altitude ranging from 1 000–1 600 m.

Conservation

Target 24%. Only very small portion statutorily conserved in the Vaalbos National Park and in the Bloemhof Dam, Soetdoring, Willem Pretorius, Barberspan (a Ramsar site) and S.A. Lombard Nature Reserves. About 4% has been transformed so far, but threats by agriculture, road building, mining and urbanisation are still increasing. Alien plants such as *Atriplex semibaccata*, *Conyza albida*, *Flaveria bidentis*, *Salsola kali*, *Schkuhria pinnata*, *Sonchus oleraceus*, *Spergularia rubra*, *Tagetes minuta*, *Verbena brasiliensis* and *Xanthium* species (Cilliers & Bredenkamp 2003, Janecke et al. 2003) have been recorded in the vegetation of these salt pans.

AZi 4 Southern Kalahari Salt Pans

Name of vegetation type	Southern Kalahari Salt Pans
Code as used in the Book - contains space	AZi4
Conservation Target (percent of area) from NSBA	24%
Protected (percent of area) from NSBA	8.2%
Remaining (percent of area) from NSBA	98.8%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Poorly protected
Area (sqkm) of the full extent of the Vegetation Type	882.78
Name of the Biome	Azonal Vegetation
Name of Group (only differs from Bioregion in Fynbos)	Inland Saline Vegetation
Name of Bioregion (only differs from Group in Fynbos)	Inland Saline Vegetation

Distribution

Northern Cape and North-West Provinces and neighbouring Kalahari regions of Botswana and Namibia: System of endorheic, closed depressions (pans) in the southern Kalahari as defined by Thomas & Shaw (1991) south of the Bakalahari Schwelle. The largest concentrations of such pans in South Africa are found near Groot-Mier in western Gordonia. Altitude ranging from 800–1 500 m.

Conservation

Least threatened. Target 24%. About 8% statutorily conserved in the Kgalagadi Transfrontier Park. The vegetation of the pans is subject to natural degradation/regeneration cycles controlled by concentration of grazing animals (antelopes in particular).

AZi 5 Bushmanland Vloere

Name of vegetation type	Bushmanland Vloere
Code as used in the Book - contains space	AZi5
Conservation Target (percent of area) from NSBA	24%
Protected (percent of area) from NSBA	
Remaining (percent of area) from NSBA	97.7%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Not protected
Area (sqkm) of the full extent of the Vegetation Type	4706.90
Name of the Biome	Azonal Vegetation
Name of Group (only differs from Bioregion in Fynbos)	Inland Saline Vegetation
Name of Bioregion (only differs from Group in Fynbos)	Inland Saline Vegetation

Distribution

Northern Cape Province: Vloere (salt pans) of the central Bushmanland Basin as well as the broad riverbeds of the intermittent Sak River (functioning as temporary connection between some of the pans) as well as its numerous ancient (today dysfunctional) tributaries. The patches of this vegetation unit are embedded especially within NKb 6 Bushmanland Basin Shrubland and NKb 3 Bushmanland Arid Grassland and to a lesser extent also within NKb 4, NKu 1, NKu 2 as well as marginal Succulent Karoo units summarised within the bioregion of Trans-Escarpment Succulent Karoo. Altitude 850–1 450 m.

Conservation

Least threatened. Target 24%. None conserved in statutory conservation areas. About 2% transformed for cultivation or building of dams (Vanwyksvlei Dam). Alien *Prosopis* occurs as scattered in some vloere and dry riverbeds. Several of the pans are mined for salt production.

AZi 6 Southern Karoo Riviere

Name of vegetation type	Southern Karoo Riviere
Code as used in the Book - contains space	AZi6
Conservation Target (percent of area) from NSBA	24%
Protected (percent of area) from NSBA	1.4% (+1.6%)
Remaining (percent of area) from NSBA	88.2%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Hardly protected
Area (sqkm) of the full extent of the Vegetation Type	5299.13
Name of the Biome	Azonal Vegetation
Name of Group (only differs from Bioregion in Fynbos)	Inland Saline Vegetation
Name of Bioregion (only differs from Group in Fynbos)	Inland Saline Vegetation

Distribution

Western and Eastern Cape Provinces: Alluvia of the Buffels, Bloed, Dwyka, Gamka, Sout, Kariega, and Sundays Rivers and their tributaries), east of Laingsburg as far west as Graaff-Reinet and Jansenville. This vegetation unit is embedded within the Koedoesberge-Moordenaars Karoo, Prince Albert Succulent Karoo, Gamka Karoo, Eastern Lower Karoo, and southern parts of the Eastern Upper Karoo as well as some parts of the Albany Thicket Biome south of Cradock. Altitude ranging from 250–1 550 m.

Conservation

Least threatened. Target 24%. Only about 1.5% statutorily conserved in the Karoo National Park as well as in the Aberdeen, Bosberg, Commando Drift, Gamkapoort and Karoo Nature Reserves and in about 10 private reserves, mainly set up for game farming. Some 12% transformed for cultivation and building of dams, including Beaufort West, Beervlei, De Hoop, Floriskraal, Kommandodrift, Lake Arthur, Leeu-Gamka, Mentz and Vanryneveldspas Dams. Frequent disturbance (floods, concentrated grazing pressure), and associated input of nutrients, increase vulnerability of these habitats to invasion of alien woody species such as *Agave americana*, *Opuntia* species, *Prosopis* species, *Salix babylonica* and *Schinus molle*, and forbs including *Atriplex eardleyae*, *A. lindleyi* subsp. *inflata*, *Cirsium vulgare*, *Salsola kali* and *Schkuhria pinnata*.

Gh 1 Karoo Escarpment Grassland

Name of vegetation type	Karoo Escarpment Grassland
Code as used in the Book - contains space	Gh1
Conservation Target (percent of area) from NSBA	24%
Protected (percent of area) from NSBA	2.9% (+3.5%)
Remaining (percent of area) from NSBA	98.9%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Poorly protected
Area (sqkm) of the full extent of the Vegetation Type	8378.30
Name of the Biome	Grassland Biome
Name of Group (only differs from Bioregion in Fynbos)	Dry Highveld Grassland Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Dry Highveld Grassland Bioregion

Distribution

Eastern, Northern and Western Cape Province: Occurs on the Karoo Escarpment, running in an east-west direction from Molteno to Noupoot in the north, and from Somerset East in a northwesterly direction towards Nieu-Bethesda. Also found on the north-facing slopes of the Winterberg Mountains around Tarkastad. The westernmost locality is on the highest-altitude flat-topped mesas of the Escarpment in the Karoo National Park near Beaufort West. Altitude about 1 100–2 502 m at the summit of the Kompasberg.

Conservation

Least threatened. Target 24%. Nearly 3% statutorily conserved in the Mountain Zebra and Karoo National Parks as well as in the Tsolwana and Karoo Nature Reserves. Slightly higher portions also protected in game farms and private nature reserves, such as Buchanon, Asanta Sana, Samara, Karoo Safaris, Hoeksfontien, Glen Harry, Oudekraal and Rupert. Erosion moderate (49%) and high (42%).

Gh 3 Xhariep Karroid Grassland

Name of vegetation type	Xhariep Karroid Grassland
Code as used in the Book - contains space	Gh3
Conservation Target (percent of area) from NSBA	24%
Protected (percent of area) from NSBA	2.5%
Remaining (percent of area) from NSBA	96%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Poorly protected
Area (sqkm) of the full extent of the Vegetation Type	13391.90
Name of the Biome	Grassland Biome
Name of Group (only differs from Bioregion in Fynbos)	Dry Highveld Grassland Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Dry Highveld Grassland Bioregion

Distribution

Free State Province and very slightly into the Northern Cape Province: Southern regions including the vicinity of Luckhoff (west), Edenburg (north), Gariep Dam (south) and Smithfield (east). Altitude 1 260–1 560 m.

Conservation

Least threatened. Target 24%. About 2.5% statutorily conserved in Gariep Dam, Tussen Die Riviere, Kalkfontein Dam, Oviston, Wurasdam and Rolfontein Nature Reserves. Some 4% already transformed by cultivation and dam-building (Bethulie, Gariep, Kalkfontein, Straussfontein and Tierpoort Dams). This dry grassland is prone to encroachment of low, unpalatable karroid shrubs when exposed to heavy grazing. Erosion moderate (71%) and low (19%).

Gh 4 Besemkaree Koppies Shrubland

Name of vegetation type	Besemkaree Koppies Shrubland
Code as used in the Book - contains space	Gh4
Conservation Target (percent of area) from NSBA	28%
Protected (percent of area) from NSBA	5.3%
Remaining (percent of area) from NSBA	97.2%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Poorly protected
Area (sqkm) of the full extent of the Vegetation Type	9677.74
Name of the Biome	Grassland Biome
Name of Group (only differs from Bioregion in Fynbos)	Dry Highveld Grassland Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Dry Highveld Grassland Bioregion

Distribution

Northern Cape, Free State and Eastern Cape Provinces: On plains of Eastern Upper Karoo (between Richmond and Middelburg in the south and the Orange River) and within dry grasslands of the southern and central Free State. Extensive dolerite-dominated landscapes along the upper Orange River belong to this unit as well. Extends northwards to around Fauresmith in the northwest and to the Wepener District in the northeast. Altitude 1 120–1 680 m.

Conservation

Least threatened because largely excluded from intensive agricultural activities. Target 28%. About 5% statutorily conserved in the Rolfontein, Tussen Die Riviëre, Oviston, Gariep Dam, Caledon and Kalkfontein Dam Nature Reserves. In addition a small patch is also protected in the private Vulture Conservation Area. About 3% of the area has been lost through building of dams (Bethulie, Egmont, Gariep, Kalkfontein, Vanderkloof and Welbedacht Dams). Erosion moderate (68%), high (20%) and low (10%).

Gs 17 Tarkastad Montane Shrubland

Name of vegetation type	Tarkastad Montane Shrubland
Code as used in the Book - contains space	Gs17
Conservation Target (percent of area) from NSBA	28%
Protected (percent of area) from NSBA	1%
Remaining (percent of area) from NSBA	98.3%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Hardly protected
Area (sqkm) of the full extent of the Vegetation Type	4239.67
Name of the Biome	Grassland Biome
Name of Group (only differs from Bioregion in Fynbos)	Sub-Escarpment Grassland Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Sub-Escarpment Grassland Bioregion

Distribution

Eastern Cape and marginally into Northern Cape Province: Noupoot, Middelburg and a point west of Cradock define the western extent of this unit and Cathcart, Queenstown and Sterkstroom the eastern extent. The unit falls within the area between the Great Escarpment in the north, marked by the Bamboesberg and Stormberg Mountains, and the minor escarpment, marked by the Winterberg and Amathole Mountains in the south. Altitude 1 020–1 780 m.

Conservation

Least threatened. Target 28%. Around 1–2% conserved in statutory conservation areas (Commando Drift, Tsolwana Nature Reserves, Mountain Zebra National Park). About 2% transformed for cultivation or by building of dams (Kommandodrif and Waterdown). Erosion is moderate (51%), high (28%) and low (18%).

NKb 1 Lower Gariep Broken Veld

Name of vegetation type	Lower Gariep Broken Veld
Code as used in the Book - contains space	NKb1
Conservation Target (percent of area) from NSBA	21%
Protected (percent of area) from NSBA	3.9%
Remaining (percent of area) from NSBA	99.5%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Poorly protected
Area (sqkm) of the full extent of the Vegetation Type	4538.17
Name of the Biome	Nama-Karoo Biome
Name of Group (only differs from Bioregion in Fynbos)	Bushmanland Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Bushmanland Bioregion

Distribution

Northern Cape Province: Hardeveld along the Orange River from Onseepkans in the west, including the canyon below the Augrabies Falls and parts of Riemvasmaak and adjacent areas to Keimoes resuming from the Boegoeberg to around Prieska in the east. A series of inselbergs and koppies occurring between Keimoes and around Kakamas, and the ridge running west of Groblershoop from Karos in the north to around Marydale in the south. The unit also occurs in neighbouring Namibia. Most of the area varies from 400–1 200 m in altitude.

Conservation

Least threatened. Target 21%. Statutorily conserved in Augrabies Falls National Park (4%). Only a very small part transformed. Erosion is low (58%), very low (27%) and moderate (14%).

NKb 3 Bushmanland Arid Grassland

Name of vegetation type	Bushmanland Arid Grassland
Code as used in the Book - contains space	NKb3
Conservation Target (percent of area) from NSBA	21%
Protected (percent of area) from NSBA	0.4%
Remaining (percent of area) from NSBA	99.4%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Hardly protected
Area (sqkm) of the full extent of the Vegetation Type	45478.96
Name of the Biome	Nama-Karoo Biome
Name of Group (only differs from Bioregion in Fynbos)	Bushmanland Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Bushmanland Bioregion

Distribution

Northern Cape Province: Spanning about one degree of latitude from around Aggeneys in the west to Prieska in the east. The southern border of the unit is formed by edges of the Bushmanland Basin while in the northwest this vegetation unit borders on desert vegetation (northwest of Aggeneys and Pofadder). The northern border (in the vicinity of Upington) and the eastern border (between Upington and Prieska) are formed with often intermingling units of Lower Gariep Broken Veld, Kalahari Karroid Shrubland and Gordonias Duneveld. Most of the western border is formed by the edge of the Namaqualand hills. Altitude varies mostly from 600–1200 m.

Conservation

Least threatened. Target 21%. Only small patches statutorily conserved in Augrabies Falls National Park and Goegab Nature Reserve. Very little of the area has been transformed. Erosion is very low (60%) and low (33%).

NKb 4 Bushmanland Sandy Grassland

Name of vegetation type	Bushmanland Sandy Grassland
Code as used in the Book - contains space	NKb4
Conservation Target (percent of area) from NSBA	21%
Protected (percent of area) from NSBA	
Remaining (percent of area) from NSBA	99.5%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Not protected
Area (sqkm) of the full extent of the Vegetation Type	2282.99
Name of the Biome	Nama-Karoo Biome
Name of Group (only differs from Bioregion in Fynbos)	Bushmanland Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Bushmanland Bioregion

Distribution

Northern Cape Province: Surrounds of Aggeneys (northern Bushmanland) and a few isolated patches south of Copperton on the eastern edge of the Bushmanland Basin suggesting the course of the paleoriverine system of the Orange River and its tributaries. The largest continuous patch of this vegetation type fills the shallow valley of the intermittent Koa River southeast and west of Aggeneys. Altitude varies mostly from 500–1200 m.

Conservation

Least threatened. Target 21%. None conserved in statutory conservation areas. Very little of the area has been transformed. The alien shrub *Prosopis* sp. can be seen as a threat. Erosion is very low (82%) or moderate (17%).

NKb 6 Bushmanland Basin Shrubland

Name of vegetation type	Bushmanland Basin Shrubland
Code as used in the Book - contains space	NKb6
Conservation Target (percent of area) from NSBA	21%
Protected (percent of area) from NSBA	
Remaining (percent of area) from NSBA	99.5%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Not protected
Area (sqkm) of the full extent of the Vegetation Type	34690.68
Name of the Biome	Nama-Karoo Biome
Name of Group (only differs from Bioregion in Fynbos)	Bushmanland Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Bushmanland Bioregion

Distribution

Northern Cape Province: Large Bushmanland Basin centred on Brandvlei and Van Wyksvlei area, spanning Granaatboskolk in the west to Copperton in the east, and Kenhardt vicinity in the north to Williston vicinity in the south. Altitude ranges mostly from 800–1 200 m.

Conservation

Least threatened. Target 21%. None of the unit is conserved in statutory conservation areas. No signs of serious transformation, but scattered individuals of *Prosopis* sp. occur in some areas (e.g. in the vicinity of the Sak River drainage system), and some localised dense infestations form closed 'woodlands' along the eastern border of the unit with Northern Upper Karoo (east of Van Wyksvlei). Erosion is moderate (56%) and low (34%).

NKI 1 Gamka Karoo

Name of vegetation type	Gamka Karoo
Code as used in the Book - contains space	NKI1
Conservation Target (percent of area) from NSBA	16%
Protected (percent of area) from NSBA	1.9%
Remaining (percent of area) from NSBA	99.5%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Poorly protected
Area (sqkm) of the full extent of the Vegetation Type	20324.91
Name of the Biome	Nama-Karoo Biome
Name of Group (only differs from Bioregion in Fynbos)	Lower Karoo Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Lower Karoo Bioregion

Distribution

Western Cape and Eastern Cape Provinces and marginally into the Northern Cape Province: Large basin between the Great Escarpment (Nuweveld Mountains) in the north and northwest and Cape Fold Belt Mountains (mostly Swartberg Mountains) in the south. From approximately the edge of the Gamka basin catchment area (i.e. of the Dwyka River tributary) in the west to about the Kariega River in the east. Altitude varies mostly from 500–1 100 m.

Conservation

Least threatened. Target 16%. About 2% statutorily conserved in the Karoo National Park and some in private reserves, such as Steenbokkie Private Nature Reserve (near Beaufort West). Only small part has undergone transformation. The alien *Salsola kali* is a serious infestation problem locally. Erosion is moderate (78%), low (11%) and high (11%).

NKu 1 Western Upper Karoo

Name of vegetation type	Western Upper Karoo
Code as used in the Book - contains space	NKu1
Conservation Target (percent of area) from NSBA	21%
Protected (percent of area) from NSBA	0%
Remaining (percent of area) from NSBA	99.4%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Hardly protected
Area (sqkm) of the full extent of the Vegetation Type	17149.51
Name of the Biome	Nama-Karoo Biome
Name of Group (only differs from Bioregion in Fynbos)	Upper Karoo Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Upper Karoo Bioregion

Distribution

Northern Cape Province and a small part in the Western Cape Province: Plains from the Fish River and upper reaches of the Renoster River in the west as far as Fraserburg and Carnarvon in the east, sandwiched between the Bushmanland Basin in the north and the Roggeveld Karoo and edges of the Great Escarpment in the south. Altitude varies mostly from 1 000–1 500 m.

Conservation

Least threatened. Target 21%. None conserved in statutory conservation areas. Very little transformed. Erosion is moderate (52%) and low (44%).

NKu 2 Upper Karoo Hardeveld

Name of vegetation type	Upper Karoo Hardeveld
Code as used in the Book - contains space	NKu2
Conservation Target (percent of area) from NSBA	21%
Protected (percent of area) from NSBA	2.9%
Remaining (percent of area) from NSBA	99.7%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Poorly protected
Area (sqkm) of the full extent of the Vegetation Type	11734.28
Name of the Biome	Nama-Karoo Biome
Name of Group (only differs from Bioregion in Fynbos)	Upper Karoo Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Upper Karoo Bioregion

Distribution

Northern, Western and Eastern Cape Provinces: Discrete areas of slopes and ridges including dolerite dykes and sills in the region spanning Middelpos in the west and Strydenburg, Richmond and Nieu-Bethesda in the east. Most crest areas and steep slopes of the Great Escarpment facing south between Teekloofpas (connecting Leeu-Gamka and Fraserburg) and eastwards to Graaff-Reinet. Altitude varies mostly from 1 000–1 900 m.

Conservation

Least threatened. Target 21%. Only about 3% statutorily conserved in Karoo National Park and Karoo Nature Reserve. Small percentage also protected in private reserves such as Rupert Game Farm. Erosion is moderate (64%) and high (2%).

NKu 3 Northern Upper Karoo

Name of vegetation type	Northern Upper Karoo
Code as used in the Book - contains space	NKu3
Conservation Target (percent of area) from NSBA	21%
Protected (percent of area) from NSBA	0%
Remaining (percent of area) from NSBA	96.6%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Hardly protected
Area (sqkm) of the full extent of the Vegetation Type	41829.17
Name of the Biome	Nama-Karoo Biome
Name of Group (only differs from Bioregion in Fynbos)	Upper Karoo Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Upper Karoo Bioregion

Distribution

Northern Cape and Free State Provinces: Northern regions of the Upper Karoo plateau from Prieska, Vosburg and Carnarvon in the west to Philipstown, Petrusville and Petrusburg in the east. Bordered in the north by Niekerkshoop, Douglas and Petrusburg and in the south by Carnarvon, Pampoenpoort and De Aar. A few patches occur in Griqualand West. Altitude varies mostly from 1 000–1 500 m.

Conservation

Least threatened. Target 21%. None conserved in statutory conservation areas. About 4% has been cleared for cultivation (the highest proportion of any type in the Nama-Karoo) or irreversibly transformed by building of dams (Houwater, Kalkfontein and Smart Syndicate Dams). Areas of human settlements are increasing in the northeastern part of this vegetation type (Hoffman et al. 1999). Erosion is moderate (46.2%), very low (32%) and low (20%). *Prosopis glandulosa*, regarded as one of the 12 agriculturally most important invasive alien plants in South Africa, is widely distributed in this vegetation type (Hoffman et al. 1999). *Prosopis* occurs in generally isolated patches, with densities ranging from very scattered to medium (associated with the lower Vaal River drainage system and the confluence with the Orange River) to localised closed woodland on the western border of the unit with Bushmanland Basin Shrubland.

NKu 4 Eastern Upper Karoo

Name of vegetation type	Eastern Upper Karoo
Code as used in the Book - contains space	NKu4
Conservation Target (percent of area) from NSBA	21%
Protected (percent of area) from NSBA	0.7%
Remaining (percent of area) from NSBA	98.1%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Hardly protected
Area (sqkm) of the full extent of the Vegetation Type	49821.32
Name of the Biome	Nama-Karoo Biome
Name of Group (only differs from Bioregion in Fynbos)	Upper Karoo Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Upper Karoo Bioregion

Distribution

Northern Cape, Eastern Cape and Western Cape Provinces: Between Carnarvon and Loxton in the west, De Aar, Petrusville and Venterstad in the north, Burgersdorp, Hofmeyr and Cradock in the east and the Great Escarpment and the Sneeuberge-Coetzeesberge mountain chain in the south. Altitude varies between mostly 1 000–1 700 m.

Conservation

Least threatened. Target 21%. Statutorily conserved in Mountain Zebra and Karoo National Parks as well as in Oviston, Commando Drift, Rolfontein and Gariep Dam Nature Reserves. About 2% of the unit has been transformed, largely due to building of dams (Gariep, Grassridge, Killowen, Kommandodrift, Kriegerspoort, Lake Arthur, Modderpoort, Schuil Hoek, Vanderkloof, Victoria West, Wonderboom and Zoetvlei). *Medi-cago laciniata* is a common and widespread alien plant. Erosion is moderate (60%) and high (38%). Veld managers perceive much of the Eastern Upper Karoo to be experiencing changes in species composition requiring high-priority action (Hoffman et al. 1999).

SVk 10 Kuruman Mountain Bushveld

Name of vegetation type	Kuruman Mountain Bushveld
Code as used in the Book - contains space	SVk10
Conservation Target (percent of area) from NSBA	16%
Protected (percent of area) from NSBA	
Remaining (percent of area) from NSBA	99.1%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Not protected
Area (sqkm) of the full extent of the Vegetation Type	4360.52
Name of the Biome	Savanna Biome
Name of Group (only differs from Bioregion in Fynbos)	Eastern Kalahari Bushveld Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Eastern Kalahari Bushveld Bioregion

Distribution

Northern Cape and North-West Provinces: From the Asbestos Mountains southwest and northwest of Griekwastad, along the Kuruman Hills north of Danielskuil, passing west of Kuruman town and re-emerging as isolated hills, i.e. Makhubung and the hills around Pomfret in the north. Altitude 1 100–1 800 m.

Conservation

Least threatened. Target 16%. None conserved in statutory conservation areas. Very little transformed. Erosion is very low to low. Some parts in the north are heavily utilised for grazing.

SVk 13 Olifantshoek Plains Thornveld

Name of vegetation type	Olifantshoek Plains Thornveld
Code as used in the Book - contains space	SVk13
Conservation Target (percent of area) from NSBA	16%
Protected (percent of area) from NSBA	0.3%
Remaining (percent of area) from NSBA	99.1%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Hardly protected
Area (sqkm) of the full extent of the Vegetation Type	8496.60
Name of the Biome	Savanna Biome
Name of Group (only differs from Bioregion in Fynbos)	Eastern Kalahari Bushveld Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Eastern Kalahari Bushveld Bioregion

Distribution

Northern Cape Province: Plains including most of the pediment areas of the Korannaberg, Langeberg and Asbestos Mountains as well as those of some ridges to the west of the Langeberg. From the vicinity of Sonstraal in the north, past Olifantshoek to areas north of Niekerkshoop between Volop and Griekwastad in the south. Also from Griekwastad northwards to the flats west of the Lime Acres area. Altitude 1 000–1 500 m.

Conservation

Least threatened. Target 16%. Only 0.3% statutorily conserved in the Witsand Nature Reserve. Only about 1% of the area has been transformed and erosion is very low.

SVk 15 Koranna-Langeberg Mountain Bushveld

Name of vegetation type	Koranna-Langeberg Mountain Bushveld
Code as used in the Book - contains space	SVk15
Conservation Target (percent of area) from NSBA	16%
Protected (percent of area) from NSBA	
Remaining (percent of area) from NSBA	99.9%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Not protected
Area (sqkm) of the full extent of the Vegetation Type	1620.89
Name of the Biome	Savanna Biome
Name of Group (only differs from Bioregion in Fynbos)	Eastern Kalahari Bushveld Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Eastern Kalahari Bushveld Bioregion

Distribution

Northern Cape Province: From the Tswalu Kalahari Reserve at the northern tip of the Korannaberg southwards in the form of multiple ridges to the Langeberg west of Olifantshoek and southwards along the Langeberg and some parallel ridges, to ridges in the vicinity of Volop. Also some ridges to the west of the Langeberg. Altitude 1 000–1 836 m at highest point.

Conservation

Least threatened. Target 16%. None conserved in statutory conservation areas but partly conserved in private reserves such as the Tswalu Kalahari Reserve. Virtually none of the area is transformed. Erosion is very low.

SVk 16 Gordonia Plains Shrubland

Name of vegetation type	Gordonia Plains Shrubland
Code as used in the Book - contains space	SVk16
Conservation Target (percent of area) from NSBA	16%
Protected (percent of area) from NSBA	8.6%
Remaining (percent of area) from NSBA	99.6%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Moderately protected
Area (sqkm) of the full extent of the Vegetation Type	7883.62
Name of the Biome	Savanna Biome
Name of Group (only differs from Bioregion in Fynbos)	Eastern Kalahari Bushveld Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Eastern Kalahari Bushveld Bioregion

Distribution

Northern Cape Province: Broad north-south band on flats west of the Korannaberg and Langeberg Mountains (and of their western pediment) and east of the main Kalahari dune-veld area (for example at Pearson's Hunt). From Van Zylsrus in the north to southwest of Witsand in the south. Also as a number of isolated patches embedded in the duneveld area between the Auob and Nossob Rivers in the Kgalagadi Transfrontier Park as well as the valley containing Groot and Klein Mier south of the park. Altitude 900–1 250 m.

Conservation

Least threatened. Target 16%. Some 9% statutorily conserved in the Kgalagadi Transfrontier Park. Very little of the area is transformed and erosion is very low.

SVk 4 Kimberley Thornveld

Name of vegetation type	Kimberley Thornveld
Code as used in the Book - contains space	SVk4
Conservation Target (percent of area) from NSBA	16%
Protected (percent of area) from NSBA	2%
Remaining (percent of area) from NSBA	82.3%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Poorly protected
Area (sqkm) of the full extent of the Vegetation Type	19512.49
Name of the Biome	Savanna Biome
Name of Group (only differs from Bioregion in Fynbos)	Eastern Kalahari Bushveld Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Eastern Kalahari Bushveld Bioregion

Distribution

North-West, Free State and Northern Cape Provinces: Most of the Kimberley, Hartswater, Bloemhof and Hoopstad Districts as well as substantial parts of the Warrenton, Christiana, Taung, Boshof and to some extent the Barkly West Districts. Also includes pediment areas in the Herbert and Jacobsdal Districts. Altitude 1 050–1 400 m.

Conservation

Least threatened. Target 16%. Only 2% statutorily conserved in Vaalbos National Park as well as in Sandveld, Bloemhof Dam and S.A. Lombard Nature Reserves. Some 18% already transformed, mostly by cultivation. Erosion is very low. Area is mostly used for cattle farming or game ranching. Overgrazing leads to encroachment of *Acacia mellifera* subsp. *detinens*.

SVk 5 Vaalbos Rocky Shrubland

Name of vegetation type	Vaalbos Rocky Shrubland
Code as used in the Book - contains space	SVk5
Conservation Target (percent of area) from NSBA	16%
Protected (percent of area) from NSBA	1.7%
Remaining (percent of area) from NSBA	98.6%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Poorly protected
Area (sqkm) of the full extent of the Vegetation Type	1451.36
Name of the Biome	Savanna Biome
Name of Group (only differs from Bioregion in Fynbos)	Eastern Kalahari Bushveld Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Eastern Kalahari Bushveld Bioregion

Distribution

Northern Cape and Free State Provinces: Extends along solitary hills and scattered ridges east of the confluence of the Orange and Vaal Rivers, mainly in the Kimberley and Herbert Districts and west of a line bounded by the western Free State towns of Luckhoff, Petrusburg, Dealesville, Bultfontein and Hertzogville. Altitude 1000–1 400 m.

Conservation

Least threatened. Target 16%. Less than 2% statutorily conserved in the Vaalbos National Park. Only about 2% already transformed.

SVk 6 Schmidtsdrif Thornveld

Name of vegetation type	Schmidtsdrif Thornveld
Code as used in the Book - contains space	SVk6
Conservation Target (percent of area) from NSBA	16%
Protected (percent of area) from NSBA	0.2%
Remaining (percent of area) from NSBA	87%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Hardly protected
Area (sqkm) of the full extent of the Vegetation Type	5032.75
Name of the Biome	Savanna Biome
Name of Group (only differs from Bioregion in Fynbos)	Eastern Kalahari Bushveld Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Eastern Kalahari Bushveld Bioregion

Distribution

Northern Cape, Free State and North-West Provinces: Foothills and midslopes to the southeast and below the Ghaap Plateau from around Douglas in the southwest via Schmidtsdrif towards Taung in the northeast. A small less typical section is found east of the Ghaap Plateau from Warrenton towards Hertzogville. Altitude 1 000–1 350 m.

Conservation

Least threatened. Target 16%. Only 0.2% statutorily conserved in the Vaalbos National Park. Some 13% already transformed, mainly by cultivation. Erosion is very low to low. Of alien plant taxa, *Prosopis* deserves attention.

SVkd 1 Gordonia Duneveld

Name of vegetation type	Gordonia Duneveld
Code as used in the Book - contains space	SVkd1
Conservation Target (percent of area) from NSBA	16%
Protected (percent of area) from NSBA	14.2%
Remaining (percent of area) from NSBA	99.8%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Moderately protected
Area (sqkm) of the full extent of the Vegetation Type	36771.71
Name of the Biome	Savanna Biome
Name of Group (only differs from Bioregion in Fynbos)	Kalahari Duneveld Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Kalahari Duneveld Bioregion

Distribution

Northern Cape Province: Areas with dunes comprising the largest part of the South African side of the Kgalagadi Transfrontier Park. South of the Molopo River border with Botswana (west of Van Zylsrus), interleaving with NKb 5 Kalahari Karroid Shrubland in the west (south of Rietfontein to the Orange River area) and in the south (around Upington and north of Groblershoop). Also occurs as a number of loose dune cordons south of the Orange River near Keimoes and between Upington and Putsonderwater. Eastern boundary is found at the longitude of Pearson's Hunt, but with outliers near Niekerkshoop in the southeast and Floradora in the northeast. Altitude 800–1 200 m.

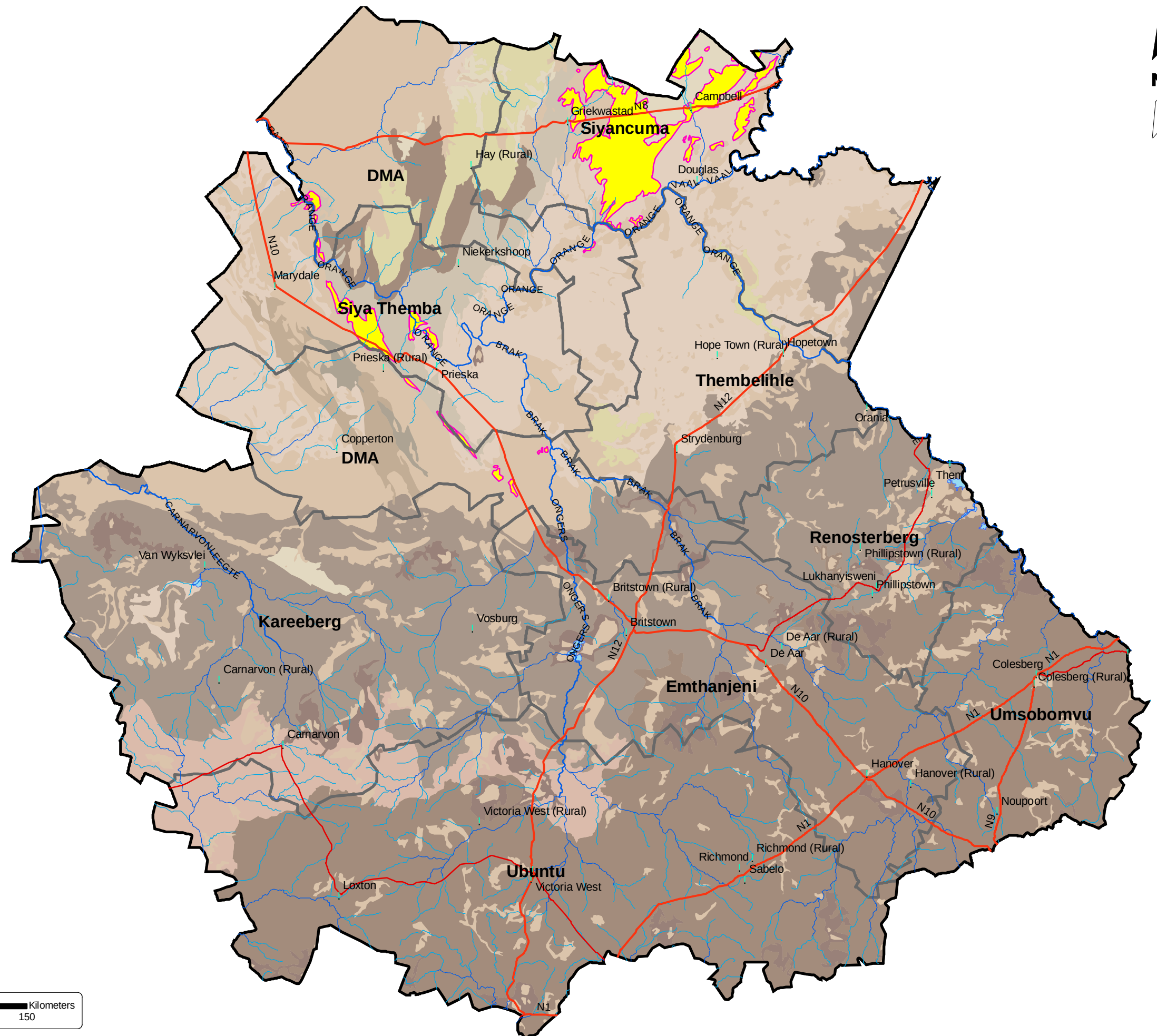
Conservation

Least threatened. Target 16%. Some 14% statutorily conserved in the Kgalagadi Transfrontier Park. Very little transformed. Generally low erosion, but some areas with spectacular destabilisation of normally vegetated dunes (through local overstocking) favoured by photographers. Erosion is normally very low.

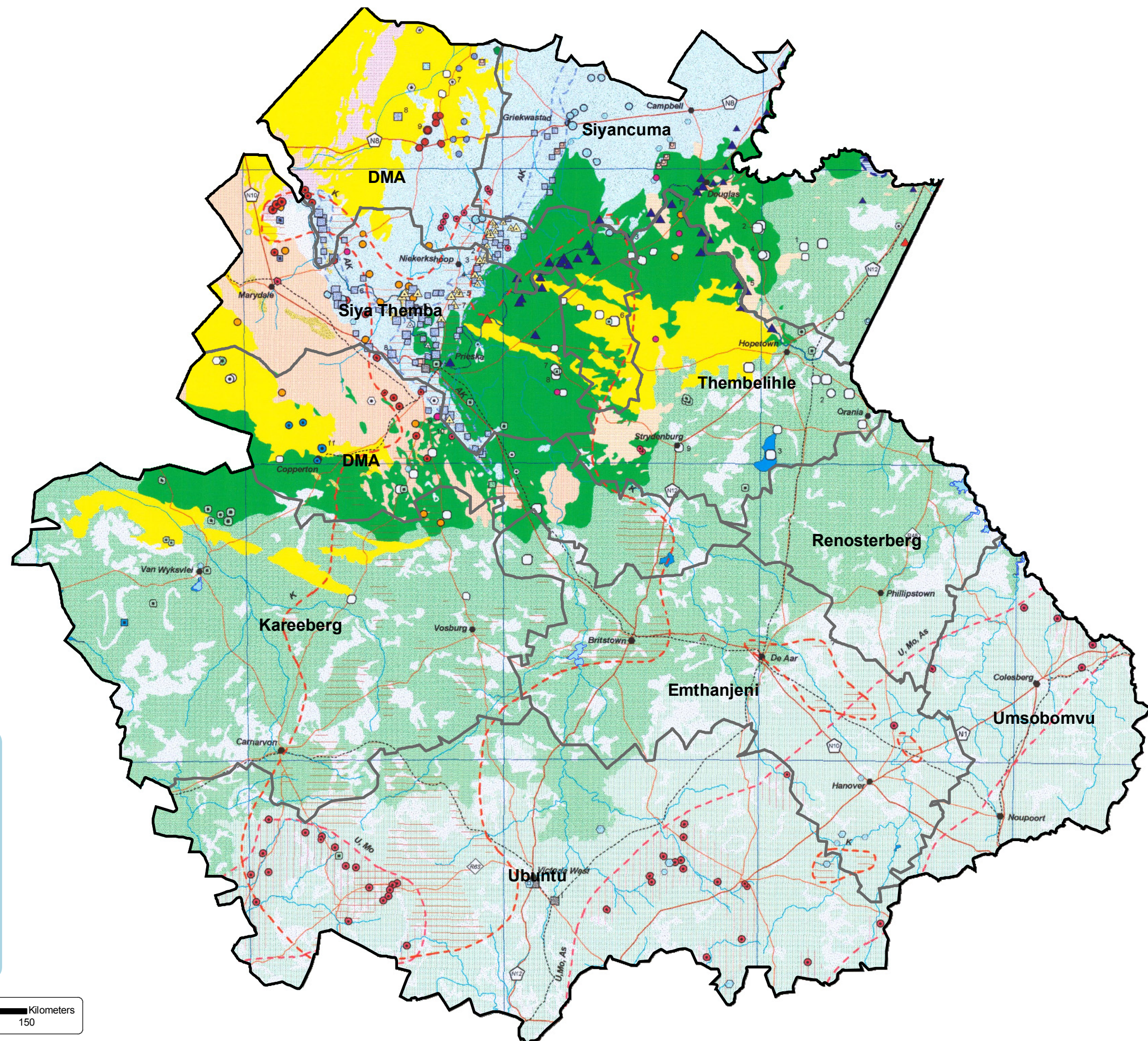
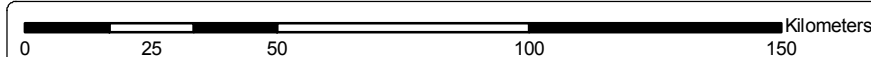
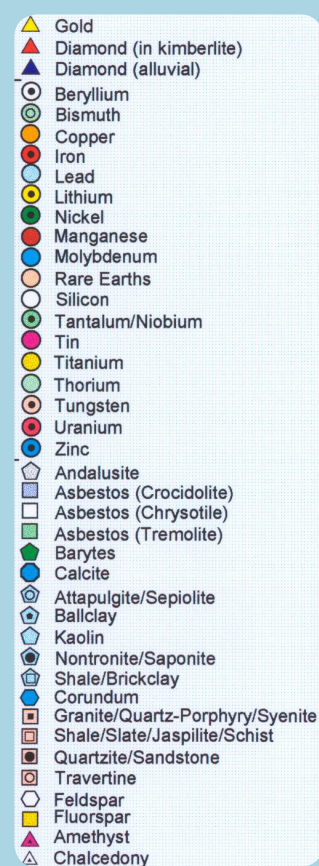
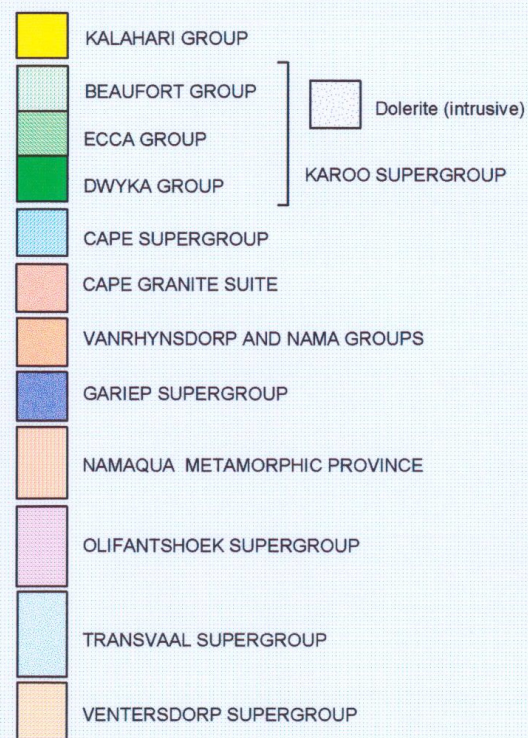
ANNEXURE 2 - MAPS

LEGEND

- DOLOMITE
- AMPHIBOLITE
- ANDESITE
- ARENITE
- CONGLOMERATE
- DIAMICTITE
- DOLERITE
- GNEISS
- GRANITE
- IGNIMBRITE
- IRON FORMATION
- LUTACEOUS ARENITE
- MUDSTONE
- ORANGE RIVER BASIN
- QUARTZ PORPHYRY
- QUARTZITE
- SAND
- SCHIST
- SEDIMENTARY
- SHALE
- SILICICLASTIC
- SILTSTONE
- TILLITE
- VOLCANIC ROCKS



GEOLOGICAL LEGEND (SIMPLIFIED)



LEGEND

- DUNE HILLS
- ESCARPMENTS
- EXTREMELY IRREGULAR PLAINS
- HILLS
- HILLS AND LOWLANDS
- LOW MOUNTAINS
- LOWLANDS WITH HILLS
- LOWLANDS WITH MOUNTAINS
- PLAINS
- PLAINS AND PANS
- IRREGULAR PLAINS
- IRREGULAR PLAINS AND PANS

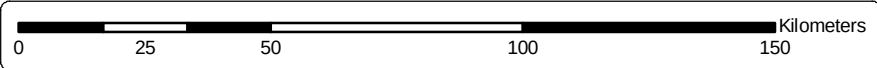


LEGEND

-  Study Area
-  Local Municipalities
-  Dams
-  Primary Rivers
-  Secondary Rivers
-  National Roads
-  District Roads

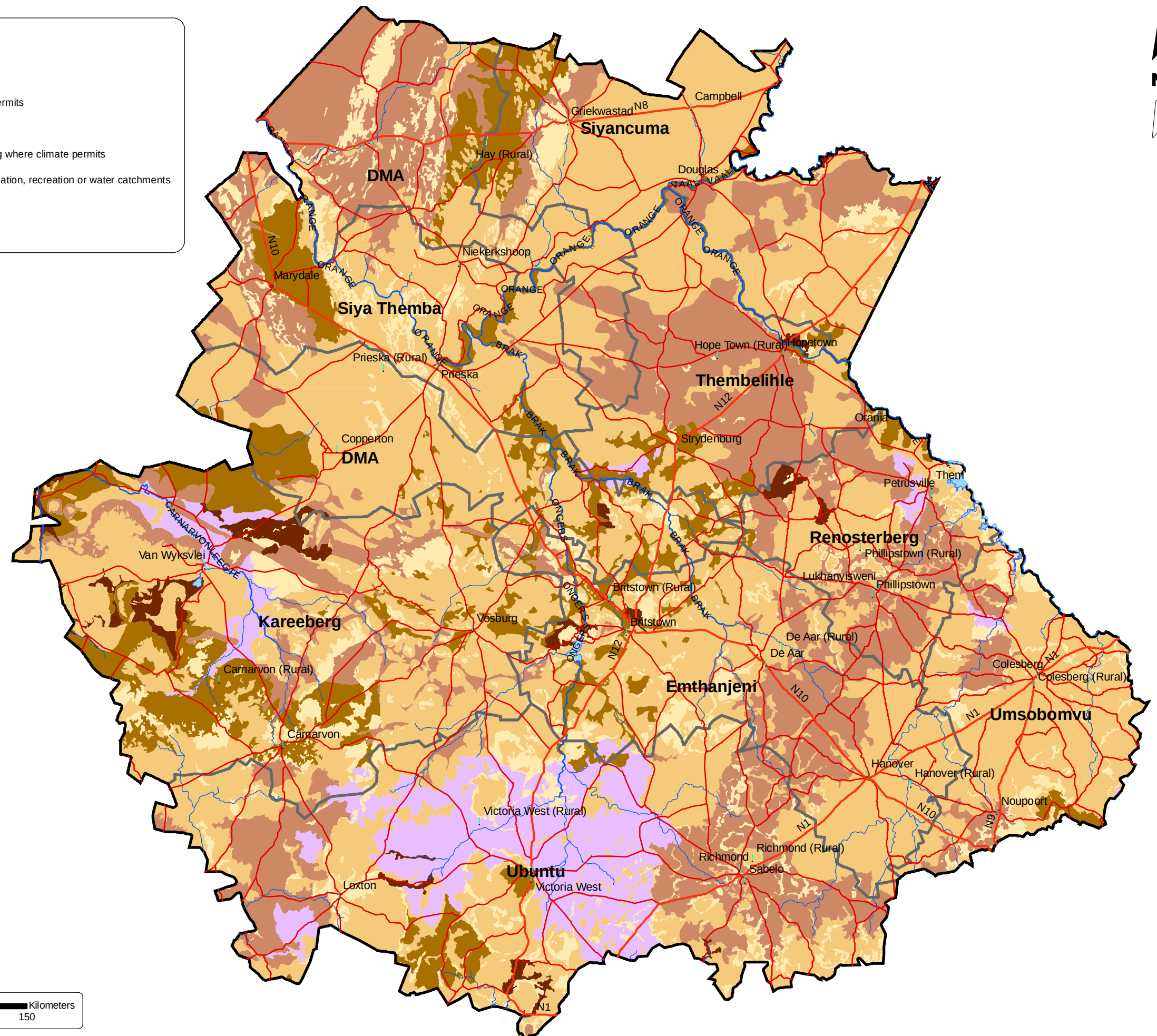
Slope Analysis

-  0 - 5°
-  5° - 14°
-  14° - 90°



LEGEND

- Soils highly suited to arable agriculture where climate permits
- Soils of intermediate suitability for arable agriculture where climate permits
- Soils of poor suitability for arable agriculture where climate permits
- Soils not suitable for arable agriculture; suitable for forestry or grazing where climate permits
- Not suitable for agriculture or commercial forestry; suitable for conservation, recreation or water catchments
- Waterbodies
- No dominant class



LEGEND

-  Study Area
-  Local Municipalities
-  Dams
-  Primary Rivers
-  Secondary Rivers
-  National Roads
-  District Roads

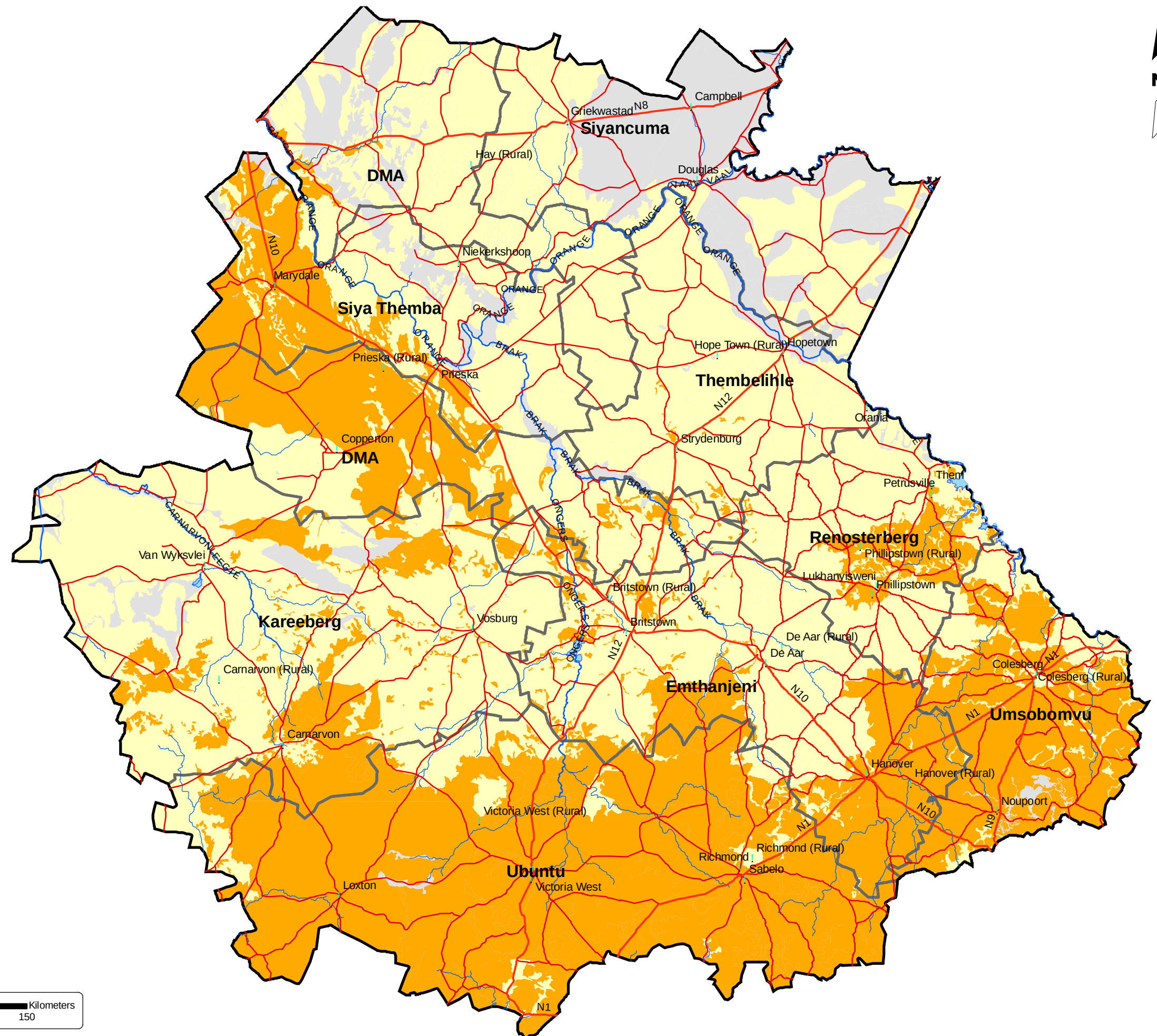
Land Capability

-  0 - 22.25 (Poor)
-  22.25 - 44.50
-  44.50 - 66.75
-  66.75 - 89 (Good)



LEGEND

-  Study Area
-  Local Municipalities
-  Dams
-  Primary Rivers
-  Secondary Rivers
-  National Roads
-  District Roads
-  Endemism > 5 Plant Species
-  Endemism 1- 5 Plant Species
-  No Endemic Plant Species

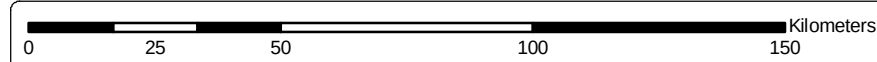


LEGEND

-  Study Area
-  Local Municipalities
-  Dams
-  Primary Rivers
-  Secondary Rivers
-  Tertiary Rivers
-  National Roads

Alien Plant Invasion

-  0 - 12.5 (Low)
-  12.5 - 25
-  25.0 - 37.5
-  37.5 - 50
-  50.0 - 62.5
-  62.5 - 75
-  75.0 - 87.5
-  87.5 - 100 (High)



LEGEND

-  Study Area
-  Local Municipalities
-  Dams
-  Primary Rivers
-  Secondary Rivers
-  National Roads

River Consevation Status

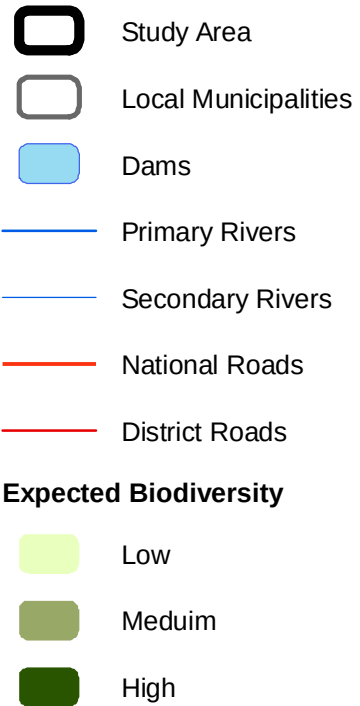
-  Critically endangered
-  Endangered

Vegetation Conservation Status

-  Least Threatened
-  Vulnerable



LEGEND



PIXLEY KASEME - INTEGRATED ENVIRONMENTAL MANAGEMENT PROGRAM
SCALE 1:1,500,000

MAP 006
BIODIVERSITY



LEGEND

-  Study Area
-  Local Municipalities
-  Dams
-  Primary Rivers
-  Secondary Rivers
-  National Roads
-  District Roads

Evaporation

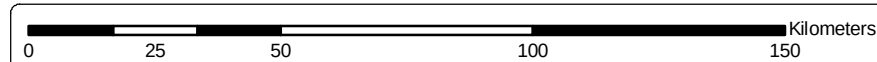
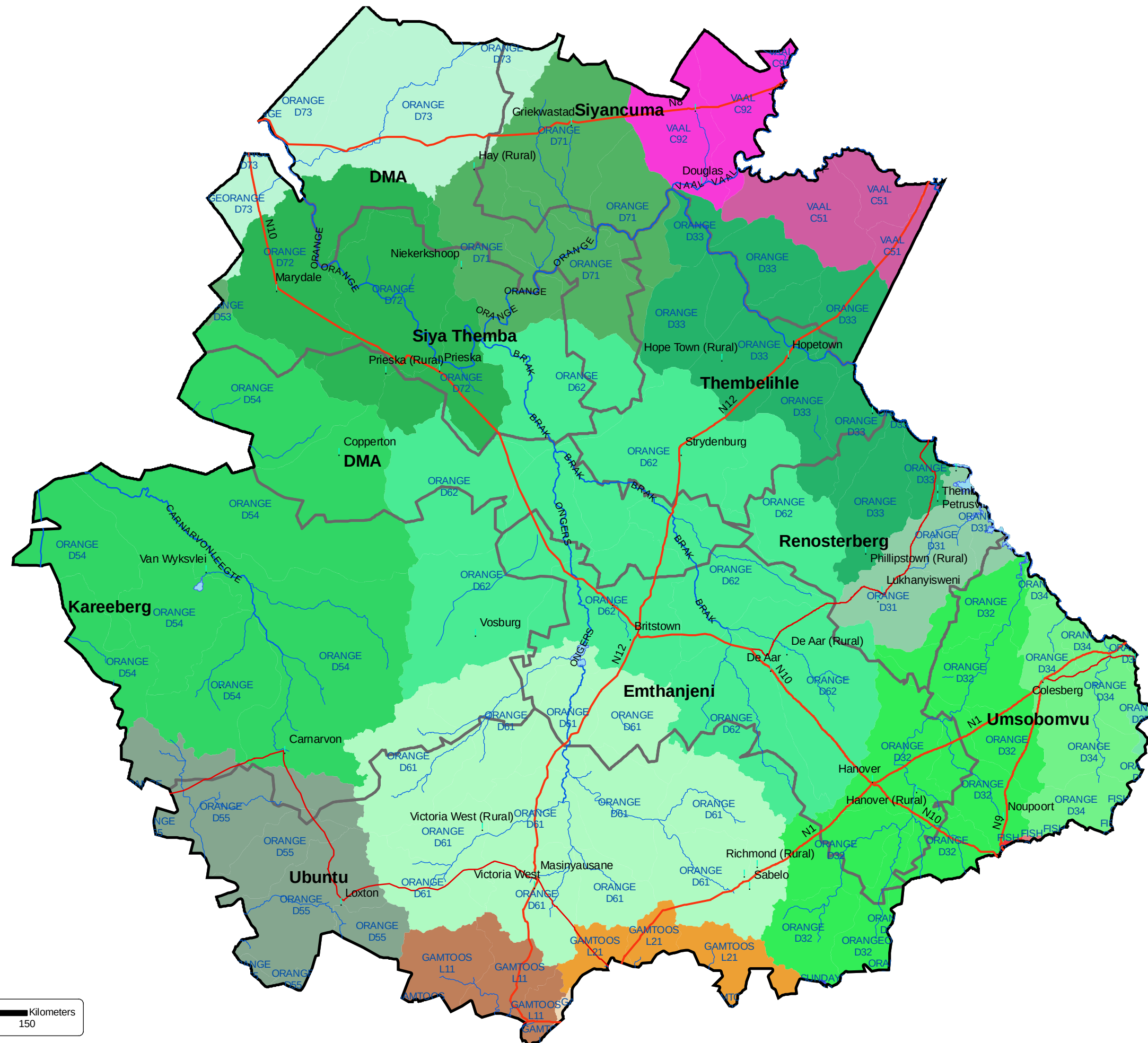
-  < 1200 mm
-  1200-1300 mm
-  1300-1400 mm
-  1400-1500 mm
-  1500-1600 mm
-  1600-1700 mm
-  1700-1800 mm
-  1800-2000 mm
-  2000-2200 mm
-  2200-2600 mm
-  > 2600 mm



LEGEND

Tertiary Catchments

- C51
- C52
- C92
- D31
- D32
- D33
- D34
- D35
- D53
- D54
- D55
- D61
- D62
- D71
- D72
- D73
- L11
- L21
- L22
- N12
- Q11
- Q14

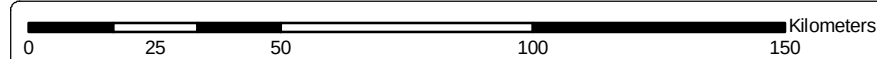


LEGEND

-  Study Area
-  Local Municipalities
-  Primary Rivers
-  Secondary Rivers
-  National Roads
-  District Roads

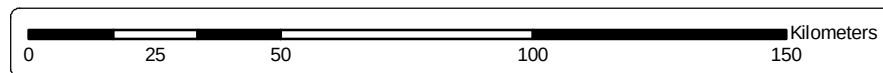
Land Cover

-  BARE ROCK AND ERODED LAND
-  BARE ROCK AND SOIL
-  BUILT-UP LAND: COMMERCIAL
-  BUILT-UP LAND: RESIDENTIAL
-  CULTIVATED GRASS
-  CULTIVATED LAND: COMMERCIAL
-  DEGRADED: SHRUBLAND AND LOW FYNBOS
-  DEGRADED: THICKET AND BUSHLAND
-  DEGRADED: UNIMPROVED GRASSLAND
-  EXOTIC PLANTATIONS
-  GRASSLAND
-  MINES AND QUARRIES
-  SHRUBLAND / FYNBOS
-  THICKET AND BUSHLAND
-  WATERBODY
-  WETLAND
-  WOODLAND



LEGEND

-  Study Area
-  Local Municipalities
-  Dams
-  Primary Rivers
-  Secondary Rivers
-  National Roads
-  District Roads
-  Secondary Roads
-  Tertiary Roads
-  Railway Lines



LEGEND

-  Study Area
-  Local Municipalities
-  Dams
-  Primary Rivers
-  Secondary Rivers
-  National Roads
-  District Roads
-  Secondary Roads

Nature Based Tourism Potential

-  Plains and hills (LOW)
-  Low mountains, hills and inland water (MED)
-  Escarpments (HIGH)



**ANNEXURE 3 – MeerKAT / SKA
TELESCOPE PROJECT
INFORMATION**



About MeerKAT

MeerKAT will be one of the world's premier mid-frequency radio astronomy facilities that will put South Africa at the cutting edge of radio astronomy.

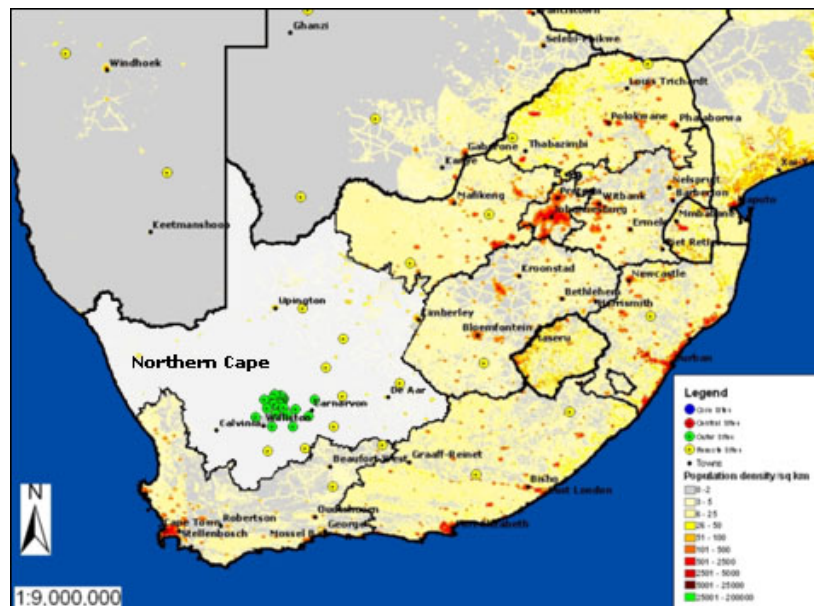
The telescope will be constructed in phases to ensure the best value for money and sound technology choices.

- The first phase, a one-dish prototype, has already been constructed at the Hartebeesthoek Radio Astronomy Observatory (HartRAO) in Gauteng.
- KAT-7, a seven-dish engineering testbed and science instrument near Carnarvon in the Northern Cape Province, will be commissioned towards the end of 2009.
- The full array of 50 or more dishes should be ready to do science by 2012. A high speed data transfer network will link the telescope site in the Karoo to a remote operations facility.

The Karoo region of the Northern Cape Province is ideal for radio astronomy, because it is remote and sparsely populated, with a very dry climate. There is minimal radio frequency interference from man-made sources such as cellular phones, broadcasting and air traffic.

MeerKAT science will explore celestial mysteries such as cosmic magnetism, the evolution of galaxies and large-scale structure in the universe, dark matter and the nature of transient radio sources. It will study pulsars and allow scientists to do novel astrophysics and astrobiology experiments.

South African engineers and astronomers are working closely with teams around the world on the cutting edge technology required to make MeerKAT work. In South Africa, the Hartebeesthoek Radio Astronomy Observatory and the South African Astronomical Observatory participate in the MeerKAT project. The MeerKAT head office is in

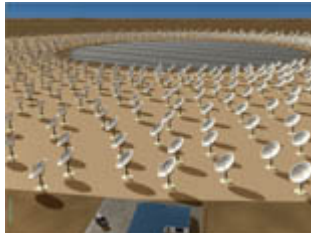
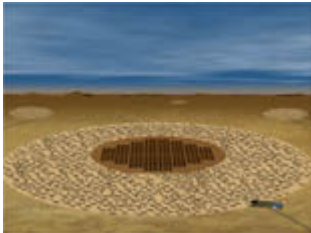


The SKA will unravel the mysteries of the origins and age of the universe. It will help us to answer fundamental questions about the laws of nature, including the study of dark energy and dark matter as well as the formation of the first galaxies, stars and planets. If there is life somewhere else in the universe, the SKA will help us find it. If the SKA is built in Southern Africa, it will attract top scientists from around the world, boost local scientific and engineering skills and seed new high-tech industries.

Countries from all continents are collaborating to build and fund the SKA. South Africa and Australia are the only two countries on the final shortlist to site this huge instrument.

The SKA will cost about 1,5 billion euro (about R12 billion) to construct. The money will come from partners around the globe. Many teams are working together to develop the science and technology of the SKA and on studies to trade off costs against technical performance of the instrument.

Photos and visuals



An artist's impressions of part of the core of the SKA. Tile-shaped antennas making up the central focal plane array is surrounded by dish-shaped antennas. The SKA will consist of thousands of antennas, spread over 3 000 kilometres. About half of the antennas will be in a central region about 5 kilometres across. Photographs: Xilostudios



An artist's impression of the twenty dishes of the Karoo Array Telescope on site near Carnarvon in the Northern Cape. Each of the 20 dishes will be 15 m in diameter and about 19 m high.

A close-up view of four of the 20 dishes of the Karoo Array Telescope, with the control room in the background.

**ANNEXURE 4 – MOKALA
NATIONAL PARK INFORMATION**



South African National Parks

SANParks™ - Official Website

Mokala National Park

"Where Endangered Species Roam..."

Mokala is SANParks newest park, situated approximately 80km south-southwest of Kimberley, and west of the N12 freeway to Cape Town. Nestled in the hills, Mokala's landscape boasts a variety of koppieveld (hills) and large open plains.

The isolated dolerite hills give the place a calming feeling of seclusion. A big surprise awaits when you pass through the hills and are confronted by the large open sandy plains towards the north and west of the Park. Drainage lines from the hills form little tributaries that run into the plains and drain into the Riet River.

Mokala is a Setswana name for a Camel Thorn (Kameeldoring). These trees occur in dry woodland and arid, sandy areas and are one of the major tree species of the desert regions of Southern Africa. This immensely important species has a great range over the Northern Cape and varies from a small, spiny shrub barely 2m high, to a tree up to 16m tall with a wide, spreading crown.

The Camel Thorn is an incredible resource to both wildlife and humans who survive in often harsh conditions characteristic of this area. Traditionally, the gum and bark have been used by local tribes to treat coughs, colds and nosebleeds. Some even use the roasted seeds as a coffee substitute.

Things to Seek

- Black Rhino
- Tsessebe
- Roan antelope
- White Rhino
- Black Wildebeest
- Indigenous plant species

Contact the park

Tel.: (053) 2040 158 / 164 / 168 Fax: (053) 2040 176

Or e-mail [Hein Grobler](#) (Hospitality Manager)

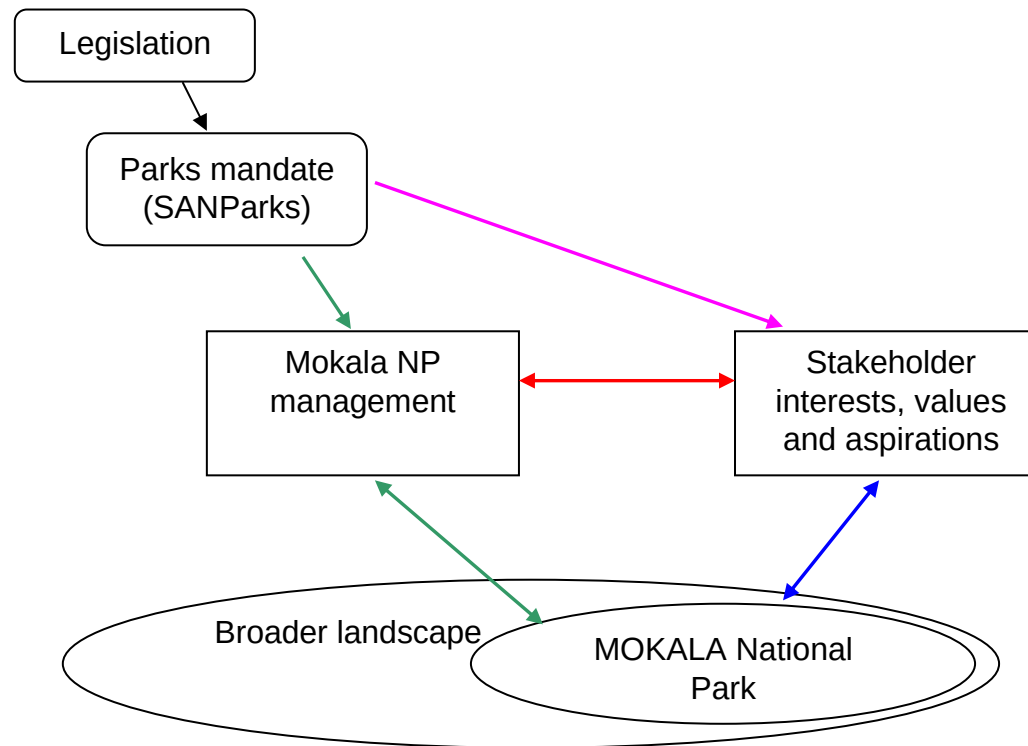
► **Have a question? Why not ask at the [forums](#)?**



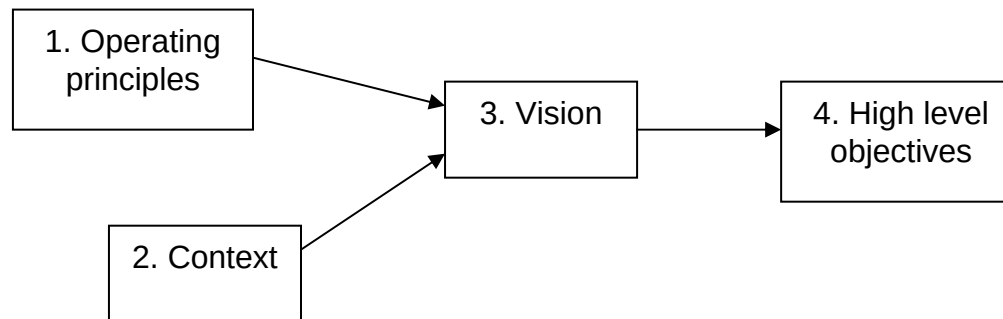
MOKALA NATIONAL PARK

- Process followed
- Outcomes
- Way forward

***The role of the desired state process (depicted by the red arrow)
within the broader context of the relationship between SANParks
and public interests.***



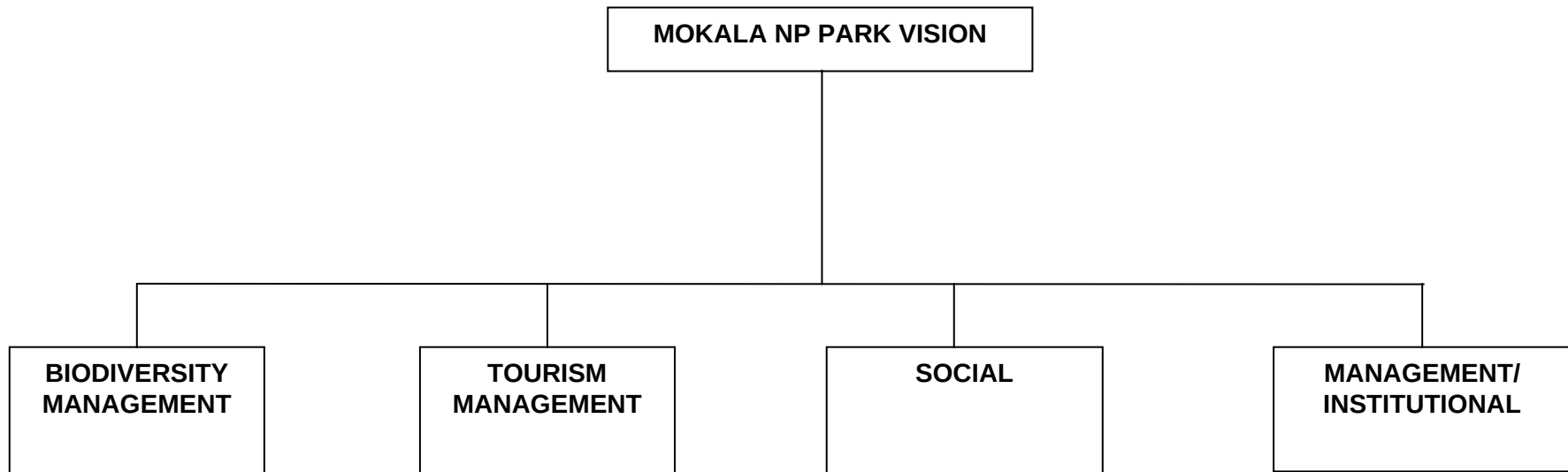
The Desired State process sequence. The vision is informed by both the operating principles and the definition of context.



VISION

- WE ARE PROUD CUSTODIANS OF MOKALA NATIONAL PARK. WE VALUE MOKALA FOR ITS BIODIVERSITY, CULTURE, HISTORY AND SENSE OF PLACE WITHIN THE BROADER CONTEXT OF ALL THE NORTHEN CAPE HAS TO OFFER FOR THE JOY AND BENEFIT OF ALL, NOW AND INTO THE FUTURE.

MANAGEMENT THEMES



Biodiversity

- Mokala NP is representative of the vegetation type of the area.
- Representative landscapes.
- Rare and unique biota, esp. plant and animal species.
- Extreme seasonal temperature variations.
- Potential for Park expansion.

Biodiversity cont.

- Economic value of rare species to SANParks.
- Drainage (whole) drainage system in Park.
- Vultures.

Tourism

- Landscape beauty/aesthetic value(& associated photo opportunities).
- Cultural and heritage attributes: Presence of e.g. archaeological, rock paintings and battle sites.
- Disease-free, esp. malaria
- Proximity to N12 Tourism Route and Large Airport

Tourism cont.

- Potential for diverse visitor activities based on a diverse attribute mix.
- Sense of Place.
- Camel thorn “mokala” icon.

Social

- Good national and provincial support for the Park.
- Good levels of public interest.
- High potential for Environmental Education – with focus also on the cultural and historical aspects.
- Relationships with neighbours.

Social cont.

- Low population densities on Park boundaries – therefore, low levels/volumes of pressure and demands on the Park.

Management / institution

- Sound/good management.
- Capacity to generate, mobilise and integrate knowledge.
- Good infrastructure.
- Opportunities for new research findings.
- Employment opportunities.
- Safe environment.

Management / institution cont.

- New Park: opportunity for private/public partnerships.
- Good platform for co-operative governance.
- Opportunities for trophy hunting.

PMP process way forward

- Park/Municipality interaction ...
- Public meeting - 26 March '08
- Final version submitted to DEAT –
18 June '08

**ANNEXURE 5 – ENDANGERED
WILDLIFE TRUST:
RIVERINE HABITAT
REHABILITATION PROJECT**

The Riverine Rabbit Working Group

A Working Group of the Endangered Wildlife Trust



RIVERINE HABITAT REHABILITATION PROJECT

STRATEGIC PLAN (Draft)

2007



VISION OF THE EWT-RRWG

The vision of the Endangered Wildlife Trust's Riverine Rabbit Working Group (EWT-RRWG) is an ecosystem and socio economic conditions in the Karoo that support a stable population of Riverine Rabbits *Bunolagus monticularis* along the seasonal river courses of the Karoo region. The group aims to conserve the biodiversity of the Karoo and to promote integrated land management practices that can sustain the Riverine Rabbit, its habitat and many other species while ensuring social-economic benefits to landowners and communities – the species functions as the Flagship Species of the Karoo.

MISSION OF THE EWT-RRWG

It is the EWT-RRWG's aim to conserve the Riverine Rabbit by undertaking field surveys, habitat evaluation and mapping exercises, habitat management and rehabilitation, environmental education and awareness, population monitoring, research and conservation stewardship programmes within the distribution range of the species.



Endangered Wildlife Trust

Vision

“A healthy planet and equitable world that values and sustains the diversity of all life”



CONTENTS

1.	BACKGROUND OF THE EWT-RRWG	4
1.1	ORIGIN OF THE EWT-RRWG.....	4
2.2	EWT-RRWG WORKING STRUCTURE.....	4
2.	EXECUTIVE SUMMARY	5
3.	PROJECT SPONSOR	5
4.	AN INTRODUCTION TO THE REHABILITATION PROJECT	6
5.	AREA OF OPERATION.....	7
6.	PROJECT OBJECTIVES AND AIMS	11
6.1	Objectives	11
6.2	Aims.....	11
7	THE REHABILITATION PROJECT	12
7.1	Summary	12
7.2	Background.....	12
7.3	Problem Analysis	14
7.4	Planning	15
7.4.1	Project Phases.....	15
7.4.2	The Rehabilitation Concept.....	17
7.4.3	Karoo Plant Nurseries	20
7.4.4	Limitations to Rehabilitation.....	24
8	METHODS.....	25
8.1	Historical Cultivation (Old lands).....	26
8.2	Gulley Erosion	27
8.3	Degraded River Channels	27
8.4	Corridors in Cultivated Lands.....	29
8.5	Other Vegetation Rehabilitation Sites.....	29
8.6	Excluding Stock and Larger Wildlife	30
8.7	Rehabilitation Nurseries.....	30
9	PROJECT OUTPUT.....	31
10	MONITORING	31
10.1	Veld Assessment.....	31
10.2	Fixed-point photographic monitoring	32
11	PROJECT SCHEDULE	33
12	PROJECT COST	34
12.1	Labour	34
12.2	Transport	35
12.3	Equipment	36
12.4	Project Coordinator	36
12.5	Nurseries	37
12.6	Summary of Costs.....	37
12.7	Other Costs and Community Involvement.....	38
13	PROJECT BENEFITS.....	39
13.1	Ecological Benefits	39
13.2	Social Benefits	40
14	CONCLUSION	41
15	REFERENCES	42
	APPENDIX 1: VELD ASSESSMENT FORM.....	44
	APPENDIX 2: PHOTGRAPHIC MONITORING SHEET	45





1. BACKGROUND OF THE EWT-RRWG

1.1 ORIGIN OF THE EWT-RRWG

The National Riverine Rabbit Co-ordinating Committee (NRRCC) was founded by institutions and individuals interested in the survival and conservation of one of Southern Africa's most threatened small terrestrial mammals, the Riverine Rabbit *Bunolagus monticularis*. The main stakeholders included the Department of Agriculture, Land Reform, Environment and Conservation (DALEC) of the Northern Cape, the Western Cape Nature Conservation Board (WCNCB), the Zoological Society for the Conservation of Species and Populations (ZSCSP), landowners of the Central Karoo region, SA National Parks and scientists from academic institutions.

Members of the NRRCC that attended a meeting in Loxton in the Northern Cape Province on 24 April 2003 agreed that the time had come to incorporate the NRRCC as a working group of the Endangered Wildlife Trust. The activities of the NRRCC were fully in line with the mission of the EWT and were complementary to what other taxon-based working groups were doing for species conservation. It was also agreed that the name of the working group would be the Riverine Rabbit Working Group (EWT-RRWG).

The EWT-RRWG started operating as a Working Group of the Endangered Wildlife Trust on the 1st of August 2003 under the management by Dr Vicky Ahlmann who has initiated the Riverine Rabbit Conservation Project in December 1998. In May 2006 an EWT Karoo Regional Office was opened by the Working Group Manager. On the 1st of March 2007 the new appointed Coordinator for the Riverine Habitat Rehabilitation Project, Petro Botha, joined Dr Vicky Ahlmann at the Regional Office in Loxton, Northern Cape.

2.2 EWT-RRWG WORKING STRUCTURE

Riverine Habitat Rehabilitation Project Coordinator: Petro Botha

PO Box 172, Loxton 6985, South Africa

Tel: 053 381 3068

Fax: 086 513 4772

E-mail: petrob@ewt.org.za

EWT-RRWG Manager: Dr Vicky Ahlmann

P.O. Box 172, Loxton 6985, South Africa

Tel/Fax: 053 381 3068

E-mail: vickya@ewt.org.za

Endangered Wildlife Trust CEO: Yolan Friedmann

Endangered Wildlife Trust

Private Bag X11, Parkview 2122

South Africa

Tel: 011 486 1102

Fax: 011 486 1506

E-mail: cbsgsa@wol.co.za



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2. EXECUTIVE SUMMARY

This project is concerned with *Bunolagus monticularis* habitat connectivity and the rehabilitation of eroded and degraded riverine habitat patches. In order for an ecosystem rehabilitation project to be successful, the project requires planning, implementation, monitoring, and adaptations where necessary as well as site maintenance to maximize the success relative to the costs involved. A holistic approach will be adopted when carrying out rehabilitation work in order to reach a balance between the quality and quantity of habitat and productivity.

Best management practices will be encouraged to achieve the project goals. One of the obstacles that have been identified when implementing the rehabilitation project could be the co-operation of land owners. Success will thus lay with the involvement of all relevant stakeholders, especially the land owners to create a high level of awareness of the importance of rehabilitation. The information network will be broadened to increase awareness and communication regarding, for example, the importance of a stable and healthy riverine habitat that is covered with indigenous natural vegetation as such a system will increase suitable habitat for a variety of animal and plant species and will support the hydrology of the river zones of the Karoo by facilitating water infiltration and groundwater storage.

Through rehabilitation and judicious management the aridification process can possibly be reversed and will thus play a significant role in the conservation of the precious water resource as well as the conservation of regional biodiversity and enhance the chances of the survival of *Bunolagus monticularis* and many other species !

The Riverine Rabbit occurs in the Nama and Succulent Karoo. The Nama Karoo (summer rainfall region) has flora and fauna that is impressively adapted to its climatic extremes. The climate is harsh, droughts are common, and seasonal and daily temperatures fluctuate considerably. It has been calculated that 2,147 species occurred in a central area of the Nama Karoo, of which 377 (16 percent) are endemic. A biological wonder is the Succulent Karoo that holds by far the world's greatest number of succulent plants, one of the 25 biodiversity 'hotspots' in the world, and at least 40 percent of these species are endemic. Most are succulents--plants with thick, fleshy tissues that can store water. One-third of the world's 10,000 species of succulent plants grows in this ecoregion. The Succulent Karoo is a winter rainfall area that stretches from southern Namibia, down through the Richtersveld and parts of Namaqualand into the Little Karoo.

The Karoo is vulnerable to several land use pressures, particularly overgrazing on communal lands, ostrich farming in the southeast, mining and the illegal collection of plants and animals for trade. Climate change is also expected to have a serious impact on the region's biodiversity.

3. PROJECT SPONSOR

The Department of Environmental Affairs and Tourism (DEAT) of South Africa is a financial sponsor of the Riverine Habitat Rehabilitation Project. The project's long-term success and continuation is dependent on securing more funding.



4. AN INTRODUCTION TO THE REHABILITATION PROJECT

The EWT-RRWG has taken on a new project that focuses on the rehabilitation of riverine habitat along seasonal rivers of the Central and Upper Karoo. This vast and open, semi arid rangeland covers a large part of South Africa and is impressively adapted to its climatic extremes. Evidence of degradation in these parts of the Karoo is clearly visible, mainly as a result of environmental (low and erratic rainfall) and anthropogenic factors (poor management practices).

The degradation is characterized by large bare and denuded areas and it seems these areas will not recover by natural succession processes alone. Some sort of active intervention has therefore inevitably become necessary in order to avoid aridification and possibly also desertification.

Many of the highly degraded and heavily eroded areas occur along the seasonal river courses of the Karoo where the critically endangered Riverine Rabbit (*Bunolagus monticularis*), a highly specialised Lagomorph, occurs. These river courses together with the riparian zones have an important biodiversity function as well as an economic value in the Karoo. These denser structures of vegetation are high in productivity and are extremely important refuges for many animal species. The riparian zones are also very important to stock farmers as it provides grazing, especially during dryer seasons. One of the major threats to biodiversity in the Karoo is the long-term overgrazing by small livestock.

The Riverine Rabbit is listed as critically endangered in the Red Data Book of the Mammals of South Africa (Friedmann & Daly, 2004). In the eighties it was suggested that the remaining suitable habitat might, theoretically, support a maximum of 1435 rabbits. Today the population size is estimated to be just a few hundred animals. At present, none of the Riverine Rabbit habitat is protected within a provincial nature reserve or national park and the species only occurs on private Karoo farmland (Ahlmann, Collins & Seal, 2000). In response to the rapidly declining populations, landowners in the Karoo have established Riverine Rabbit conservancies covering an area of approximately 350 000 ha of private farmland (*pers. comm.* Ahlmann, 2007¹).

The Riverine Rabbit, being a habitat specialist, is only finding protection from predators and heat, as well as a diverse diet in the dense scrubs that occur on alluvial soils adjacent to seasonal rivers (Ahlmann & Collins, 2004). As a habitat specialist, the Riverine Rabbit is not able to survive outside the riparian areas, and thus function as an indicator species (Ahlmann & Collins, 2004), reflecting the presence or absence of specific environmental conditions. They are also indicators of healthy river ecosystems in the Karoo. Approximately two-thirds of the *Bunolagus* original range, and consequently its population, have already been lost due to the habitat changes (Coetzee, 2005a), and the originally naturally discontinuous riverine habitat, has consequently become even more fragmented.

¹ Dr Vicky Ahlmann, Riverine Rabbit Working Group, PO Box 172, Loxton, 6985.





The habitat rehabilitation project, rehabilitation site selection, focuses on areas that fall within the known distribution range of the Riverine Rabbit. Heavily degraded habitat between intact habitat patches is of high priority and will be considered for rehabilitation first. According to Pastorok *et al* (1997), restoring of the environment can have three goals, namely restoration, rehabilitation and/or management. Should restoration be the goal, an ecosystem need to be restored to a close approximation of its condition before it was disturbed. Should the goal be rehabilitation, a system is improved to a good working order and thirdly, should management be the goal, manipulation of a system will be involved to ensure the maintenance of one or more functions.

With this project, the goal is to improve the natural system to a good working order by re-vegetating degraded and eroded areas, and slow down the process of erosion. To re-vegetate the areas, rehabilitation nurseries is required and needs to be established in order to provide the necessary indigenous vegetation, seeds and seedlings, for the rehabilitation process.

The Karoo plant nursery will initially run as a non-profit project, with the main aim to provide plants for the rehabilitation work. Through this project the EWT-RRWG will provide jobs and skills to the local community and build capacity amongst them. The estimated time for the nursery to be fully functional will be approximately five years, after which the goal is to have the nursery function as an economically viable community project. The social aspect of poverty and lack of job opportunities in the region is thus incorporated into the rehabilitation project, making it an even more exciting and challenging project.

5. AREA OF OPERATION

The Karoo is situated on a plateau that ranges from 400m to 2000m with the largest part at about 1200m above sea level. With an area of around 400,000 square kilometer, it is about the size of the whole of Germany. The Karoo can be divided into the Tankwa and Little Karoo (winter rainfall region) and the Great, Upper and Northern Karoo (summer rainfall region), also known as the Nama and Succulent Karoo (see figure 1). The Nama Karoo falling into the summer rainfall region mostly occurring on the central plateau of the Cape Province in South Africa, although it extends over the Orange River into Namibia in the northwest. The Great Escarpment, which runs parallel to the coast 100 km to 200 km inland, divides the eco-region into two parts: one between 550 m to 900 m in elevation, the other between 900 and 1,300 m (Palmer & Hoffman, 1997). The Succulent Karoo, falling into the winter rainfall region, stretching along the Atlantic coast of Africa, from southwestern South Africa into southern Namibia, covering 116,000 square kilometers of desert. It boasts the world's richest succulent flora, as well as high reptile and invertebrate diversity.



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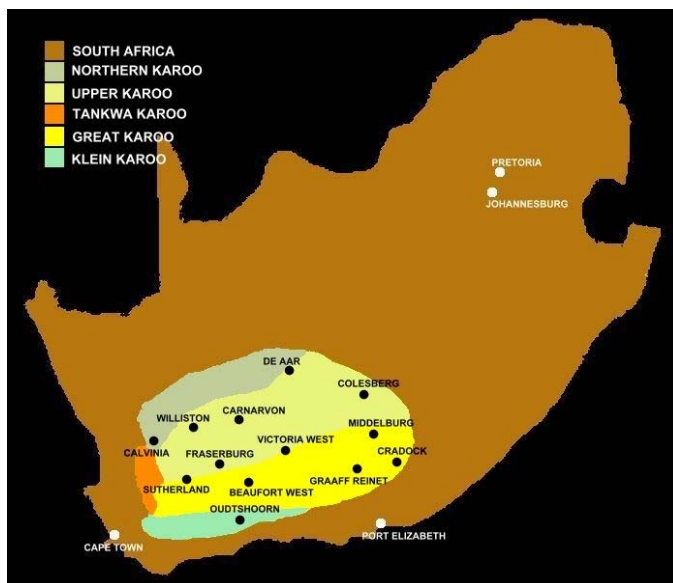


Figure 1: Map of the Karoo (Source: Karooinfo)

The Nama Karoo is a vast, open, arid region dominated by low-shrub vegetation. Although not remarkably rich in species or endemism, the flora and fauna of the region are impressively adapted to its climatic extremes. The area of operation geology represents that of the Beaufort group sedimentary basin (Coetzee, 1994). The alluvial soils are of particular interest for their role in the vegetation and sedimentation patterns that forms the preferred habitat of the Riverine Rabbit. Alluvial soil deposits are formed by weathering of the sedimentary mudstone and sandstone and the deposition of water-transported weathered material in the valley bottoms (Ellis & Lambrechts *In* Coetzee, 1994). These alluvial deposits are suitable for burrow, as they are soft enough to excavate but compact enough to prevent collapsing. The climate is harsh, as it is typically the case with arid regions. Droughts are common, and both seasonal and daily temperatures fluctuate considerably. Dwarf shrubs (chaemaphytes) and grasses (hemicryptophytes) dominate the current vegetation, their relative abundances being dictated mainly by rainfall and soil (Palmer & Hoffman, 1997). Mean maximum temperatures in mid-summer (January) exceed 30°C, whereas mean minimum mid-winter (July) temperatures are below freezing (Palmer & Hoffman, 1997). Rainfall is highly seasonal, peaking between December and March (Palmer & Hoffman, 1997). Annual rainfall ranges between 100 mm to 500 mm, decreasing from east to west and from north to south (Palmer & Hoffman, 1997). The Upper Nama Karoo with fairly dense to dense vegetation and semi-arid shrub land occurring on the central upper Karoo plateau to altitudes between 1050 m and 1700 m above sea level, receive low and erratic rainfall (200 – 250 mm/year) mainly during late summer and autumn (Hoffman, 1996). There is little published data regarding species richness or endemism for the Nama Karoo flora. Gibbs & Russel (1987) calculated 2,147 species occurred in a central area of the Nama Karoo (198,000 km²), of which 377 (16 percent) are endemic.





The Succulent Karoo is a biological wonder of the world, with unrivalled levels of diversity and endemism for an arid area. The Succulent Karoo holds, by far, the world's greatest number of succulent plants and has been recognised by WWF internationally as one of the 25 biodiversity 'hotspots' that falls entirely in an arid region.

In spite of the incredible natural diversity, local and global awareness of the significance and value of the Succulent Karoo is low. Only 30 000 km² of the Succulent Karoo (about 27%) exists in a relatively pristine state. Existing traditional conservation areas are 'islands' which do not include a range of climatic and environmental conditions to allow plants and animals to move in response to seasonal and long-term climatic changes. This is particularly critical in the Succulent Karoo, where species are already experiencing the impact of human-induced climatic change. As a result of existing pressures already fully 936 plant species, 17% of the total that occur in the Succulent Karoo, are listed as threatened by the IUCN Red Data List1 (SKEP, 2007). Only 3.5% of the biome is formally protected in conservation areas. Most of the region, an estimated 100,000 km², is used as communal or commercial grazing. Although this land use can be compatible with the maintenance of biodiversity, overgrazing has severely degraded as much as two-thirds of this area. The recent expansion of the ostrich farming industry has devastated thousands of hectares in the Little Karoo, and is likely to pose a greater threat in the future. Over 5000 plant species occur in the region, of which nearly 2 000 are endemic.

Land use in the Karoo currently consist of sheep farming, some ostrich farming, game farming (that is currently on the increase), as well as crops farming that include lucerne, onions, garlic etc. Mining and development activities are likely to expand in the future. Currently, various Environmental Impact Assessments are taking place in and near the distribution area of the Riverine Rabbit. Succulent plant species are also highly prized by collectors and are threatened by illegal collection and trade. Climate change is also expected to have a serious impact on the region's biodiversity as well as major alien invaders, such as the Prickly Pear *Opuntia aurantiaca* and Mesquite *Prosopis glandulosa*.

Ideally, the rehabilitation project should be aimed at the whole seasonal river landscape matrix in the Karoo, and not just the riverine channel. This approach, however, would necessitate a much wider involvement of agricultural expertise and a re-examination of extensive grazing practice. Although it is all relevant, it is not within the immediate scope of *Bunolagus* habitat connectivity, and thus not in the scope of this rehabilitation project. The rehabilitation project will thus be applied where an improvement in habitat connectivity is possible and where it can be practically achieved in terms of costs and logistics.

The known distribution range of the critically endangered Riverine Rabbit ranges South of Prince Albert (Western Cape) up to Touwsriver and Sutherland in the West to Williston and up to Carnarvon in the Northern Cape, and East again to areas between Victoria West and Richmond (see figure 2). The Riverine Rabbit was always known to occur in the Nama Karoo biome but since 2004 fragmented populations were confirmed in various areas of the Succulent Karoo biome thus being more widely spread throughout the Western Cape that was previously believed (Ahlmann, 2006).



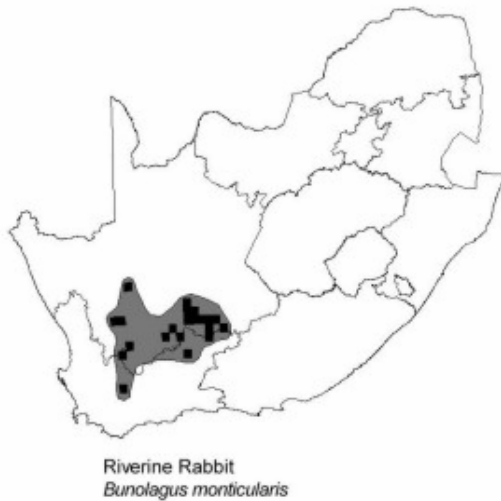


Figure 2: Map of the Distribution of the Riverine Rabbit (*Bunolagus monticularis*), South Africa.
(Source: Red Data Book of the Mammals of South Africa, 2004)

Major seasonal rivers in the distribution area, where rehabilitation sites have been identified, are as follows:

Western Cape

- Beaufort West District: Soutrivier, Kromrivier, Sakrivier, Sandrivier and Leeurivier.

Northern Cape

- Fraserburg District: Sakrivier, Brakrivier, Gansvleirivier, Bloemfontein se Rivier, Soutrivier, Klein Rietrivier, Rietrivier and Leendertsrivier.
- Williston District: Soutrivier and Klein Sakrivier
- Carnarvon District: Brakrivier, Gansvleirivier and Soutpoortrivier.
- Richmond District: Ongersrivier
- Victoria West District: Groenrivier, Ongersrivier, Brakrivier, Visgatrivier, Klein Brakrivier, Soutrivier and Slangfontein se Rivier.





6. PROJECT OBJECTIVES AND AIMS

6.1 Objectives

- a) The primary objective is to connect fragmented areas where *Bunolagus monticularis* occurs. This will be done by establishing natural vegetation cover in eroded and degraded areas along seasonal rivers to form corridors between fragmented habitat sites.
- b) Draw up habitat management guidelines for the rehabilitation of riverine habitat. These guidelines are required for the survival of the Karoo's flagship species *Bunolagus monticularis* and to maintain biodiversity. Maintaining biodiversity will increase the long-term sustainability of natural resources and combat desertification and aridification by protecting ground water resources.
- c) Apply and conduct research on the dynamics and ecosystem functioning of seasonal rivers and the riparian zone that includes:
 - River dynamics
 - Soil characteristics response to alien vegetation invasion
 - Cost-Benefit analysis of community involvement in conservation
 - Rehabilitation methods for a riparian zone

6.2 Aims

- a) Establish vegetation cover on bare, degraded and eroded riverine areas along seasonal rivers in the Central and Upper Karoo to:
 - Create corridors for animal species to move between habitat patches.
 - Maintain fertility and moisture of soil.
 - Maintain biological diversity.
 - Increase the chances of survival of the Riverine Rabbit.
- b) Do research on rehabilitation methods in the Karoo.
- c) Do research on viable flora species to use in rehabilitation actions in the Karoo.
- d) Develop protocols for rehabilitation in the Karoo.
- e) Create an information network by creating awareness and enhancing multi-way communication.
- f) Provide job opportunities, training and capacity building to the local communities in the Region.





7 THE REHABILITATION PROJECT

7.1 Summary

Rehabilitation in terms of this project is referring to the stabilization of disturbed soil surfaces and the re-establishment of a protective vegetation cover. The destabilization of soil surfaces along seasonal Karoo rivers occurs largely as a result of soil erosion due to: vegetation cover reduction, cultivation of alluvial soils, dam constructions and poor water runoff organization at flood irrigated cultivated lands. As a result of soil surface disturbances, natural vegetation cover is thinned and soil surfaces are eroded into gullies and an inhospitable environment is created that limits the potential for plant germination and plant survival.

The success of rehabilitation depends on the mechanical disturbance of the soil, increasing water infiltration and providing physical barriers that will slow water movement, limit the effect of raindrops impact, reduce soil temperature and catch windblown seed. Very important is the introduction of viable seeds in areas where seed banks have been depleted. Important to keep in mind are those climatic factors, like precipitation and temperature, playing a major role in the success or failure of re-vegetation actions.

The rehabilitation project focuses its attention on reconnecting relatively undisturbed patches of *Bunolagus* habitat with each other. For reasons of logistics and costs, this implies focusing on the riparian corridor and disregarding rehabilitation requirements outside of the riparian zone. The methods that will be used are fairly diverse in order to effectively treat a diverse range of habitat degradation. Very little, if any, successful Karoo rehabilitation work has been done along the seasonal rivers (Coetzee, 2005a). The techniques that will be used are yet untested in the *Bunolagus* habitat context, and many of the techniques that will be used are based on suggestions by Coetzee (2005a). A certain amount of experimentation and research will thus be necessary.

The overall objective is to conserve *Bunolagus* as flagship species and thus biodiversity of the area, as well as combat desertification and aridification by protecting ground water resources, and provide training and build capacity amongst the community.

7.2 Background

The Riverine Rabbit is one of the most threatened terrestrial mammal species of Southern Africa. It is a highly specialized mammal that lives in the semi-arid Central and Upper Karoo of South Africa. The species can only survive in fairly pristine seasonal river vegetation on the soft and deep alluvial soils of the riverine areas. Here it uses these soils for burrowing and making dens for breeding purposes. The destruction and modification of these habitats due to grazing practices and other agricultural practices has had a dramatic effect on the species' population over the past century.

Habitat modifications have very serious long-term consequences as semi-arid regions recover slowly due to low and variable rainfall, physical limitations to increase soil moisture and depleted soil seed banks. When riverine habitat is lost, small groups of animals become isolated from each other. Along riverine habitat, the vertebrate diversity according to Coetzee (1994) include Rodentia





like the porcupine (*Hystrix africaeaustralis*), the vlei rat (*Otomys unisulcatus*) the Brants whistling rat (*Parotomys brantsii*) and the short tailed gerbil (*Desmodillus auricularis*). Carnivora includes the African wild cat (*Felis lybica griselda*), bat eared fox (*Otocyon megalotis*), aardwolf (*Proteles cristatus*), the cape clawless otter (*Aonyx capensis*), water mongoose (*Atilax paludinosus*). Other Lagomorph species that occur in the area are the Cape hare (*Lepus capensis*), the scrub hare (*Lepus saxatilis*) and on the rocky elevations, the Smiths red rock rabbit (*Pronolagus rupestris*). Fauna included is the Aardvark (*Orycteropus afer*), Dassies (*Procavia capensis*) and the steenbok (*Raphicercus campestris*). Representing Reptilia, is the white throated monitor (*Varanus exanthematicus*), the tent tortoise (*Psammobates tentorius tentorius*) and the helmeted terrapin (*Pelomedusa subrufa*), all associated with riverine habitat.

Birds of the Karoo, include the endemic ferruginous lark (*Certhilauda burra*) and the Sclater's lark (*Spizocorys sclateri*), others near-endemic: Karoo chat (*Cercomela schlegelii*), tractrac chat (*Cercomela tractrac*), red lark (*Certhilauda burra*), Karoo scrub robin (*Cercotrichas coryphaeus*), red-headed cisticola (*Cisticola subruficapillus*), and the Namaqua prinia (*Phragmacia substriata*). Other characteristic species of the Nama Karoo which are regarded as "Vulnerable" in South Africa are tawny (*Aquila rapax*) and martial (*Polemaetus bellicosus*) eagles, African marsh harrier (*Circus ranivorus*), lesser kestrel (*Falco naumanni*), blue crane (*Anthropoides paradiseus*), kori (*Ardeotis kori*) and Ludwig's (*Neotis ludwigii*) bustards, and the red lark (Dean *et al.* 1991).

Detrimental vegetation changes have taken place in the Karoo as a result of the impact of extensive small stock farming. Veld degradation, results in the development of large bare patches. These bare patches become compacted and limit moisture penetration (Visser, Botha & Hardy, 2003). Although sandy soil does not become compacted, there is still a degree of crust-forming that could have a negative effect on seed germination (Van der Merwe & Kellner, 1999).

During a study by Coetzee (1994) of a representative 80 km of the Sak River within the *Bunolagus* distribution area, it was found that anthropogenic fragmentation of the rabbit's habitat is a major threat to the survival of the species. Coetzee (1994) found that historically cultivated lands (10% of his study area) and recently cultivated lands (17% of his study area) are major contributors to habitat fragmentation, while areas degraded by soil erosion (5%) and inundated by impoundments (3%) also fragment the riverine habitat. Although 65% of his study area is still relatively intact, according to Coetzee (2005a), it is fragmented into isolated islands of habitat with varying degrees of potential for inter-patch movement by dispersing rabbits.

Not all riverine habitats are fragmented and completely surrounded by anthropogenic altered land. Some areas are banded on both sides by an arid, stony Karroid habitat that provides neither the plant cover density nor the food plant species that are preferred by the Riverine Rabbit. This comparatively inhospitable habitat, on both sides of the seasonal rivers, effectively restricts the Riverine Rabbits to the remaining fragments of habitat along the river channel (Coetzee, 1994).

Arnold *et al* In Coetzee (1994), suggest that long-term survival of animal species in fragmented habitats will depend on the viable population size in each fragment or the functional linking of the fragments to form a demographic unit or meta-population. Arnold further suggests that long-term





persistence of a species is more likely in a meta-population situation than an isolated population. The reason according to Allendorf & Leary *In Coetzee* (1994) is that meta-populations exchange genes to counter inbreeding depression. The *Bunolagus* sub-populations within the habitat fragments might be of insufficient size to be considered viable in the long term and population persistence in landscapes that have been anthropogenically altered may thus be dependent on habitat linkages. According to Bridgewater *In Coetzee* (1994), a corridor must be very different to the surrounding agriculturally altered land, but need not be similar to the native remnant vegetation. His findings imply that connectivity is not necessarily dependent on maintaining original vegetation “strips” as corridors, but that other grades of replacement of degraded vegetation will function effectively as well. As an example from Coetzee (1994), the *Phragmites* reedbeds and other riverine vegetation which occurs within the Sak River channel is regarded as suitable cover for dispersing *Bunolagus*, and the river itself is thus seen as a major component of inter-fragment connectivity. The use of corridors primarily to move from one habitat fragment to another will thus be less dependent on habitat quality and width than fragments permanently occupied but will rather be facilitated by linear continuity. Coetzee (1994) suggested that connectivity between rivers will only be possible at major river confluence sites. Effective *Bunolagus* dispersal will thus be entirely dependent on the minimum impassable barriers to dispersal between these river confluences.

Bunolagus is thus likely to survive in the remaining habitat provided that adequate connectivity is maintained between the habitat remnants. An important conclusion of the habitat fragmentation study was that a combination of landscape, habitat, social and education actions need to be implemented to create suitable habitat connectivity for dispersing *Bunolagus*.

7.3 Problem Analysis

A major in the Karoo is the decrease in vegetation cover, and the change in the veld vegetation species composition. This together with the increased rate of soil erosion, water runoff, limited water infiltrations and soil crust formations, results in favourable micro-sites being lost that are necessary for germination and the establishment of seedlings (Van den Berg & Kellner, 2003).

The existing problems caused by the loss of natural riverine vegetation along seasonal rivers in the Karoo are caused by a combination of factors. Factors identified include:

- Mismanagement practices like the cultivation of big areas in the riparian zone, over utilization by livestock and modifications of river channels.
- Socio-economic factors like poverty and the lack of awareness and education.
- Climatic factors like low and erratic rainfall patterns.

The result of the above mentioned factors can be seen in the degradation of the land, and especially the degradation of habitat along critically important river zones.





Results that have an extreme detrimental effect on the environment are as follows:

- Reduced vegetation cover and density
- Changes in species composition
- Loss in biodiversity
- Alien invasion
- Bare patches
- Soil erosion and nutrient depletion
- Soil compaction
- Poverty
- Change in river hydrology
- Aridification
- Desertification

7.4 Planning

7.4.1 Project Phases

The habitat rehabilitation project consists of four phases. Phase 1, the concept and initiation phase, is nearly completed, and ongoing is the process of obtaining resources. Phase 2, the development phase has started. Permits have been applied for and possible rehabilitation sites have been identified. These sites are now being prioritized. Phase 3, the implementation phase starts once the rehabilitation team has been trained and the nursery is up and going. Phase 4, monitoring will run continuously throughout the project as it is very important to monitor the success of each activity in order to determine its success and/or failure to meet the objectives set out. This will contribute to modification, changes and adaptations of the project where necessary. Table 1 contains a summary of activities of each phase.

Phase 1: Concept and Initiation Phase

The project was initiated by Dr. Vicky Ahlmann, Manager of the EWT-RRWG, after a strategy for rehabilitation was written by Ken Coetzee. Ken Coetzee of the Specialized Conservation Services in George is a specialist in veld management and rehabilitation. Ken Coetzee did a study in 1994 on the fragmentation of *Bunolagus* habitat. Ken is of the opinion that *Bunolagus* is likely to survive in the remaining habitat provided that adequate connectivity is maintained between the habitat remnants. He is also of opinion that connectivity between rivers will only be possible at major river confluence sites, and effective *Bunolagus* dispersal will thus be entirely dependent on the minimum impassable barriers to dispersal between these river confluences. An important conclusion of the habitat fragmentation study was that a combination of landscape, habitat, social and education actions need to be implemented to create suitable habitat connectivity for dispersing *Bunolagus*.



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After his study in 1994, Ken wrote a strategy for the rehabilitation of habitat connectivity along seasonal rivers in the Karoo. This strategy focuses on a process for the selection of rehabilitation sites and also provides the details of the recommended rehabilitation methods. Although the techniques are untested in the *Bunolagus* habitat context, he outlined the means by which these actions can be achieved.

Phase 2: Design and Development Phase

It is important for the development of this project to have input from relevant project stakeholders. The use of land to establish the nursery needs to be negotiated with Ubuntu Municipality. Permits for collecting and growing indigenous plants need to be obtained as well as a nursery licence. A working team then needs to be established and they need to be trained for the rehabilitation work. Veld assessment will take place of the site before rehabilitation is done, together with the first set of photo-monitoring. As soon as the permits are in place, seeds can be collected for growing seedlings as well for using when reseeding at rehabilitation sites. It is at this stage important that funding for the project is established for at least 5 years, so that the schedules, resources and budgets can be finalized accordingly.

Phase 3: Implementation Phase

Once the working team has been trained the rehabilitation scheduled will be communicated. The team will be motivated as a main objective of the project to establish independent rehabilitation working groups. The rehabilitation plan will be implemented.

Phase 4: Monitoring

This is a very important phase and includes the maintenance of the rehabilitated sites. Since the project is so crucial, not only for the survival of *Bunolagus*, but also for all the other ecological and social benefits, maintenance and monitoring is essential. Review of the project will be done continuously and all methods will be evaluated and documented. More workings teams will be establish as resources become available.

Table 1: Project Life Cycle Outlined

PLAN		ACCOMPLISH	
Phase 1	Phase 2	Phase 3	Phase 4
Initiating	Development	Implementation	Monitoring
1. Identify needs/problems 2. Gather data 3. Establish goals and objectives 4. Basic Strategy Plan 5. Obtaining resources 6. Identify potential	1. Obtain land & permits 2. Prioritize rehabilitation sites 3. Establish a working team & get them trained 4. Veld assessment 5. Start photo monitoring 6. Collect seeds 7. Set up nursery	1. Set up working team at site. Communicate work schedule for each specific rehabilitation site. 2. Motivate team 3. Detail technical requirements	1. Review continuously 2. Evaluate 3. Document results 4. Redirect resources 5. Establish more working teams





rehab sites	8. Grow seedlings	4. Establish:	
7. Identify fauna & substrate collection sites	9. Conduct studies	- detailed schedule	
8. Obtain approval for next phase	10. Identify alternatives	- control systems	
	11. Develop baseline plan	5. Procure goods	
	12. Establish master plan	6. Execute work	
	13. Assess risks	7. Direct/forecast/control: (scope, quality, time, cost)	
	14. Obtain approval & resources	8. Resolve problems	

7.4.2 The Rehabilitation Concept

7.4.2.1 Introduction

The re-establishment of natural processes such as the mineral cycling, resource capturing, dispersal and pollination for example is essential for achieving enduring rehabilitation success (Milton, 2001). If appropriate traps and barriers are used during rehabilitation, natural vegetation can be established as these sites catching nutrients, water and seeds that are dispersed by wind and water.

The rehabilitation project aims to prevent erosion and establish a vegetation cover along seasonal rivers to provide corridors that will connect fragmented Riverine Rabbit habitat patches. By establishing an indigenous vegetation cover, ecological processes can be initiated that will lead to an increase in soil fertility, moisture and seed banks, as well as an increase in biodiversity. Through the project awareness about degradation and rehabilitation practices will be created that could lead to enhanced sound veld management strategies throughout the Karoo.

Different rehabilitation methods will be tested, as none of the methods have been tested in the *Bunolagus* habitat before. The removal of exotic vegetation at the selected sites is of high priority as infestations by exotic vegetation are widely recognized as the second largest global threat to biodiversity, after direct habitat destruction, with is the biggest threat (Richardson & Van Wilgen, 2004). In the Nama Karoo, woody invaders like the Mesquite (*Prosopis* species) have invaded large areas of alluvial plains and seasonal water courses. Several cacti (*Opuntia* species) and saltbushes (*Atriplex* species) are some of the other invaders in the Nama and Succulent Karoo. Global reviews of the effects of plant invasions suggest that most damaging species transform ecosystems by: using excessive amounts of resources (water, light & oxygen), adding resources (nitrogen) and by redistributing salt (Richardson & Van Wilgen, 2004; Angua, 2005).

7.4.2.2 Typical Sites for Rehabilitation Projects

In the Karoo typical sites of degradation and primary focal areas for rehabilitation projects as suggested by Coetzee (2005a) include the following:

A. Historical Cultivation

These are soil-compacted old lands that are no longer profitable and that either become eroded or colonized by pioneer plants, often cosmopolitan agricultural weeds. In some cases, these lands





begin to develop a natural plant cover. These sites are generally on terraces that have been levelled and sub-divided with earth beams for flood irrigation. The requirement at these sites is to loosen the soil to increase infiltration and re-establish a natural vegetation cover that can revive natural processes and restore productivity. The plants used for re-vegetation should consist of the hardy local Karroid plants that bind soil and provide a cover that will shade the soil surface. The rehabilitation area must be fenced off to permit vegetation recovery in the absence of domestic stock utilization.

B. Gulley Erosion

These sites usually consist of a system of active river terrace or river bank erosion, gulleys with little or no inter-gulley vegetation cover. Soil structure is usually lost and the vulnerable soil is transported into the river channel with each rainfall event. The requirement is primarily to eliminate the cause of the erosion and then to check the accelerated runoff water flow by means of combination small constructed barrier types. These silt barriers must be seeded as a first phase of vegetation cover re-establishment. Seriously eroded “badlands” should not be treated with these methods, but should rather be radically reconstructed with earth moving machinery, extensive soil surface stabilization and vegetation establishment. As with the rehabilitation of old lands, gulley erosion rehabilitation sites should also be fenced off to exclude grazing animals.

C. Degraded River Channels

These are sites that have been degraded through over-utilization by domestic stock which feed on, and drastically reduce, the riparian vegetation cover which normally protects the river banks from accelerated soil erosion during flooding events. The requirements may include soil stabilization structures but will largely consist of the re-establishment of a variety of reeds, sedges, grasses and shrubs that naturally occur along these rivers. The exclusion of grazing animals will be necessary.

D. Corridors in Cultivated Lands

The cultivated and fallow lands on alluvial soil frequently fill the river channel floor from side to side, completely transforming *Bunolagus* habitat and effectively fragmenting habitat continuity along the river. The requirement is to restore corridors of natural vegetation, at least 2m wide, between the lands and the river bank, between individual lands and along the roads between the lands. Artificial cover, consisting of dry brush-packing can be established as an interim measure.

These corridors, although seemingly minimal will nevertheless provide dispersing rabbits with “stepping stone” corridor habitat through these transformed and relatively inhospitable areas that effectively sever habitat patches from each other. As with the other treatments, stock grazing must be excluded, at least initially, from these restoration sites.

E. Impoundments (River Channel Dams) and Soil Conservation Works

Impoundments are the greatest challenge for the restoration of *Bunolagus* habitat continuity. Some of the impoundments in the Sak River, for example, were shown to be impassable barriers for *Bunolagus*, completely filling the river channel for a distance of up to 8 km. Rehabilitation efforts,





however, will focus on the smaller impoundments where there is some potential for corridor habitat rehabilitation. The area around many of the impoundments is often devoid of plant cover as a result of the earth-moving activities. The exposure and heaping up of subsoil to create a dam wall results in a sterile and inhospitable environment for plant establishment. The requirements will differ from site to site, but the re-establishment of a natural vegetation cover, wherever possible, right up to the impoundment wall and even along the high-water level of the dam will vastly increase the potential for *Bunolagus* dispersal. The use of artificial cover consisting of a “thatch” of dry brush with ground level openings should be considered in sites where vegetation establishment will be difficult, such as on the dam wall itself or on areas where bedrock has been exposed by soil erosion.

Soil conservation earth works are also sites that are severely transformed by earth moving with heavy machinery. The requirement is the same as for the impoundments, which are the re-establishment of a natural vegetation cover and possibly the use of artificial cover as an interim measure.

7.4.2.3 Site Selection

Selection of rehabilitation sites will initially be based on existing knowledge of the situation along the seasonal rivers of the *Bunolagus* distribution range, but each potential site will conform to all the following selection guidelines as suggested by Coetzee (2005a).

(i) *Bunolagus* Distribution:

The sites selected for rehabilitation will be within the known distribution range of the Riverine Rabbit with recorded confirmation of *Bunolagus* occurrence in the drainages along which the rehabilitation sites are to be located.

(ii) River Confluences:

Confluences of seasonal rivers are important three-way dispersal corridors for *Bunolagus*. These confluences will thus be primary focal sites for the rehabilitation project.

(iii) Habitat Persistence:

Rehabilitation will primarily be concentrated along rivers where numerous and extensive patches of confirmed *Bunolagus* habitat can still be found.

(iv) Barriers to Dispersal:

The rehabilitation project will not be attempted in sections of river in which there are major barriers to *Bunolagus* dispersal. Very large dams and extensive areas of cultivation are examples of impassable barriers. Rehabilitation efforts will initially be concentrated at sites where corridor establishment is a realistic objective.





(v) Proximity to Town:

The sites selected for rehabilitation will be within practical daily travelling distances to and from the communities from which the field work teams will be sourced. A one-way travelling distance of 150 km ($\pm$ 2 hours travelling time) is probably the practical maximum distance that will still permit a productive working day on site.

(vi) Landowner Co-operation:

The complete supportive co-operation of all of the landowners within the area selected for rehabilitation is critical to the success of each project. Gaining landowner co-operation will require dedicated input that focuses on the ultimate overall benefits of the rehabilitation works to the landowner, other than the improvement of *Bunolagus* dispersal.

7.4.2.4 Animal Exclusion

Results from a study done in Ethiopia on the effectiveness of excluding animals from an area to restore degraded soils show that by excluding animals from such sites, are not only effective in restoring vegetation, but also in improving soil nutrients and reducing erosion (Mekuria *et al*, 2007). Where rehabilitation projects are undertaken, it will be necessary to establish animal exclusion plots, at least for a certain time period. It is also recommended by Van der Merwe & Kellner (1998) that rehabilitated areas not be grazed during the first year, while in the second and third year they should only be grazed lightly. Smaller animals can on the other hand facilitate rehabilitation by importing seeds an organic matter and improving soil permeability and fertility (Milton, 2001). By using brush packing, shelter is provided for small animals like rodents, perches for birds and substrate for insects.

7.4.3 Karoo Plant Nurseries

7.4.3.1 Introduction

Successful rehabilitation of degraded arid lands may rely on direct manipulative measures, such as translocations of already-established plants, making the understanding of the optimal habitat conditions for translocation necessary in order to guide the rehabilitation project. It has been suggested by Coetzee (2005a) that rehabilitation nurseries be established in each of the worker source towns where a reliable source of water is available. Any piece of unused open ground with a water connection can be used.

Alternatively, nurseries can be established on conveniently located farms, provided that water and a full-time nursery manager are available on site. The nurseries should be set up as community projects with the costs of ground use and water provided by the municipality or farmer as a contribution to the project. Dedicated management is involved and includes the collection of seed in riverine habitat.





Table 2 contains a list of potentially suitable species that can be cultivated in nurseries for rehabilitation planting. The list of plants will be tested for rehabilitation planting. Suitability for varying degrees of substrate moisture is indicated, as well as the availability of each species. It must be appreciated that rehabilitation planting within the *Bunolagus* distribution range has not been attempted before, at least not at the recommended scale. A great degree of trial and error must thus be expected and the necessary practical guidelines will only become available through experimentation.

Table 2: Potentially suitable indigenous plants for rehabilitation planting. Moisture tolerance is indicated as well as availability/source (Coetzee, 2005a).

SPECIES	SUITABLE FOR PERMANENTLY WET SITES	MODERATELY WET TO SEASONALLY MOIST SITES	DRY SITES	AVAILABILITY
<i>Aristida congesta</i>			X	Own nursery
<i>Asparagus africanus</i>			X	Own nursery
<i>Atriplex semibaccata</i>		X	X	Commercial
<i>Berkheya spinosa</i>		X	X	Own nursery
<i>Cenchrus ciliaris</i>			X	Commercial
<i>Chaetobromus dregeanus</i>			X	Own nursery
<i>Chloris virgata</i>		X	X	Own nursery
<i>Chrysanthemoides incana</i>		X	X	Own nursery
<i>Cynodon dactylon</i>		X	X	Commercial
<i>Cyperus laevigatus</i>	X			Root plugs from river
<i>Cyperus marginatus</i>	X			Root plugs from river
<i>Digitaria eriantha</i>		X	X	Commercial
<i>Diplachne fusca</i>	X			Own nursery
<i>Ehrharta calycina</i>		X	X	Commercial
<i>Enneapogon desvauxii</i>			X	Own nursery
<i>Eragrostis bergiana</i>		X	X	Own nursery
<i>Eragrostis bicolor</i>	X	X	X	Own nursery
<i>Eragrostis chloromelas</i>		X	X	Own nursery
<i>Eragrostis curvula</i>		X	X	Commercial
<i>Eragrostis lehmanniana</i>		X	X	Commercial
<i>Eragrostis obtusa</i>		X	X	Own nursery
<i>Eriocephalus ericoides</i>		X	X	Commercial
<i>Exomis michrophylla</i>		X	X	Own nursery
<i>Felicia filifolia</i>		X	X	Own nursery
<i>Fingerhuthia africana</i>		X	X	Own nursery
<i>Fingerhuthia sesleriae formis</i>		X		Own nursery
<i>Galenia fruticosa</i>			X	Own nursery
<i>Galenia procumbens</i>			X	Own nursery
<i>Helichrysum pentzoides</i>		X	X	Own nursery
<i>Helichrysum zeyheri</i>			X	Own nursery





Table 2 continue: Potentially suitable indigenous plants for rehabilitation planting.

SPECIES	SUITABLE FOR PERMANENTLY WET SITES	MODERATELY WET TO SEASONALLY MOIST SITES	DRY SITES	AVAILABILITY
<i>Hermannia filifolia</i>		X	X	Own nursery
<i>Hyparrhenia hirta</i>		X	X	Own nursery
<i>Juncus punctorius</i>	X			Root plugs from river
<i>Kochia salsoides</i>	X	X		Own nursery
<i>Leonotis leonurus</i>		X	X	Own nursery
<i>Lycium ciereum</i>			X	Own nursery
<i>Monechma incanum</i>			X	Own nursery
<i>Pentzia incana</i>			X	Commercial
<i>Pentzia sphaercephala</i>		X	X	Own nursery
<i>Phragmites australis</i>	X	X		Root plugs from river
<i>Pseudoschoenus inanus</i>	X			Root plugs from river
<i>Pteronia erythrochaeta</i>			X	Own nursery
<i>Pteronia membranacea</i>			X	Own nursery
<i>Salsola aphylla</i>		X	X	Own nursery
<i>Salsola glabescens</i>		X	X	Own nursery
<i>Scirpus diocus</i>	X			Root plugs from river
<i>Sporobolus fimbriatus</i>		X	X	Own nursery
<i>Sporobolus ioclados</i>		X	X	Own nursery
<i>Stipagrostis ciliata</i>			X	Own nursery
<i>Stipagrostis obtusa</i>			X	Own nursery
<i>Stipagrostis namaquensis</i>			X	Own nursery
<i>Suaeda fruticosa</i>		X	X	Own nursery
<i>Sutherlandia frutescens</i>		X	X	Own nursery
<i>Tetragonia fruticosa</i>		X	X	Commercial
<i>Triperis spinescens</i>		X	X	Own nursery
<i>Tripteris scariosum</i>		X	X	Own nursery
<i>Tripteris sinuatum</i>		X	X	Commercial
<i>Typha capensis</i>	X			Root plugs from river
<i>Walafrida geniculata</i>		X	X	Own nursery
<i>Zygophyllum flexuosum</i>			X	Own nursery

7.4.3.2 Requirements

A. Permits

Permits are required for collecting, transporting, growing and selling indigenous flora in the area of operation, i.e. Western Cape (WC) and Northern Cape (NC). The permit applied for from CapeNature (WC) is a Research/Collecting Permit. Permits applied for from NC's Department of Nature and Environmental Conservation is a permit to 'export flora/import protected flora', a permit to pluck protected flora, and a permit to grow and sell flora. Important for the permit application in NC is a resource assessment report (area where plants will be collected and current status of the plant population in the area).

B. Nursery Site

A nursery where plants will be nurtured and bred will be developed. When selecting a site, it is important to identify a possible site where the surface area is flat, protected against wind and have



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enough sunlight during the day. The site should also be protected against human vandalism and herbivorous animals. A reliable fresh water source should be close. The site should be conveniently close to town and near a road to make access easy for deliveries, customers and workers. What needs to be established is a nursery shade house where seeds can be grown. A small place measuring 4 by 6 meters will do to start with. Also needed is a place under shade where seedlings can be kept until used at a rehabilitation site. A storeroom where tools can be kept and seeds can be dried and stored is also important. Also required are basic facilities like a toilet, basin and small kitchen for the workers. The site will need to be fenced off in order to have access control.

C. Equipment

- Nursery shade house (4 x 6 metres): 9 treated gum poles, string to tie poles, 10 treated planks (to be nailed all around the nursery shade house), nails, hammer, shade cloth, staple gun and staples, nylon cord, sewing needle, scissors, ground sheeting (3m wide x 8m long) and a door.
- Seedling shaded roof (4 x 6 metres): 9 treated gum poles and shade cloth.
- Area fencing material: posts, droppers, wire, barbed wire, wooden poles to be put up as a wind barrier, motor vehicle gate / gate material.
- Nursery gardening equipment: wheelbarrow, spades, forks, hosepipe, rake, watering can, hand trowel, broom, water tank, water pipes and taps.
- Other nursery materials: empty plastic bottles and tins, plastic plant bags, kraal manure (horse/cow), basic fertilizer, basic pesticides a rain meter and a scale.
- Storeroom and ablution facility: need to be dry and lockable to store equipment and seeds, shelves to hold tools, table and shade cloth to dry seeds on.

7.4.3.3 Operation

A. Ownership of the Nursery

For the first 5 years the nursery will be run by the EWT-RRWG as a non-profit nursery. During this period community members will be trained and capacitated to take the nursery further as a community project. In regard to the development into a community project the local municipalities will be involved and hopefully the nursery can be placed on the relevant Municipal Integrated Development Plans (IDP).

B. Labour

The project will make use of casual workers, as labour is required. These workers will receive on-job training and will be capacitated to take the nursery further as a community project and or start their own nurseries and rehabilitation working groups.





C. Flora Harvesting

The best seed selection for a site will be of vegetation that occurs in the area. The seeds of some of the plants recommended for the rehabilitation work are commercially available, but many will have to be specially cultivated from seeds collected in the veld.

Seeds collected need to be stored in a dry place (ideally not for longer than a year). Records will be kept regarding the species collected, place (site) and date.

Harvest time is critical, because unexpected rain and wind can cause large seed losses. Seeds are usually harvested during spring. Seeds will be harvested by hand at first, after which it will be spread open to dry.

D. Planting substrate

To ensure successful sowing and veld re-establishment seed preparations are important to consider before attempting the establishment of seed mixtures. A seedbed that is not firm enough dries out quicker than a moisture-rich bed. Seed sowing-depth is also important whereby seeds must not be sowed too deep. The sowing depth is usually determined by the size of the seed. If seeds are sowed too deep, it will result in seeds competing with each other to reach the surface.

Different planting substrates will be used at first to determine the best substrate for plants that will be replanted in rehabilitated sites. As per personal discussion with Prof Sue Milton, the best combination to use as planting substrate for the nursery is natural soil mixed with river sand to create a loose soil structure (*pers. comm.* Milton², 2007). As pointed out by Allsopp from the Agricultural Research Council (Milton, 2001), if indigenous plants and their symbionts are to be re-established successfully, they need to be maintained in fresh soil until they are translocated to the rehabilitation site.

7.4.4 Limitations to Rehabilitation

It is important when developing and implementing a rehabilitation plan to take all aspects into account that can contribute to the success or obstruction of the project, i.e. socio-economical, biophysical (or natural) and even political aspects.

7.4.4.1 Rainfall

The consideration of natural limitation, such as rainfall which falls outside the reach of human intervention and adaptation is essential. An extremely low rainfall season can lead to the failure of any rehabilitation efforts due to drought.

²Prof. Sue Milton, PO Box 47, Prince Albert, 6930. sukaroo@mweb.co.za





7.4.4.2 Artificial Limitations

Apart from natural limitation, the most significant factors usually affecting the success of rehabilitation could be as follows:

a) Soil Structure and Texture

Drainage ability of the soil and soil stability can influence the success of the rehabilitation project, and care thus have to be taken when planning the rehabilitation process for each selected site, taking into consideration the amount of topsoil left.

b) Slope Gradient and Lengths

It will be important to consider the slope gradient as water run-off needs to be limited. As water run-off is decreased, erosion in the area will slow down, and this will thus create a better change for vegetation to re-establish on the slope.

c) Compaction

Compaction causes poor drainage and water-logging and the lack of soil pores will result in little water being stored for the use of plants. Plants growing in compacted soil also have shallow root systems that provide poor physical anchorage for the plants. The plants are also then unable to exploit nutrients beyond the surface layer.

d) Seed Dormancy

Methods for breaking seed dormancy as well as germination requirements of some Karoo shrub species are not known (Van den Berg & Kellner, 2003). This might be a problem when growing plants in the nursery. Also at rehabilitation sites, outcomes may not be as predicted due to seeds not germinating at the expected time.

8 METHODS

Mechanical cultivation methods have been showed to increase the species richness and rehabilitation success in sites (Van der Merwe & Kellner, 1998). From the study done by Visser, Botha & Hardy (2003), it was clear that the cultivation of bare patches (breaking the soil crust and providing organic matter) is necessary for the successful re-establishment of vegetation on bare patches in the Nama Karoo. The design of traps construction (pitting, ripping and brush packing) for water and seed collection can influence the results of the techniques. As demonstrated by Van Rooyen *In Milton* (2001), experiments with grid, spiral and star-shaped brush-packs on denuded fields of the Kalahari indicated that grid-shaped packs reduced wind speed, but were ineffective in trapping seeds except around their perimeters. Star-shaped brush-packs trapped seeds and fine





particles and lead to patchy re-vegetation of dunes. It will be necessary to conduct trials on the effectiveness of re-establishing vegetation in clumps as opposed to non-clumped designs. Getting pioneer plants established at first will protect the soil against erosion and trap seeds carried by the wind and will then serve as a microclimate in which these seeds can germinate and establish.

The methods used need to be fairly diverse in order to effectively treat a diverse range of habitat degradation. The primary focal areas for rehabilitation have already been outlined and the methods suggested for rehabilitation will be briefly described per focal area as follows (by Ken Coetzee, 2005a):

8.1 Historical Cultivation (Old lands)

These sites are generally flat, soil-compacted and sparsely vegetated. The objective is to increase rainwater infiltration to help restore the natural soil moisture. This can be done by making a series of hollows (pitting) by hand across the site, each of which will collect approximately 80 litres of runoff. Only 50 hollows will result in 4 000 litres of valuable soil moisture which would previously have been lost to the site as runoff into the river. Each of the hollows can be treated with a soil pH buffer (if necessary), a few handfuls of manure (if available), a mixture of pioneer indigenous plant seed and a layer of protective locally cut brush. This method is relatively cheap, fairly quick to establish and very effective. Care must be taken not to disturb the already established vegetation on the site. Once the seeded plants are relatively well established in the hollows, follow-up seeding can be done both in and outside of the hollows, using the secondary establishment species. The guiding principle for plant re-establishment is to plant only the species that are locally indigenous. The use of alien plants for rehabilitation work may inadvertently result in the unwanted invasion of the river system which may also be to the detriment of the riverine rabbit.

The primary establishment plant species should include:

<i>Atriplex semibaccata</i>	<i>Galenia procumbens</i>
<i>Cenchrus ciliaris</i>	<i>Bassia salsoloides</i>
<i>Cynodon dactylon</i>	<i>Pentzia incana</i>
<i>Eragrostis lehmanniana</i>	<i>Pteronia membranacea</i>
<i>Eriocephalus eriocoides</i>	<i>Fingerhuthia africana</i>

Secondary establishment species can include the following:

<i>Asparagus africanus</i>	<i>Berkheya spinosa</i>
<i>Chrysanthemoides incana</i>	<i>Digitaria eriantha</i>
<i>Eragrostis bergiana</i>	<i>Eragrostis bicolor</i>
<i>Eragrostis curvula</i>	<i>Exomis microphylla</i>
<i>Felicia filifolia</i>	<i>Helichrysum pentzoides</i>
<i>Helichrysum zeyheri</i>	<i>Hermannia filifolia</i>





<i>Leonotis leonurus</i>	<i>Lycium cinereum</i>
<i>Pentzia phaeocephala</i>	<i>Pteronia erythrochaeta</i>
<i>Salsola aphylla</i>	<i>Salsola glabrescens</i>
<i>Sporobolus fimbriatus</i>	<i>Sporobolus ioclados</i>
<i>Stiparostis ciliata</i>	<i>Suaeda fruticosa</i>
<i>Tetragona fruticosa</i>	<i>Osteospermum scariosum</i>
<i>Osteospermum sinuatum</i>	<i>Osteospermum spinesens</i>
<i>Selago geniculata</i>	<i>Zygophyllum flexuosum</i>

8.2 Gulley Erosion

Combating gulley erosion is complex and difficult and the ultimate objective for rehabilitation will be used as a guide. This is to establish a protective vegetation cover. Destructive runoff water flow in gulleys can be checked with numerous small barriers along the gulley that will permit water to slowly percolate through, but which will hold back the fertile silt, organic material and animal droppings that are usually carried off the land by water.

The gulley checks can be made out of wire netting and brush, wire netting and stones, worn rubber tyres and a variety of other options, depending on material availability. All of the checks should be lined with a layer of sisal, jute or coir geo-textile to ensure effectivity. The geo-textiles can also be used as stand-alone barriers if carefully attached to vertical stakes and well anchored into the channel sides and floor. Each of the gulley checks should be seeded, before the first rainfall, and the seedling site protected with brush mulch.

A modification of these low “fence” structures can also be used on gently to moderately sloping sheet-eroded sites to check soil loss over a wide area to help establish a series of vegetated cover strips across the site.

No attempt should be made to stabilize deeply eroded “badlands” and most of the effort should focus on the head (nick point) of the gulleys and on the smaller gulleys and sheet-eroded areas where corridor improvement is practically achievable.

8.3 Degraded River Channels

The primary goal for river channel rehabilitation should be to re-establish stands of the original vegetation cover that has been lost as a result of over-utilization of the riverine area with domestic stock. The erosion of the river channel is a direct result of a reduction of the protective vegetation cover. The loss of grasses in river channels has had a particular destabilizing impact along rivers of the Karoo (Acocks, 1976 *IN* Coetzee, 2005a).





The primary action should initially be to completely exclude all further utilization of the riverine channel for grazing. The river should be fenced off from the non-riverine range, using a rabbit-“friendly” fence.

Riparian plants must then be established in carefully selected sites. These sites must provide sufficient soil and moisture for the plants and severely degraded sites should be avoided.

Minor stabilization work can be done for planting purposes, but the stochastic flooding events of these seasonal rivers precludes any major construction work in the channel. Efforts should thus be channelled into planting. Spade-sized root plugs of sedges and reeds should be locally sourced in stable riverine sites where their careful, random removal must not result in the destabilization of any particular patch of stable riparian vegetation.

The best results in wet sites will be obtained using root plugs of:

<i>Cyperus laevigatus</i>	<i>Phragmites australis</i>
<i>Cyperus marginatus</i>	<i>Diplachne fusca</i>
<i>Juncus punctorius</i>	<i>Pseudoschoenus inanus</i>
<i>Scirpus dioecus</i>	<i>Typha capensis</i>

Marginally drier sites can be stabilized by seeding with: (Acocks, 19976 In Coetzee, 2005a)

<i>Cynodon dactylon</i>	<i>Eragrostis lehmanniana</i>
<i>Digitaria eriantha</i>	<i>Fingerhuthia sesleriaeformis</i>
<i>Ehrharta calycina</i>	<i>Hyparrhenia hirta</i>
<i>Eragrostis bicolor</i>	<i>Pennisetum macrourum</i>
<i>Eragrostis chloromelas</i>	<i>Sporobolus fimbriatus</i>
<i>Eragrostis curvula</i>	<i>Sporobolus ioclados</i>

In drier sites, the following species should be used: (Acocks, 1976 In Coetzee, 2005a)

<i>Asparagus africanus</i>	<i>Berkheya spinosa</i>
<i>Chrysanthemoides incana</i>	<i>Eriocephalus ericoides</i>
<i>Exomis michryophylla</i>	<i>Helichrysum zeyheri</i>
<i>Kochia pubescens</i>	<i>Leonotis leonurus</i>
<i>Monechma incanum</i>	<i>Pentzia incana</i>
<i>Salsola aphylla</i>	<i>Salsola glabrescens</i>
<i>Suaeda fruticosa</i>	<i>Tetragonia fruticosa</i>
<i>Tripteris sinuatum</i>	<i>Tripteris spinescens</i>





And the grasses:

Cenchrus ciliaris

Fingerhuthia africana

Stipagrostis ciliata

Stipagrostis namaquensis

Stipagrostis obtusa

Seeded or planted sites in the river channel should be protected with a layer of brush to keep most of the herbivores away initially.

8.4 Corridors in Cultivated Lands

A strip of natural riverine habitat, at least 2m wide, should be retained between the cultivated area and the river bank. This strip will be adequate to protect the river bank from accelerated erosion and provide an ample corridor in terms of habitat quality and width, for dispersing *Bunolagus*.

A strip of natural vegetation, at least 1m wide, should be maintained between each separate cultivated land unit, each land will thus be “bordered” by a strip of *Bunolagus* corridor habitat. Similar strips of natural vegetation should be maintained along the roads within the cultivated land area. These strips of habitat, however minimal, will provide stepping-stone corridor refugia to facilitate *Bunolagus* dispersal across the cultivated area.

At sites where these provisions were not included into the original layout design of the lands, the required corridors can be created by applying the already described habitat rehabilitation methods to the proposed corridors. The method will be much the same as that of the old lands and using the already listed plant species. River bank and corridor cover can initially be artificially provided with brush-packing, which will also help to protect the rehabilitation planting efforts.

8.5 Other Vegetation Rehabilitation Sites

Other sites that were identified for rehabilitation are the impoundment earthworks and areas affected by soil conservation works. The methods already described for habitat rehabilitation can be adapted for these sites using the same soil stabilization techniques and the same plant cover species.

Sloping earth dam walls and other earthworks can be covered with a chopped brush cover as an alternative to vegetation establishment if these sites prove too difficult or costly to re-vegetate. A protective brush cover should provide *Bunolagus* with a suitable “artificial” cover on very exposed areas and over critical short distances.



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8.6 Excluding Stock and Larger Wildlife

Actions of livestock that have uncontrolled access to rivers, not only over-graze the bank-side of vegetation, which results in weakening of plant roots and the loss of their soil binding properties, but also degrade banks through grazing.

The best results will be achieved at each of rehabilitation project sites by excluding all domestic stock and larger wildlife completely from the site. This can be achieved with the co-operation of the landowner by excluding grazing within the existing grazing camp system, if practical, or by specially constructing an exclusion fence around the area to be rehabilitated. The absolute co-operation of the landowner is thus critical. Exclusion fences should be constructed to a specification that will exclude all domestic stock and wildlife larger than *Bunolagus*. This can be achieved by spacing the fence wires or by incorporating small openings for rabbits.

The fences should be kept in place at least long enough to permit the permanent establishment of a vegetation cover on the site. The duration of exclusion from grazing will vary from site to site, and will be dependent on factors like rainfall, soil health, suitability of the rehabilitation method for the site and the unknown impact of small animals like rodents and insects.

Landowners should thus be primed to accept that the rehabilitation work can only be expected to yield results in the long term and that the exact timing for stock exclusion is not yet known.

8.7 Rehabilitation Nurseries

The seeds of some of the plants recommended for the rehabilitation work are commercially available, but many will have to be specially cultivated from seed collected in the veld. This necessitates the establishment of nurseries in which plants can be grown until strong enough to be planted out into rehabilitation sites. Nurseries can be established in each of the worker source towns where a reliable source of water is available. Any piece of unused open ground with a water connection can be used. Alternatively, nurseries can be established on conveniently located farms, provided that water and a full-time nursery manager are available on site.

The nurseries should be set up as community projects with the costs of ground use and water provided by the municipality or farmer as a contribution to the project. Nurseries will need to be fenced to keep herbivorous wildlife and domestic stock away. The infrastructure is otherwise simple and cheap to construct. Dedicated management is involved and includes the collection of seed in riverine habitat (See Table 2 for a list of species that can be cultivated in nurseries).





9 PROJECT OUTPUT

1. The project will be developed into a small economically independent rehabilitation business.
2. Key role player such as landowners will be convinced that the perceived benefits of the rehabilitation work will be to their economical advantage and therefore deserving their support.
3. Media articles and publications will be produced on the EWT-RRWG's Riverine Habitat Rehabilitation Project.
4. Artificially fragmented areas will be connected (if financially viable) by the establishment of natural vegetation covers on eroded and degraded areas along seasonal Karoo rivers.
5. A strategic plan and the necessary infrastructure will be in place for landowners who are interested in rehabilitating riverbanks on their land (i.e. nurseries for indigenous plants in various Karoo towns, a trained working team to assess the status of the veld and to implement appropriate rehabilitation techniques).

10 MONITORING

It is absolutely essential that the progress and effectiveness of the rehabilitation methods used are evaluated and recorded at regular intervals in order to find the best methods to reach the required objectives. The same method of evaluation will be used each time monitoring is done to ensure comparable results. It is important to find out what is working, is it cost-effective and what needs to be modified or adapted to improve the effectiveness of the methods used. Photography offers the best way in which to record progress at fixed points within a rehabilitation area (Coetzee, 2005b). Also according to Coetzee (2005b) useful information about subtle vegetation changes can be obtained via the use of vegetation condition transects. It is important to inspect the treated erosion systems after rainstorms to verify if any of the structures are in need of repair work, since if not attended to, it will eventually result in wasted money and a possibly bigger erosion problem.

The success of vegetation re-establishment efforts will be monitored not only by recording plant species as well as vegetation densities, but also by determining which plants germinate well and which species survive. It is important to note that rehabilitation monitoring is a long-term process.

10.1 Veld Assessment

As part of the veld assessment the soil surface, vegetation cover, plant types, forage value and the seedlings will be scored using the adapted multi-criteria veld assessment form as described by Esler, Milton & Dean (2006). Repeated assessments will be done to see how the veld responds to rehabilitation and vegetation planting. A strip of 100 meters long and two meters wide will be used. These sites will be marked with two metal droppers, one driven into the ground at either end of the 100 m veld assessment strip. One of these markers will be used as a support for a rain gauge. An assessment will be done before any rehabilitation is done at the site. Thereafter it will be done two weeks after it has rained and thereafter the veld will be assessed twice a year, once in spring and once in autumn, as recommended by Esler, Milton & Dean (2006).



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The veld assessment form obtained from Esler, Milton & Dean (2006) has been adapted and instead of the original three sections (site description, grazing record and veld assessment), it only has two sections (site description and veld assessment). The reason for this is that the sites will be excluded from livestock grazing for a certain period, depending on the specific site. The site description will record the date of the assessment, the farm and coordinates of the site, the topographic position of the site, the type of the vegetation and soil on the site, and any obvious damage to the veld. Then the veld will be assessed along the marked strip by walking from one market to the other, making written notes of vegetation cover, forage value of plants, grazing intensity, disturbance indicators, seedlings of perennial plants and soil and habitat health. The veld impressions will be converted to scores ranging from 5 (excellent) to 1 (very poor). See Appendix 1 for an example of the Veld Assessment Form.

The scoring system used is the system described by Esler, Milton & Dean (2006). Vegetation cover refers to the percentage of the ground that is covered by plant canopies. If the percentage of the soil covered is as much as the bare ground, the cover is 50 %. If less than half of the soil surface is covered by plants, then it will be determined how much is covered, 20, 25 or 30 %. To assess the forage value of the veld, the percentage of all plant biomass that is palatable. The higher the percentage of usable plants in your veld, the higher the condition scores.

To assess the grazing intensity, it will be observed whether palatable and very palatable plants have been partially utilized (score 4-5) or grazed down to their base or woody stems (score 1-2).

Disturbance indicator score good veld (score 4-5) as being free of alien weeds, and should have little space for opslag and spreading mat plants. Opslag is plants that appear after rain and live for less than a year (Esler, Milton & Dean, 2006). Seedlings of perennial plants may belong to palatable or unpalatable plant species. When most seedlings belong to palatable plants the veld will remain or become productive (Score 4-5). If the seedlings are mostly or all unpalatable, the veld condition is poor or deteriorating (score 1-2). When assessing the soil and habitat health, the ability of the soil to trap and absorb water to support plants are important, living crusts, fertile patches and animal diggings are positive signs of soil health so the area could score 4-5. An abundance of capping, exposed roots, saline puffines and rills indicate water loss, soil erosion and salt accumulation and harsh habitat conditions score 1-2.

10.2 Fixed-point photographic monitoring

The technique is simple to implement and inexpensive. Widely spaced fixed-point photographic sites need to be established throughout the rehabilitation site. Four photographs taken from a single point in each of the compass directions will show changes in ground cover, vegetation density, plant canopy height and to some extent, species composition. At the fixed point, at a fixed height and in fixed directions every time, photographs will be taken on different dates, and will be comparable. Focusing at a distance of about 30 meters, rather than on the horizon, usually give a clearer picture of the soil and plants according to Esler, Milton & Dean (2006). A fixed-point photograph record sheet will be filled in (see Appendix 2 of sheet modified from the one drawn up by Coetzee, 2005b), containing details of plant species composition, cover description and





utilization by animals. The locations of each fixed-point monitoring site would be marked on a map of the property. To be able to compare photographs, the pictures will be taken at the same time of the day. Esler, Milton & Dean (2006) suggest pictures be taken midday when shadows are minimal. Photographs will be taken before any rehabilitation work is done at the site and there after it will be done on the same day as the veld assessment (two weeks after the first rains, than twice a year, once in spring and once in autumn).

11 PROJECT SCHEDULE

Phase 1	Estimated Time Schedule
Initiating	April 2007 / June 2007
1. Identify need/Problem	Ongoing
2. Gather data	March - June 2007
3. Establish goals and objectives	March 2007
4. Basic Strategy Plan	May - June 2007
5. Obtaining resources	Ongoing
6. Identify potential rehabilitation sites	May 2007
7. Identify fauna collection sites	June 2007
8. Identify substrate collection sits	June 2007
Phase 2	
Development	May 2007 - October 2007
1. Obtain land for the first nursery.	May/June 2007
2. Obtain permits for the first nursery.	May/June 2007
3. Select priority rehabilitation sites.	June 2007
4. Fence in Nursery	June 2007
5. Set-up Nursery	July 2007
6. Obtain seeds.	July 2007
7. Grow seedlings.	July – Ongoing
8. Select first site.	June 2007
9. Plan site specific rehabilitation strategy	June 2007
10. Do veld assessment.	July 2007
11. Take photographs of the area for photographic monitoring.	July 2007
12. Get together a working team of casual workers.	July 2007
13. Get equipment together & give training to workers.	July - August 2007
14. Start rehabilitating site, testing different rehabilitation methods.	September 2007
15. Obtain resources.	
16. Conduct studies.	Ongoing
17. Identify alternatives rehabilitation methods.	Ongoing
18. Develop baseline plan:	Ongoing
a. end products	November 2007
b. quality standards	
c. resources	
d. activities	
19. Establish: master plan, budget, cash flow	
20. Assess risks	November 2007





Phase 3	
Monitoring	
1. Set up working team for sites. Communicate work schedule for each specific rehabilitation site.	November 2007 - Ongoing
2. Motivate team	Ongoing
3. Detail technical requirements	Ongoing
4. Establish: - detailed schedule - control systems	Ongoing
5. Procure goods	Ongoing
6. Execute work	Ongoing
7. Direct/forecast/control: (scope, quality, time, cost)	Ongoing
8. Resolve problems	Ongoing
Rehab Implementation	From August 2007
1. Review	Ongoing
2. Evaluate	Ongoing
3. Document results	Ongoing
4. Redirect resources	Ongoing
5. Establish more working teams	Ongoing

12 PROJECT COST

Primary cost estimations as done by Ken Coetzee (2005a):

12.1 Labour

It has been established that there are ten towns within *Bunolagus* distribution range that could become involved in the corridor rehabilitation project. Some of these centres can contribute more than one rehabilitation team to the project and there may be other smaller unlisted settlements that could also benefit from a work creation project such as this. Work teams of eight persons have been used as the standard for this proposal. Eight people easily fit onto a light delivery vehicle (LDV) and the group is small enough to work together or big enough to split up into two small groups. For payment calculation, it is important to comply with the minimum permissible wage for casual labour, but also to be sensitive to the “going rate” within the region. The project, however, is dedicated to the up-liftment of the people involved and a long term involvement, so a minimum wage will not be suitable. For the rehabilitation effort to be successful, workers must be carefully selected, well trained and equitably remunerated. This project cannot merely become a vehicle for the financial improvement of previously disadvantaged, but unproductive people that remain uncommitted to the rehabilitation project. Projected costs for a single rehabilitation team of 8 people, including a driver and team leader for a five-day week is calculated as follows:



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Table 3: Approximate wage costs per working team of 8 persons for one, two and three teams.

PAYMENT PERIOD	ONE TEAM	TWO TEAMS	THREE TEAMS
Day	R 640-00	R 1 280-00	R 1 920-00
Week	R 3 200-00	R 6 400-00	R 9 600-00
Month	R 12 800-00	R 25 500-00	R 38 400-00
Quarter	R 38 400-00	R 76 800-00	R115 200-00
Year	R153 600-00	R307 200-00	R460 800-00

12.2 Transport

At an average running rate of about R2-50/km, the costs of LDV's travelling 40 km per day can be calculated as follows:

Table 4: Approximate running costs for rehabilitation team transport calculated at an average of 40 km per day.

PAYMENT PERIOD	ONE TEAM	TWO TEAMS	THREE TEAMS
Day	R 100-00	R 200-00	R 300-00
Week	R 500-00	R 1 000-00	R 1 500-00
Month	R 2 000-00	R 4 000-00	R 6 000-00
Quarter	R 6 000-00	R 12 000-00	R 18 000-00
Year	R 24 600-00	R 48 000-00	R 72 000-00

Finance for vehicle running costs can either be paid to community members working on the rehabilitation projects who already own LDV's or to other vehicle owners within the community who provide only the transport service. The way it is done depends very much on the local economic situation.





12.3 Equipment

A set of simple hand tools will be needed for each of the rehabilitation teams. The approximate cost of the basic tools required is indicated in Table 5:

Table 5: Estimated costs, per team, for basic tools.

TOOLS	ONE TEAM	TWO TEAMS	THREE TEAMS
8 Spades	R 520-00	R1 040-00	R 1 560-00
8 Picks	R 832-00	R1 664-00	R 2 496-00
4 Fencing pliers	R 704-00	R1 408-00	R 2 112-00
2 x 8 lb hammers	R 782-00	R1 564-00	R 2 346-00
2 hacksaws	R 276-00	R 552-00	R 828-00
4 Bush saws	R 184-00	R 368-00	R 552-00
4 Slashers	R 548-00	R1 096-00	R 1 644-00
TOTAL COST	R3 846-00	R7 692-00	R11 538-00

12.4 Project Coordinator

A project co-coordinator will guide the rehabilitation projects, assist with equipment, establish working teams, co-ordinate activities, receive donations and administer the payments for transport and wages. The coordinators primary tasks are to do quality control of the work, on-the-job training and planning further rehabilitation work. If the project does eventually involve all ten towns, more than one coordinator will be required. It is, however, estimated that only one such person will be required initially. This important post should not be occupied by a part-time farmer or semi-retired person with other interests, it should rather be occupied by a young, suitably qualified person with a desire to work in the field and do pioneering rehabilitation work. Projected costs for this position are as indicated in Table 6.

Table 6: Estimated costs of a full-time rehabilitation project coordinator.

COST	PER MONTH	PER YEAR
Salary	R 13 000-00	R156 000-00
Transport	3 000 km x R2-50/km = R7 500-00	R 90 000-00
Telephone, administration, fax, stationery	R 1 000-00	R 12 000-00
TOTAL	R21 500-00	R258 000-00





12.5 Nurseries

A nursery should be established in each centre that provides rehabilitation work teams. Each nursery will require a nursery manager and one worker, who will be directly responsible to the project manager. Approximately 2 500m² (50m x 50m) will be needed and a reliable water supply is necessary. The land, water and minimal infrastructure that are required should be donated by the municipality or landowners, perhaps in return for a repayment in rehabilitation work or plants. The estimated costs for small nursery establishment and maintenance are as follows in Table 7:

Table 7: The establishment and running costs of a small rehabilitation nursery.

COST	DAILY COST	MONTHLY RUNNING COST	ANNUAL RUNNING COST
Wages - manager	R100-00/day	R2 000-00	R24 000-00
Wages - worker	R80/day	R1 600-00	R19 200-00
Materials	-	-	R 6 000-00
Equipment	-	-	R 2 000-00
TOTALS	R180/day	R3 600-00/month	R51 200-00

The logistical support of transport for manure, organic mulch, soil and the collection of seed in the field can be provided when required either by the project manager or the rehabilitation team operational in the area. It will thus not be necessary to provide additional transport for the nurseries. A larger nursery may be a more practical option than a number of smaller ones, but will result in less employment and up-liftment possibilities for the area.

12.6 Summary of Costs

Table 8 shows what the total estimated costs per rehabilitation team will be for one month, six month and 12 month periods. The costs of the project manager are included as well.

Table 8: Total of all estimated costs based on one rehabilitation team, one nursery and a project manager.

COST	ONE REHABILITATION TEAM		
	PER MONTH	PER SIX MONTHS	PER YEAR
Wages	R 12 800-00	R 76 800-00	R153 600-00
Salaries	R 13 000-00	R 78 000-00	R156 000-00
Transport for manager	R 7 500-00	R 45 000-00	R 90 000-00
Administration	R 1 000-00	R 6 000-00	R 12 000-00
Transport rehab teams	R 2 000-00	R 12 000-00	R 24 000-00
Nursery	-	-	R 51 200-00
Equipment	-	-	R 3 846-00
TOTALS	R36 300-00	R217 800-00	R490 646-00





The total cost of one team's wages, with its equipment and transport costs, can be added to the annual costs total in Table 8 to give an idea of an increase in costs, as the number of rehabilitation teams increases. This is done in Table 9 to illustrate what one to four rehabilitation teams will cost per year.

Table 9: Total costs for 1, 2 3 and 4 rehabilitation teams per annum.

TYPE OF COST	COST OF 1 TEAM	COST OF 2 TEAMS	COST OF 3 TEAMS	COST OF 4 TEAMS
Wages	R153 600	R307 200	R460 800	R 614 400
Manager salary	R156 000	R156 000	R156 000	R 156 000
Manager transport	R 90 000	R 90 000	R 90 000	R 90 000
Administration	R 12 000	R 12 000	R 12 000	R 12 000
Rehab team transport	R 24 000	R 48 000	R 72 000	R 96 000
Equipment	R 3 846	R 7 692	R 11 538	R 15 384
Nursery	R 51 200	R 51 200	R102 400	R 102 400
TOTALS	R490 646	R672 092	R904 738	R1 086 184

12.7 Other Costs and Community Involvement

The foregoing section deals with the direct costs of labour, transport, equipment and management but purposely does not quantify the cost of rehabilitation construction materials. These critical requirements create an opportunity for the public to get involved in the rehabilitation of the riverine habitat. For example, the geo-textiles needed could be provided by the big engineering, slope and roadside stabilizing companies and importers of all types of geo-textiles and shade cloth. The requirements for the rehabilitation work are relatively minimal when compared to the usual engineering and agricultural applications. Testing the use of these products for environmental rehabilitation will be to the benefit of the donator. Long-term commitments to the rehabilitation project should be the aim for donor involvement. The same applies to other materials like wire mesh, steel wire rolls, iron standards and wooden stakes. Much of this material is often available as second-hand scrap that is no longer suitable for fence reconstruction, but is nevertheless ideal for rehabilitation work. Manufacturers can also be contacted for reject wire netting, steel fence standards and other useful materials.

Experience in the past has shown that this type of requirement is easily met if the trouble is taken to search and request for it. The donations could be widely advertised as no small part in *Bunolagus* conservation efforts. Similarly, protective clothing for workers can be acquired through donations directly from the manufacturers or from the outlets such as the agricultural co-operative stores that can be found in most small towns. The responsibility for getting the donations can become that of the project manager, but community involvement should again be used to locate and request for donations. The removal of internal fencing on one newly established game reserve, for example, could keep two rehabilitation teams supplied with materials for a very long time. The minimal infrastructure, land and water needed to establish and run a small nursery should be donated by the community in which the nursery is situated. The skills required by the nursery staff can also be donated or be paid for by a donation, either by a training centre or by any local person that is willing to pass on the necessary skills. There are many ways in which to acquire these skills and pay for them.





13 PROJECT BENEFITS

Habitat rehabilitation can enhance biodiversity and increase the carrying capacity, possibly also reverse the desertification process. This improved veld condition can increase the property values. The following benefits are prescribed by Coetzee (2005a).

13.1 Ecological Benefits

A. Ecosystem productivity:

General degradation of riverine vegetation through overgrazing destroys the ecosystems ability to make maximal use of solar energy. This results in a loss of production and thus plant biomass, with the subsequent deterioration of the grazing resource and the animals dependent on the vegetation, in this case, small domestic livestock. This riverine vegetation is critically important to the farmers of the area. As a result of a higher moisture and nutrient content, these riverine areas provide good grazing long after most of the other grazing resources are depleted during the dry season and during drought. The judicious rehabilitation and conservation management of the comparatively lush riverine vegetation will thus be of significant economical benefit to the landowner and will also ensure adequate *Bunolagus* habitat connectivity.

B. Protecting Water Resources:

A stable and healthy vegetation cover will facilitate infiltration and groundwater storage, rather than the runoff of rain water. This will be of overall benefit to the ground water reserves. Most of the farm settlements in the *Bunolagus* distribution area are located along the seasonal rivers. Groundwater is pumped and utilized for irrigation, stock watering and domestic needs. The continual replenishment of the groundwater reserve is thus critical to the permanent settlement of the area. Reversing the aridification process through the rehabilitation and judicious management of the riverine habitat will thus play a significant role in the conservation of the precious water resource. This ecological benefit, in an essentially arid region, will be financially significant to the landowner while being ecologically significant for *Bunolagus*, its habitat and habitat connectivity.

C. Protecting the Soil:

By retaining a healthy riverine vegetation cover, the landowner can buffer the ecosystem against the ravages of flooding and drought. Protective vegetation in the river channel, and on its banks, will prevent accelerated soil erosion, loss of riverine grazing and the premature silting up of weirs and farm dams further downstream. Damage to the soil surface due to the effects of over-utilization of the vegetation cover can limit the ability of plants to recover and reproduce, even when rested. Retention of a healthy and productive vegetation cover will help to prevent accelerated soil erosion, soil compaction, increased runoff and subsequent siltation of the river. The economic advantages of the resultant soil conservation and superior grazing reserves are obvious, as are the general benefits to the riverine ecosystem.



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13.2 Social Benefits

A. Ecotourism:

Farm visits for tourists are a fast growing aspect of national ecotourism. In addition to the already popular hunting in the Karoo, numerous farms in the *Bunolagus* distribution area receive and accommodate visitors who simply enjoy the fresh air, the outdoors, natural Karoo scenery and a “farming” way of life. Well managed lush riverine vegetation, rather than unattractive, overgrazed and eroded veld, provides some of the attraction of the area. The idea of walks along the seasonal rivers could be developed and the concept of one of the rarest mammals in Africa, and in fact on earth, occurring and specifically protected on these farms will enhance the attraction of the farms for visiting tourists. In addition to the endangered riverine rabbit, other increasingly uncommon Karoo mammals such as the armadillo (*Orycteropus afer*), black-footed cat (*Felis nigripes*) and the aardwolf (*Proteles cristatus*) will also benefit from seasonal river rehabilitation and could also become an attraction in these areas. The economic benefit for the landowner, and the supporting community, is obvious as is the benefit of well managed riverine vegetation to the *Bunolagus* metapopulation.

B. Community upliftment:

The rehabilitation of riverine habitat will clearly play no small part in the overall economic improvement within the agricultural sector of the region. This means that general economic stability should filter to the local town communities which provide a range of services to the agricultural sector.

Two important social benefits of the rehabilitation programme will be the employment of workers for rehabilitation projects and the social upliftment that accompanies training and empowerment. A number of self-managed worker teams are envisaged as well as the establishment of a number of nurseries to provide the plants for the rehabilitation work.

At best, the towns of Fraserburg, Carnarvon, Loxton, Victoria West, Nelspoort, Williston, Calvinia, Sutherland, Touwsrivier and Laingsburg could be targeted for involvement in rehabilitation projects. At a rate of one nursery per town and only two rehabilitation teams of 8 per town, this could amount to the permanent employment and economic empowerment of approximately 180 previously unemployed people (20 in nurseries and 160 in rehabilitation teams). With an average family size of about 5, at least 900 people could benefit directly and many more indirectly from the proposed rehabilitation projects.

If sufficient funding can be procured, there is no reason why these rehabilitation projects should not become a long term land care institution. The landscape under the magnifying glass here is certainly in need of the care.



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14 CONCLUSION

The rehabilitation project outlines the practical way in which to select and rehabilitate *Bunolagus* inter-habitat patches that will result in connectivity. The suggested methods can be easily adapted to the varying conditions of different rehabilitation sites. Good on-the-job training and experienced supervision will be required initially, but the project has great potential for the empowerment of previously unemployed people and the creation of small economically independent rehabilitation businesses. The success of the proposed rehabilitation strategy initially will determine marketability of these independent rehabilitation teams.

The proposed rehabilitation work teams and nurseries will not only contribute to up-liftment of previously disadvantaged rural people in small Karoo towns, but also to the general community awareness about the vulnerability of *Bunolagus* and its habitat. Landowner co-operation is critical to the overall success of the rehabilitation project. They will have to be convinced that the perceived benefits of the rehabilitation work will be to their advantage and therefore deserving of their support. The benefits relate to the long-term restoration of Karoo riverine ecosystem functioning which is very difficult to quantify and will have no immediate financial spin-offs for the landowner. Aside from the benefits to the landowner and the communities, the implementation of the rehabilitation project will definitely improve the connectivity between the remaining patches of *Bunolagus* habitat. The thus has the potential to create an increased awareness for landscape rehabilitation, promote a responsible land ethic, empower rural people and improve the chances for *Bunolagus* meta-population survival.

The rehabilitation project relies heavily on the donation of funding for wages, transport, equipment and training. A dedicated effort will thus be needed to raise interest in donations for funding and this then must be the starting point for the project.



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- 3 -
SUSTAINABILITY
INDICATORS



APPENDIX 1: VELD ASSESSMENT FORM

Veld Assessment Form									
DATE:					VELD ASSESSOR:				
SITE DESCRIPTION									
Farm Name:				Plot No:			GPS Co-ordinate:		
Topography at Site:					Soil Type:				
Vegetation Type:									
Distance from water: m					Rain in past 3 months: mm				
Damage by: (circle Y or N)	Hail:	Y / N	Drought	Y / N	Ruspes	Y / N	Locusts	Y / N	
Can you see:(circle Y or N)	Dongas	Y / N	Trampled paths	Y / N	Bare heuweltjies	Y / N			
VELD ASSESSMENT									
SCORE	1	2	3	4	5	TOTAL			
A Vegetation cover (not opslag) (% of soil covered)						1 2 3 4 5			
B Forage value (% palatable)						1 2 3 4 5			
C Grazing intensity (% new shoot removal from palatable plants)						1 2 3 4 5			
D Disturbance indicators (% of cover comprising weeds, opslag, mat plants)						1 2 3 4 5			
E Seedling ratio (Palatable to unpalatable seedlings)						1 2 3 4 5			
F Soil health - ve signs: erosion, capping + ve signs: lichen, diggings, organic litter						1 2 3 4 5			
TOTAL SCORE:									
Total score indicates the following veld condition:									
Excellent >25	Good 21 – 25	Intermediate 16 – 20	Poor 11 – 15	Severely degraded 6 – 10					
Species numbers and type 100 m x 2 m strip									
<u>Trees</u>	<u>Bossies</u>	<u>Grasses</u>	<u>Opslag</u>	<u>Total Species</u>					

CONCLUSIONS:



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**APPENDIX 2: PHOTOGRAPHIC MONITORING SHEET****Fixed-point Photograph Record Sheet**

FARM NAME:	<u>DATE:</u>	<u>SURVEYOR:</u>	
PLOT NO:			
GPS CO-ORDINATE:			
GRID REF NO:			
POINT DESCRIPTION: (How to find the plot marker)			
HABITAT DESCRIPTION: (Use back of form, if necessary)			
VEGETATION TYPE:			
TREE & SHRUB SPECIES:			
DWARF SCRUB SPECIES:			
HERBACEOUS PLANT SPECIES:			
COVER DESCRIPTION:			
COVER TYPE	HEIGHT	% OF PLOT	DOMINANT SPECIES
CANOPY COVER			
GROUND COVER			
UTILISATION:			
BROWSING INTENSITY:	PLANTS BROWSED		BROWSING HERBIVORES
HEAVY			
MODERATE			
LIGHT			
GRAZING INTENSITY	PLANTS GRAZED		GRAZING HERBIVORES
HEAVY			
MODERATE			
LIGHT			
OTHER NOTES:			



- 3 -
SUSTAINABILITY
INDICATORS

Proposed Sustainability Indicators for the Pixley Ka Seme District Municipality Integrated Environmental Management Plan

(Indicators from various sectors are included to be expanded or reduced based on applicability to the Pixley Ka Seme District Municipality)

OVERVIEW

South Africa urgently needs economic growth and development. However, the major challenge is to manage development in such a way that economic, social and environmental sustainability are ensured.

Sustainable Development is acknowledged in government development policies such as the RDP white paper, and forms the cornerstone of the recently accepted Environmental Management Policy, and the Policy on the Conservation and Sustainable Use of South Africa's Biological Diversity. (The latter policy was developed as a response to the ratification of the Convention on Biological Diversity by South Africa.)

The introduction of Sustainable Development represents a paradigm shift in government policy¹. Indeed, it represents major changes from fragmented management and narrow conservation to the paradigm of integration, and systems thinking- these being essential tenants of Sustainable Development.

It has been said that...." the new policies introduced by Sustainable Development has unsettled mindsets both within and outside the public sector. In so doing, it has succeeded in putting before the nation and its people the means and criteria to identify those things that make for our peace, development and prosperity. It gives us a formidable framework to interact with the world, and our own past, present and future. The biosphere is a single whole and South Africa's biodiversity is one of its most important, richest and integral parts " ².

Agenda 21³ calls for Integrating environment and development at the policy, planning and management levels. Section 8.6 of Agenda 21 calls on signatory countries to "develop systems for monitoring and evaluation of progress towards achieving Sustainable Development by adopting indicators that measure changes across economic, social and environmental dimensions".

The last few years has seen a world wide increase in the awareness of the urgent need to implement the principles of Sustainable Development .In short, Sustainable Development

¹ It can be argued that the philosophy of 'sustainable development' is a manifestation of a broader social and scientific 'paradigm shift'. Described (for example by Capra, 1882; and Sterling, 1990) as a shift from the mechanistic/ Cartesian to the systems /ecological paradigm. The science of ecology (Pickett *et al.* 1992;), and quantum physics (Capra, 1975) are particularly important catalysts to this shift.

² Hon. Peter R Mokaba, MP, in the forward to the White Paper on Environmental Management Policy. Department of Environment Affairs and Tourism July 1997.

³ Agenda 21 originates from the United Nations Conference in Rio de Janeiro in 1992 (UNCED). It is, an action plan for Sustainable Development. 170 countries, including South Africa, have signed the Agenda 21 and binded themselves to start and support a sustainable development in their countries.

requires that economic and other development policies should be based on the principles of sustainability, namely: *intergenerational equity*; *intragenerational equity*, the precautionary principle (risk aversion strategies) long term planning, systems thinking and the conservation of biodiversity.

It has been said that the Environmental Impact Assessment process or EIA⁴, has become the most important conceptual tool of Sustainable Development; this is because it explicitly links the environment with development. Importantly, it demands that the process of economic development takes into consideration the ecological perspective of socio-economic transformation⁵.

The need to integrate environmental sustainability issues into all levels of development planning is also reflected in a more integrated and holistic approach to solve pressing socio-economic issues such as poverty alleviation.

Because of the inherently holistic, and crosscutting nature of Sustainable Development, monitoring and policy implementation, require both inter and intra-governmental department cooperation. This is particularly necessary for monitoring & evaluation programs, and the economic rationalization of government interventions.

Monitoring and evaluation plays an important role in helping both government and public, understand and simplify large amounts of information extracted from an increasingly complex world. It is often overlooked, but the objective of monitoring sustainability indicators is not only for government to get feedback on how its policies may be effecting sustainability, but also for the electorate to evaluate the success or failure of government and its policies. This implies that the process of monitoring and evaluating plays a particularly important function in upholding the democratic right of the citizen's access to information on the performance of the government of the day.

This report provides an evaluation framework for issues important in measuring and implementing progress towards a sustainable society in the Pixley Ka Seme District Municipality area. Although many of the issues are generic, some are specific to Pixley Ka Seme District Municipal area. For each issue, one or more pressure, and one or more state indicators are identified. Justification, linkages with other indicators, and data availability, are also discussed under each issue.

Terms of Reference

This report addresses the task set out in section 4 of the Integrated Environmental Management Plan terms of reference: The establishment of a Sustainable Development monitoring system.

Specific requirements of the task include:

- Provide guidelines for the identification and prioritisation of environmental indicators e.g.
 - o Indicators should be

⁴ EIA is a process of examining the effects of potential development activities on the state and functioning of the natural and social environment. Forms an essential input into the process of Integrated Environmental Management.

⁵ Wilson, P et al (1995) Emerging Trends in National Environmental Legislation in Developing Countries Chapter 12, in UNEP (1995) UNEP's New Way Forward: Environmental Law and Sustainable Development, In UNEP/Environmental law Unit, Nairobi.

- Relevant to sustainability
- Reflect environmental conditions, pressures as well as environmental management practices that are adopted to deal with these issues.
- Be easy to interpret in order to indicate changes that have occurred over time
- Be understandable and accepted by the users and stakeholders
- Be comparative
- Use National Indicators as guideline.
- Consult province on progress on drafting Provincial Indicators. ~ Align indicators with Local Priorities.
- Set up monitoring guidelines and procedures
- Incorporate Indicators into user-friendly electronic Management Information System
- Required deliverables: A Sustainable Development monitoring system

Report layout

An executive summary provides a contextual overview and summary of the key findings of the study.

Chapter 1 provides a descriptive introduction to the principles and key elements of Sustainable Development. (Details on the use of indicators, selection criteria and methods of monitoring are not dealt with here and can be sourced elsewhere)

Chapter 2 deals with environmental sustainability; key issues are identified along with a set of pressure and state indicators for each issue. Chapter 3 deals with social sustainability, and Chapter 4 with economic sustainability. A similar layout and structure is used for each of the three sustainability dimensions, including issue justification, pressure indicators, and state indicators, linkages and data availability. The final Chapter, 5, discusses the aggregation of indicators into indices, and use in decision support for measuring of a sustainability index.

The appendices (A to H) provide supplementary and supportive information. A reference section provides details on information sources, further reading, and Internet resources.

Approach

Sustainability involves three conceptual dimensions: economic, social, and ecological.

An issue driven approach was adopted. This served to reduce some of the complexity, by focusing on key issues of sustainability. The Identification of relevant issues was based on Government policy (such as the RDP, Environmental Management Policy, Policy on the Conservation and Sustainable Use of South Africa's Biological Diversity) international conventions (Agenda 21, UNCH habitat agenda, and the Convention on Biodiversity). In addition, Issue identification was also based on contextual information specific to Pixley Ka Seme District Municipality (this included factors that may threaten the integrity, stability or resilience of social, economic and ecological systems in the region).

Indicators identification, where possible, is based on standard indicators used nationally and/or internationally. Prime sources include indicators used for national and regional State of

Environment Reporting, and indicators recommended by international organizations such UN Commission on Sustainable Development⁶.

Where possible, limits to acceptable change are suggested, however, for most indicators this will not be possible, as they simply do not exist (with the exception of air and water quality, where national or international standards exist). Knowledge of ecological (or other system) thresholds is very limited. These limits to change need to be dealt with as management objective targets, and in the spirit of adaptive management (with monitoring and research), limits to acceptable change can be refined over time, but until then, the precautionary principle needs to be applied. Decisions involving limits to acceptable change need to be made on a case-by-case basis, and where necessary, employing the use of environmental impact assessment and trade-off analysis.

The aggregation of sustainability indicators into performance indices is a currently receiving much attention worldwide. Various frameworks that allow for indicator aggregation into a Sustainable Development Index (SDI) are discussed in chapter five, including the barometer of sustainability and the dashboard of indicators approach.

Recommendations

- Implement the principles of Sustainable Development. This may require the improvement and restructuring of the decision-making process, so that consideration of socio-economic and environmental issues are fully integrated. This will also assure a broader range of public participation.
- Promote inter and intra departmental cooperation to monitor and collect data on recommended indicators of Sustainable Development.
- Present indicator information in an accessible and aggregated form for policy makers and public (use for example, the medium of a **State of Environment Report**).
- Integrate key performance Indicators⁷ with Sustainable development indicators.

Financial cost of monitoring

Budget requirement for monitoring of sustainability indicators for Pixley Ka Seme District Municipality are highly dependent on the degree of inter, and intra-governmental department cooperation. Many of the indicators used in this report are currently monitored by departments other than DACE, for example by Department of Water Affairs and Forestry, The Department of Land Affairs and Department of Housing. In addition, national surveys collect much of the social and economic data, while crime statistics are available on a regional basis. There is, however, a need to integrate these diverse monitoring efforts and centralise the data collection with in the Sustainable Development monitoring framework presented in this report.

Results: table of sustainability indicators

Table ii. Environmental, social and economic sustainability indicators for Pixley Ka Seme District Municipality.

(Headline indicators represent the priority indicator for each issue).

⁶ See publication: Report to the United Nations Commission on Sustainable Development. Draft Report. Nov, 1999. : Results from testing of CSD indicators of Sustainable Development in South Africa. Department of Environmental Affairs and Tourism

⁷ Berrisford S. 2000 . Key Performance Indicators KPIs: Law and Policy^{3rd} Draft 5 March 2000. for Northern Cape Government.

SUSTAINABILITY DIMENSION: ENVIRONMENT			
Sector/issues	Pressure indicators	State indicators	Headline indicator
SECTOR: SURFACE WATER			
Issue: decline in water quality due to pollution	• Volume of effluent discharged into rivers as a proportion of total flow • Pollution discharged into rivers	• DWAF Water quality Index	• DWAF Water quality Index
Issue: reduced river flows and water quantity	• Annual and monthly rainfall. • Stream inflow deviation from long term average	• Levels of important dams	• Stream inflow deviation from long term average.
SECTOR: GROUND WATER			
Issue: regulation of sustainable use of ground water supply	• Ground water abstraction rates • Numbers of boreholes per catchment or sub catchment	• Ground water reserves, measured as water depth levels of wells at selected monitoring sites. • Difference between abstraction rate and recharge rates per catchment	• Difference between abstraction rate and recharge rates per catchment
Issue: ground water quality may be unsuitable for human consumption in some areas	• Volume of effluent discharged into rivers as a proportion of total flow • Pollution indices from mining and industry • Pollution indices from agricultural chemicals •	• DWAF water quality index for ground water.	• DWAF water quality index for ground water.
SECTOR: AIR POLLUTION			
Issue: Winter air pollution, in particular around settlements	• % of households with Eskom electricity	• The number of days per annum the WHO standards are exceeded for SO₂, NO_x, CO, O₃, suspended particulate matter	• The number of days per annum the WHO standards are exceeded

SUSTAINABILITY DIMENSION: ENVIRONMENT			
Sector/issues	Pressure indicators	State indicators	Headline indicator
		(SPM) and lead (Pb). The average annual concentrations of SO₂, NO_x, CO, O₃, suspended particulate matter (SPM) and lead (Pb).	
SECTOR: RANGELANDS			
Issue: decline in agricultural productivity of rangelands	- Livestock and game stocking rates (measured in large stock units per hectare) - Livestock and game feeding classes ratios - Annual rainfall (expressed as percentage of regional long-term average) - Number of grazing camps per farm (livestock only) - Fire frequency (as indicated by burn scar mapping from satellite imagery)	Using remote sensing (satellite imagery): - Vegetation photosynthetic activity (using NDVI index derived from LANDSAT imagery) - Bare soil index (combining Northern Cape ENPAT with LANDSAT imagery) - Bush encroachment Index (using Normalized Difference Green index, and Mid-Infra red index),	Indices of rangeland condition
SECTOR: AGRO-ECOLOGICAL			
Issue: shifts in climatic patterns	International global climate change trends and predictions	Regional climatic indicators (presented as % deviation from long term average) for: - Temperature - Humidity - Rainfall - Occurrence of frost	International global climate change trends and predictions
Issue: non-sustainable agricultural practices	- Area of land under cultivation (commercial mono-crop) - Area of land under subsistence crops - Percentage area under organic farming methods	- Area of land left fallow (recent and old lands) - Agricultural crop productivity (in tons per ha) - Average livestock calving rates % Bare soil index	Agricultural crop productivity (in tons per ha)

SUSTAINABILITY DIMENSION: ENVIRONMENT			
Sector/issues	Pressure indicators	State indicators	Headline indicator
Issue: agricultural pollutants	• Use of fertilizers (tons per ha) • Use of pesticides (tons per ha) • Area of land under cultivation • Area of land under irrigation	• Bio-accumulation of agro-chemicals (measurements of organic pollutant levels in predatory birds) • Area under Genetically modified crops (and the application of bio-safety regulations). • Number of officially registered organic farmers	• Use of pesticides (tons per ha)
Issue: equitable access to agricultural resources	• Access to agricultural credit, (broken down according to race) • Access to agricultural education and technical support (broken down according to race)	• Number of successful land security of tenure settlements. • Percentage of land area in the following categories: white owned/ black owned/ title deed/ tribal trust. • Area of land under subsistence crop farming against area of land under commercial cropping.	• Area of land under subsistence crop farming against area of land under commercial cropping
Issue: threat of animal disease outbreaks	• Budget spent on veterinary services to the public in the area. • Animal husbandry training and awareness programs	• Number, type and location of reported infectious disease outbreaks in Pixley Ka Seme District Municipality area	• Number of reported infectious disease outbreaks
SECTOR: CONSERVATION OF BIODIVERSITY			
Issue: loss in biodiversity quantity and habitat fragmentation	• Rates of urban expansion and clearing of land for agricultural lands (remotely sensed data)	• % Area covered with natural vegetation, % area transformed (remotely sensed) • % Area under formal conservation protection	• % Area under formal conservation protection

SUSTAINABILITY DIMENSION: ENVIRONMENT			
Sector/issues	Pressure indicators	State indicators	Headline indicator
		Number of red data species and their population trends.	
Loss in biodiversity quality (ecosystem health)	Areas of land transformed	% Of area infested with alien vegetation - Indices of rangeland condition (% of area bush encroached, % bare ground) - Riparian health index	Riparian health index
Issue: non sustainable use of biodiversity resources	- Prices paid for resources (for example important medicinal plants such as the African potato) - Harvesting rates - Harvesting methods (whole plant or renewable part)	- Ecosystem health indices - Species diversity changes - Changes in indicator species associated with each resource - Budget spent on public expense on implementing resource management regulations & monitoring	Budget spent on public expense on implementing resource management regulations, research & monitoring

SD DIMENSION: SOCIAL			
Sector/issues	Pressure indicators	State indicators	Headline indicator
SECTOR: LAND AND HOUSING			
Issue: promote security of tenure	- Numbers of households with out security of tenure - Information on all known land claims, and land conflicts in the area	- Numbers of households with security of tenure - Number of successful security of tenure projects since project implementation	Number of successful security of tenure projects since project implementation
Issue promote the right to adequate housing	Proportion of informal to formal dwellings	Household or shelter types (% of each class, including informal shacks, formal house with one two, three or more rooms)	ratio informal to formal housing
Promotion of access to basic services	Government expenditure on improving basic services	- Access to water (piped in dwelling, piped on / near site, other) - Access to energy (electricity / other) - Sanitation (toilet type, refuse removal type)	% Dwellings with access to piped water & electricity
SECTOR: HUMAN HEALTH			
Issue: spread of infectious disease & poor nutrition	- Immunization against infectious childhood diseases (as % of population) - HIV awareness (expenditure, number of programmes) - Availability, use and attitude towards condoms - Nutritional status of children	- Infant mortality rate - Antenatal HIV infection rate - Average life expectancy - Reported incidents of infectious diseases outbreaks	Antenatal HIV infection rate
SECTOR: SOCIAL HEALTH			
Issue: eradication of poverty	Unemployment rate	Headcount index of poverty (% population living below poverty level, set as some	Headcount index of poverty

SD DIMENSION: SOCIAL			
Sector/issues	Pressure indicators	State indicators	Headline indicator
		minim basic income or standard of living) • Poverty gap index	
Issue: crime	• Unemployment rates • Police per 100 people	Crime statistics	• Key crime statistics
Issue: employment	• GDP per capita, national and regional • % Growth in tourism industry both nationally, and regionally (within the Pixley Ka Seme District Municipality area	• Gross employment levels (% employed, % unemployed, % not economically active) • % Living in Pixley Ka Seme District Municipality area, but employed outside of area.	• Gross employment levels
Issue: population dynamics	• Gross population growth rate for Pixley Ka Seme District Municipality • Rate of growth of urban population	• Population density, by age group and region. • % Population Urban, % population rural • % Urban population informally settled, % formally settled	• Gross population growth rate for Pixley Ka Seme District Municipality
Issue: education	• Government expenditure on education in target area. • Private sector expenditure on education in area. • Average distance to nearest school • Number of schools per 1000 people • Number of teachers per 100 pupils.	• Primary school enrolment rates per year • High school enrolment rates per year. • Adult literacy rates	• Adult literacy rates
Issue: gender equality	• Difference between male and female school enrolment ratios.	• Women per hundred men in the labour force	• Women per hundred men in the labour force
Issue: racial harmony	Establish perceptions of racial tensions in the	Number of reported racially motivated	• Number of reported

SD DIMENSION: SOCIAL			
Sector/issues	Pressure indicators	State indicators	Headline indicator
	area, are they improving or deteriorating?	incidents in schools, industry and on farms.	racially motivated incidents •
SECTOR: URBAN ENVIRONMENTAL MANAGEMENT			
Issue: reduce and manage urban pollution & waste	• Expenditure on waste management • Urban population densities • Generation of hazardous wastes (amount and area contaminated)	• Waste recycling and re-use (volume recycled as % of total, mechanisms in place: yes /no /effective/ not effective, per region) • Municipal waste disposal (yes/ no/ effective /not effective, per region) • Waste water treatment coverage	• Expenditure on waste management
Issue: disaster management	• Regional expenditure on disaster management. • Establishment of a disaster management committee (yes, no). • Number of dwellings/houses falling within the 100-year flood mark of rivers and dams	• Implementation of fire management plan (yes /no). • Reported incidents of toxic spills or poisonings on biota – e.g. fish kills, vulture deaths. • Number of deaths/serious injuries relating to disaster events.	• Number of deaths/serious injuries relating to disaster events.
Issue: Implementation of environmental impact assessment regulations and ISO compliance	• Expenditure on EIA's as percentage of total development costs. • Number of people committed by local government to environmental management. • Average % of regional GDP spent on environmental management.	• Number of applications for land use change and the %'s of EIA scopings, % exemptions, % full EIA's. • Percentage of industries, mines, factories that are ISO compliant.	• Number of applications for land use change and the %'s of EIA scopings, % exemptions, % full EIA's.
SECTOR: GOVERNANCE			
Issue: opportunity for participation and redress		• Voter turn out rates	• Voter turn out rates

SD DIMENSION: SOCIAL			
Sector/issues	Pressure indicators	State indicators	Headline indicator
Issue: fiscal accountability		Fiscal accountability index.	Fiscal accountability index.
SECTOR: QUALITY OF LIFE			
Issue: satisfaction with living in Pixley Ka Seme District Municipality		Perceived quality of life index	Perceived quality of life index

SD DIMENSION: ECONOMIC			
Sector/issues	Pressure indicators	State indicators	Headline indicator
SECTOR: AGRICULTURE			
Issue: optimize the socio-economic benefits derived from agriculture		- GDP derived from agricultural sector - Number of jobs provided by agricultural sector	Number of jobs provided by agricultural sector
Issue: minimize agricultural ecological costs		- Total area of land transformed by agriculture. - Estimated rate of land transformation due to agriculture. (ha/5 years) - Green house gas emissions from agricultural sector. - Estimated total pollution emissions derived from agricultural sector, including all agro-chemical	Estimated rate of land transformation due to agriculture. (ha/5 years)
SECTOR: INDUSTRY AND MINING			
Issue: optimize the socio-economic benefit derived from industry & mining		- GDP derived from industry & mining in Pixley Ka Seme District Municipality - Number of jobs within the industry & mining sector	Number of jobs within the industry & mining sector
Issue minimize the ecological impact from industry & mining		- Total area of land transformed by industry & mining within Pixley Ka Seme District Municipality - Estimated rate of land transformation	Estimated total pollution emissions.

SD DIMENSION: ECONOMIC			
Sector/issues	Pressure indicators	State indicators	Headline indicator
		due to industry & mining (ha /5 years). • Green house gas emissions from industry & mining within Pixley Ka Seme District Municipality. • Estimated total pollution emissions.	
SECTOR: TOURISM			
Issue: optimize the socio-economic benefit derived from tourism		• GDP derived from tourism in Pixley Ka Seme District Municipality • Number of jobs created by tourism sector	• Number of jobs created by tourism sector
Issue: minimize ecological impacts of tourism		• Total area of land transformed by tourism sector • Estimated rate of land transformation due to tourism sector (ha /5 years). • Estimated total pollution emissions, from tourism sector	• Estimated total pollution emissions, from tourism sector
Issue: monitor supply and demand within the tourism industry	• Political stability index (possibly use the fluctuations in SA Rand as a surrogate indicator) • Crime rates (actual and perceived) • Growth in South African tourism industry	• Percentages of international tourist, tourist from Northern Cape, tourist from outside Northern Cape • Perceived market share and competition. • Potential market advantages of Pixley Ka Seme District Municipality as a tourist destination. • Tourism marketing strategies for Pixley Ka Seme District Municipality, successes & failures.	• % Growth per year in tourism industry within Pixley Ka Seme District Municipality

SD DIMENSION: ECONOMIC			
Sector/issues	Pressure indicators	State indicators	Headline indicator
		• Occupancy rates (%) • Number of tourist bed night per year.	
Issue: Health of tourism industry (HOT index)	• Economic health conducive to tourism • Environmental health • Cultural impact • Local authorities attitudes • Visitor satisfaction	• HOT index	• Visitor satisfaction
SECTOR: CAPITAL INFLOW, OUTFLOW FROM PIXLEY KA SEME DISTRICT MUNICIPALITY			
Issue: track capital flows into and out of Pixley Ka Seme District Municipality		• % Of people employed outside Pixley Ka Seme District Municipality, but living inside area. • Estimated % of monthly income spent within Pixley Ka Seme District Municipality area. • Percentage of small and micro enterprises within Pixley Ka Seme District Municipality owned by people living outside of the area.	• Estimated % of monthly income spent within Pixley Ka Seme District Municipality area

- 4 -

INSTITUTIONAL AND LEGAL FRAMEWORK

INSTITUTIONAL AND LEGAL FRAMEWORK

In this section all legislation relevant to the environment has been listed and summarised. In the opportunities table for each municipality, the applicable legislation for each development category is indicated in the table next to each category. For further information pertaining the relevant legislation this section should be consulted. It is only a summary that will enable the user of this program to relate a development proposal to the applicable legislation. It is however important that a legal advisor be consulted if complicated issues arise which involves more than one act. It is also important to realise that legislation changes rapidly and that this section will be outdated quite soon.

This section also includes the result of an authority audit. The purpose and result of the audit was to indicate which department is responsible and accountable to apply certain legislation. For example, Department of Mineral and Energy (DME) is responsible to implement and police the Mineral and Petroleum Resources Development Act, no 28 of 2003. The user of the IEMP will be able to determine what legislation is applicable to a development category and who is the responsible department.

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA NO 108 OF 1998	Section 24: Everyone has the right to an environment that is not harmful to their health or well-being and to protect it for the benefit of present and future generations. Must take measures to prevent pollution and ecological degradation and promote conservation while promoting justifiable economic and social development
NATIONAL ENVIRONMENTAL MANAGEMENT ACT NO 107 OF 1998	Section 2: The principles set out in this section apply throughout the Republic to the actions of all organs of state that may significantly affect the environment. Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. Section 28: Duty of care and remediation of environmental damage Section 30: Control of emergency incidents Section 31: Access to environmental information and protection of whistle-blowers Regulations have been published in April 2006 that replaces the listed activities for EIA's as listed in ECA - these new regulations have impact on all kinds of infrastructure and other development.
BIODIVERSITY ACT	Act responsible to assist in management, conservation of biological diversity as well as ensuing sustainable use and equitable sharing of benefits derived. Section 40 allows MEC to establish a bioregional plan for a given area to align conservation strategies. Section 43 allows anybody who wishes to protect and indigenous species or ecosystem to set up a Biodiversity management plan. Although plans must be approved by the Minister. Section 52 allows MEC to publish provincial list of threatened ecosystems, local development plans should then take these into consideration.

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
	Minister can publish a threatened species list. Activities involving these species can then not be carried till a permit is obtained as per Section 57. Similar ruling applies for alien species as per Section 69. Chapter 6 deals with bio-prospecting, where a permit is required to undertake such an activity.
ENVIRONMENT CONSERVATION ACT NO 73 OF 1989	This Act deals with the effective protection of the environment and more specifically waste management (section 20), discarding of waste (section 20(6) and the prohibition of littering (section 19(1)). GN 1986 (GG 12703 of 24 August 1990): Identification of matter as waste GN 51 (GG 15428 of 24 January 1994) - General environmental policy which should be applied with any anticipated new activities GN R 1182, GN R 1183 and GN R 1184 (all promulgated ito GG 18261 of 5 September 1997), stipulate EIA's to be done in terms of certain activities identified under section 21(1). GN R 1196 (GG 15832 of 8 July 1998): Application for disposal site procedure GN R 154 (GG 13717 of 10 January 1992): Noise control regulations in terms of section 25 R.625 of 9 May 2003: Regulations regarding plastic carrier bags and plastic flat bags Section 31A: Powers of Minister, competent authority, local authority or government institution where environment is damaged, endangered or detrimentally affected. Proc R 29 (GG 16346 of 7 April 1995): Assignment of this act to the Provinces.

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
ATMOSPHERIC POLLUTION PREVENTION ACT NO 45 OF 1965 (Soon to be replaced by the current Air Quality Bill)	To provide for the prevention of the pollution of the atmosphere. It deals with the control of noxious or offensive gases (Part II) and the application of registration certificates where scheduled processes are carried on (section 9). Part III deals with atmospheric pollution by smoke and includes the installation of fuel burning appliances and smoke control regulations. Part IV: Dust control GN R 1387 (GG 22941 of 21 December 2001): Revised guidelines for sulphur dioxide Part V: Air pollution by fumes emitted by vehicles GN R 1651 (GG 4393 of 20 September 1974): Emission by diesel driven vehicles
CONSERVATION OF AGRICULTURAL RESOURCES ACT NO 43 OF 1983	This act provides for the control over utilization of natural agricultural resources, to promote the conservation of soil, water resources and vegetation and the combating of weeds and invader plants. Section 2 : Except for the provisions relating to invader plants and weeds, this Act shall not apply to any land situated in an urban area or to any area declared to be a mountain catchment area under the Mountain Catchment Area Act, 1970. GN R 1048 (GG 9238 of 25 May 1984): Regulations dealing with weeds and invader plants.
ADVERTISING ON ROADS AND RIBBON DEVELOPMENT ACT NO 21 OF 1940	The purpose of this act is to regulate the display of advertisements outside certain urban areas at places visible from public roads and the depositing or leaving disused machinery or refuse near certain public roads.
EXPLOSIVES ACT NO 26 OF 1956	The purpose of this act is to consolidate the laws relating to the manufacture, storage,

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
	sale transport, importation, exportation and the use of explosives. GN R 1604 (GG 3648 of 8 September 1972): Spillage of explosives, disposal of explosive waste.
FENCING ACT NO 31 OF 1963	The purpose of this act is to consolidate the laws relating to fences and the fencing of farms and other holdings and matters incidental thereto. Section 10: Repair of boundary fences
FERTILIZERS, FARM FEEDS, AGRICULTURAL REMEDIES AND STOCK REMEDIES ACT NO 36 OF 1947	The purpose of this act is to provide for the appointment of a registrar of fertilizers, farm feeds, agricultural remedies and stock remedies; for the registration of fertilizers, farm feeds, agricultural remedies, stock remedies, sterilizing plants and pest control operators; to regulate or prohibit the importation, sale, acquisition, disposal or use of fertilizers, farm feeds, agricultural remedies and stock remedies. Section 3 and 7(2)(a)(ii): Registration of fertilizers, farm feeds, agricultural remedies, stock remedies, sterilizing plants and pest control operators. Section 7: Sale of fertilizers, farm feeds, agricultural remedies and stock remedies.
FIRE BRIGADE SERVICES ACT NO 99 OF 1987	This act provides for the establishment, maintenance, employment, co-ordination and standardization of fire brigade services.
FOREST ACT NO 122 OF 1984	Most of the provisions of this act have been repealed by the National Forests Act, but the regulations relating to timber and protected trees remain. GN 1339 (GG 5242 of 6 August 1976): Protected trees
HAZARDOUS SUBSTANCES ACT NO 15 OF 1973	In general this act provides for the control of substances which may cause injury or ill-health to or death of human beings; it divides such substances or products into groups

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
	in relation to the degree of danger. It also prohibits the dumping or disposal of such substances and products.
HEALTH ACT NO 63 OF 1977	In general this act provides for measures to promote the health of inhabitants of the Republic and the rendering of health services. It also deals with nuisance which means anything which is offensive, injurious or dangerous to health and would include any stream, pool, marsh, urinal, drain, the accumulation of refuse, any industrial premises not kept in a cleanly state and free from offensive smells (section 1).
AGRICULTURAL PESTS ACT NO 36 OF 1983	To provide for measures by which agricultural pests may be prevented and combated; and for matters connected therewith.
MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT NO 28 OF 2003 (In force since 1 May 2004)	This Act makes provision for equitable access to and sustainable development of the nation's mineral and petroleum resources. This act together with the Mine Health and Safety act no 29 of 1996 and the regulations promulgated in terms of the Mines and Works act no 27 of 1956 apply only to mining areas.
NATIONAL BUILDING REGULATIONS AND BUILDING STANDARDS ACT NO 103 OF 1977	To provide for the promotion of uniformity in law relating to the erection of buildings in the areas of jurisdiction of local authorities and for the prescribing of building standards Any building, excluding a dwelling house, in which refuse is or will be generated shall be provided with an adequate storage area for refuse containers (Regulation U1) The location of any area contemplated in regulation u1 shall be such that access thereto from any street for the purposes of removing any refuse is to the satisfaction of the local authority (Regulation U2).

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
NATIONAL FORESTS ACT NO 84 OF 1998	To reform the law on forests and in general to promote the sustainable management and development of forests for the benefit of all. It also includes measures for the protection of trees and emergency procedures therefore.
NATIONAL HERITAGE RESOURCES ACT NO 25 of 1999	In general this act provides for an integrated and interactive system for the management of the national heritage resources and to empower civil society to nurture and conserve their heritage resources for future generations. It includes burial sites and graves and archeological sites, national monuments, etc.
NATIONAL ROAD TRAFFIC ACT NO 93 OF 1996	Deals with road traffic matters, but as far as environmental matters are concerned, it deals with the transportation of certain dangerous goods. Regulations have been issued to this effect (GN R 225 (GG 20963 of 17 March 2000).
NATIONAL VELD AND FIRE FOREST ACT NO 101 OF 1998	Section 1 : The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic and in this regard the Act provides for a variety of institutions, methods and practices for achieving the purpose. This includes the formation of fire protection associations (section3) and the duty to prepare and maintain fire breaks (section 12).
GAME THEFT ACT NO 105 OF 1991	To regulate the ownership of game in certain instances; to combat the theft and wrongful and unlawful hunting, catching and taking into possession of game; and to provide for matters connected therewith.
NATIONAL WATER ACT NO 36 OF 1998	The purpose of this act is to protect water resources and the allocation of water. It deals with the protection of water resources (Chapter 3) and the prevention and the remedying of the effects of pollution (section 19) and the control of emergency incidents (section 20). Regulations have been promulgated on the use of water for mining and related activities aimed at the protection of water resources and includes the separation of clean and dirty

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
	water systems.
WATER SERVICES ACT NO 108 OF 1997	The general purpose of this act is the provision for access to basic water supply and sanitation frameworks for water service institutions and water service providers and the monitoring of water service providers. It includes industrial use of water and the discharge of industrial effluent (section 7).
WATER ACT NO 54 OF 1956	This Act has been repealed but the regulations promulgated in terms thereof still remain in force. These include: GN R 2834 (GG 10048 of 27 December 1985): Regulations for the erection, enlargement, operation and registration of water care works GN R 991 (GG 9225 of 18 May 1984): Requirements for the purification of waste water or effluent GN R 3208 of 29 August 1969: Regional standards for industrial effluent GN R 1560 (GG 10366 of 25 July 1986): Dams with a safety risk
NUCLEAR ENERGY ACT NO 46 OF 1999	To regulate aspects of nuclear fuel and related matters.
OCCUPATIONAL HEALTH AND SAFETY ACT NO 85 OF 1993	In general this act provides for the health and safety of persons at work. However, many regulations have been promulgated in terms of this act which are of an environmental nature. GN R 1179 (GG16596 of 25 August 1995): Hazardous chemical substances GN R 155 (GG 23108 of 10 February 2002): Asbestos regulations GN R 236 (GG 23175 of 28 February 2002): Lead regulations

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
PHYSICAL PLANNING ACT NO 125 OF 1991	Relates to zoning, spatial and guide plans.
LOCAL GOVERNMENT TRANSITION ACT NO 209 OF 1993	Deals with Integrated Development Plans.
DEVELOPMENT FACILITATION ACT NO 67 OF 1995	Policy framework for land development, the so-called Local Development Objectives.
PROMOTION OF ACCESS TO INFORMATION ACT NO 2 OF 2000	This act gives effect to the constitutional right of access to any information held by the state and any information that is held by another person and that is required for the exercise or protection of any rights as provided for in section 32 of the Constitution. Any person whose environmental rights (as per section 24 of the Constitution) have been infringed, may request relevant information held by the state or private bodies.
PROMOTION OF ADMINISTRATIVE JUSTICE ACT NO 3 OF 2000	This act gives effect to the right to administrative action that is lawful, reasonable and procedurally fair and to the right to written reasons for administrative action as contemplated in section 33 of the Constitution.
PROTECTED DISCLOSURES ACT NO 26 OF 2000	This act makes provision for procedures in terms of which employees may disclose information regarding unlawful or irregular conduct by their employers or other employees and it provides for the protection of employees who make a disclosure which is protected in terms of this act.
THE SOUTH AFRICAN NATIONAL ROADS AGENCY LIMITED AND NATIONAL ROADS ACT NO 7 OF 1998	This act provides for a national roads agency for the Republic to manage and control the Republic's national roads system and take charge of matters like development and maintenance within the framework of government policy. It also prohibits any person from depositing or leaving a disused vehicle or machine or a disused part of a vehicle or machine, or any rubbish or other refuse on a national road (section 51).
NORTHERN CAPE PLANNING AND DEVELOPMENT ACT NO 7 OF 1998	This will be applicable to any planning and land development related activities and serves to guide the administration of any spatial plans, policies, etc.

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
CAPE NATURE AND ENVIRONMENTAL CONSERVATION ORDINANCE NO 19 OF 1974	To consolidate and amend the laws relating to nature and environmental conservation. It includes provisions relating to the hunting or possession of endangered wild animals, the hunting of protected wild animals. It regulates the prohibition of killing or capturing of protected wild animals in excess of daily bag limit, the prohibition of the manipulation of boundary fences, laying of poison, possession of endangered flora and the picking of certain flora.
PN 955 OF 29 AUGUST 1975	These regulation were issued ito the aforesaid Ordinance and apply to, <i>inter alia</i>: • Wild animals • Fish in inland waters • Professional hunters, etc
PROC 1 OF 23 JANUARY 2002	This regulation was issued ito the same ordinance above. In this regulation the MEC determines that in the areas listed in Schedule 1 and in respect of the species of protected wild animals mentioned in the first and second columns, respectively, of Schedule 2, the hunting seasons and the daily bag limits as set out in the third and fourth columns, respectively, of the said Schedule 2.
CAPE ROADS ORDINANCE NO 19 OF 1976	The general purpose of this ordinance is to consolidate and amend the law relating to public roads and public paths. Any person who damages, destroys or defaces any public road or public path or places any obstruction or obstacle on, in over or under a public road, etc. will be guilty of an offence and upon conviction liable to a fine.
AN 575 OF 29 SEPTEMBER 1950	These are standard drainage regulations which were issued in terms of section 201 of Ordinance 10 of 1912 and they mainly deal with drainage systems, alterations thereto,

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
	the local authority's approval, inspection, maintenance, etc
CAPE LAND USE PLANNING ORDINANCE NO 15 OF 1985	This ordinance will be applied if there is any change in land use. It stipulates that structure plans be prepared.
PN 1050 OF 5 DECEMBER 1988	This piece of legislation was promulgated in terms of the Land Use Ordinance No 15 of 1985 and sets out the administrative procedure regarding departure, zoning and subdivision.
PN 527 OF 25 JULY 1952	Cape standard sanitary regulation promulgated in terms of Ordinance no 19 of 1951. It deals with septic tanks, closets and urinals and domestic refuse.
PN 504 OF 19 JUNE 1953	Cape Local Authorities Standard Water regulations
PN 416 OF 14 MAY 1954	Regulations relating to inflammable liquids and substances.
PN 504 of 12 AUGUST 1983	Drainage by-law
OTHER DOCUMENTS OF IMPORTANCE	Minimum requirements for classification, handling and disposal of hazardous waste, second edition, 1998 (issued by DWAF) Vienna Convention for the protection of the ozone layer Convention on Biological Diversity King report on corporate governance for South Africa, 2002 Montreal Protocol on Substances that deplete the ozone layer, 1987 Northern Cape Environmental Implementation Plan (GN 40 of 2003) World Heritage Convention Act no 49 OF 1999 (provides for the incorporation of the World Heritage Convention into South African law; the enforcement and implementation

RELEVANT LEGISLATION	OBJECTIVES / PRINCIPLES
	of the World Heritage Convention in South Africa; the recognition and establishment of World Heritage Sites, etc)

**LEGAL OBLIGATIONS AS PER
DTEC**

International Obligations - Protocol & Conventions	
1	Lusaka Agreement on Co-operative Operations Directed at Illegal Trade in Wild Fauna & Flora (1974)
2	Convention on International Trade in Endangered Species of Fauna and Flora – CITES (1975)
3	Convention on Wetlands of International Importance (RAMSAR) (1975)
4	Convention on the Conservation of Migratory Species of Wild Animals (Bonn) (1991)
5	Convention on Biological Diversity (CBD) (1995)

National Obligations - Biodiversity Legislation	
1	National Environmental Management Act 107 of 1998 (NEMA)
2	National Environmental Management Biodiversity Act 10 of 2004 (NEMBA)
3	National Environmental Management Protected Areas Act 57 of 2003 (NEMPA)
4	National Environmental Management Protected Areas Amendment Act 31 of 2004 (NEMPAA)
5	Environment Conservation Act 73 of 1989 (ECA)
6	Game Theft Act 105 of 1991 (GTA)

National Obligations - Policies / Procedures & Guidelines	
6	National Policy and Strategy for Problem Animal Control in South Africa
7	Red billed kwela
8	Cycad Policy
9	Locust control in South Africa
10	Opportunity Species
11	Ban on the importation of primates
12	Hunting of Leopard
13	Exotic parrots
14	Breeding in captivity of domesticated Guinea-fowl
15	Exotic Birds species
16	Exotic Fish species
17	National Policy and Strategy for Problem Animal Control in South Africa

Provincial Ordinances	
1	Nature and Environmental Conservation Ordinance 17 of 1974
2	Nature and Environmental Conservation Regulations - Provincial Notice PN 955 / 1975
3	Problem Animal Control Ordinance 26 of 1957

Provincial Policies / Procedures & Guidelines	
18	A Freshwater Gill Net Fisheries Policy for the Northern Cape
19	Large Predator Policy
20	Keeping Blue Cranes in Captivity
21	Hunting of leopard Policy
22	Afrika Olifant – Merk van Ivoor
23	Inspection Services Policy
24	Guidelines for Bird Ringing Permits
25	Guidelines for Zoological Research Permits
26	Guidelines for Flora Research Permits
27	Falconry Policy
28	Birds of Prey Policy
29	Law Administration Policy
30	Policy on the trade and captivity of avifauna
31	Professional Hunting Policy
32	Wildlife Facilities Policy
33	Hippo policy

Provincial Policies / Procedures & Guidelines	
34	Adequate Enclosure Policy
35	Conservancy Policy
36	Hunt of Opportunity Species
37	Primate Policy
38	Policy for the establishment of Private Nature Reserves
39	Reptile Policy
40	Small Carnivore Policy
41	Translocation of game Policy
42	Transportation of game policy
43	Game exchange scheme policy
44	Policy on wildlife pet trade

- 5 -

**LOCAL MUNICIPALITY
ISSUES, STRATEGIES AND
OPPORTUNITIES**

EMTHANJENI

ENVIRONMENTAL SUMMARY - EMTHANJENI MUNICIPALITY

1. PRIORITY ENVIRONMENTAL ISSUES & STRATEGIES

Specific Environmental Issues	Environmental Consequences	Strategies and legislation to address Issues for the Municipality
WATER: No water purification is done in De Aar, Britstown & Hanover (all fed from groundwater). The water quality from Boreholes in Emthanjeni is hard and presents problems for bathing, washing and electrical appliances [p 10 chapter 1]. STORM WATER: The east of De Aar, Hanover and Britstown do not have any stormwater drainage. Low-lying areas in these towns have also experienced flooding in the past. SEWAGE: Sewerage purification works – de Aar: The sewage effluent is currently within the prescribed limits of the permit. The permit also demands that the treated water be used for irrigation, which is not currently being done. Pollution risk for Paardevlei. POLLUTION: 1. In Britstown, Hanover and smaller villages, the boreholes for bulk water if often close to the sewage purification works, causing Pollution risk. 2. Brickmaking Kilns in Hanover area cause air pollution and are potentially not licensed or approved.	Human health & dental care (teeth go bad from such water) Erosion takes place. Human safety come under threat. Groundwater quality is negatively affected. 1. Groundwater becomes contaminated – unfit for human use. Air pollution. Habitat transformation (quarries) Erosion of open soil areas.	Purification Plant must be erected Storm water management plan – see projects below. DWAF must monitor. Urban Greening must be fed from treated water. 1. Proper Management of the sewage treatment works to prevent spillage (DWAF to monitor compliance). DME, DTEC must monitor compliance & enforce the law.

2. KEY PERFORMANCE (SUSTAINABILITY) INDICATORS FOR THE ENVIRONMENT

FROM IDP:

THE ENVIRONMENTAL PLAN OF EMTHANJENI MUNICIPALITY

OBJECTIVES

1. a cleaner, greener and more environmentally friendly Emthanjeni.
2. Emthanjeni pledges that it will be one of the leading Municipalities in environmental and development work.
3. Emthanjeni will give priority to the Local Agenda 21 work.
4. Emthanjeni will recognise local agenda 21 as a process that can add value to our Integrated Development Plan (IDP).
5. Emthanjeni will manage the environment of Emthanjeni according to national and international law and legislation.

YEAR 2010 VISION FOR THE ENVIRONMENT

Emthanjeni will be guided in its activities by the following vision for the environment in the Year 2010.

In seven years time

- Environmental issues will be dealt with in a structured and efficient way.
- The population of Emthanjeni Municipality will be environmentally educated, aware and conscious.
- Equitable environmental education (included Poortjie Nature School) will have ensured that people care for and respect their environment.
- Environmental poverty will no longer exist and no communities will live in an environment that is detrimental to their health or well being.
- Waste management will be efficient, and recycling efforts will be supported and sustained by the population.
- The livelihoods of the citizens will be sustainable and in harmony with the natural environment.
- Water and energy resources and utilisation will be optimally and efficiently managed.

3. IMPLEMENTATION OF ENVIRONMENTAL PLAN

The environmental Plan will be implemented at the highest level of local government in Emthanjeni (Town Council). The plan principles will give guidance and act as a framework for environmental governance.

- A commitment to adopting, using and applying appropriate environmental management tools as part of the overall environmental management strategy of local government.

- Environmental education programmes at all levels of local government.

4. STRATEGY AND ACTIVITIES

4.1 URBAN RENEWAL PROGRAMMES / PROJECTS

4.2 WASTE MANAGEMENT

- Develop waste management programmes that involve collection strategies, recycling, segregation etc.
- Develop landfill planning and management strategies – alternatives to incineration of medical waste.
- Education and public awareness.

4.3 WATER

- Implement catchment / river basin management strategy.
- Share lessons on water provision strategies and the management of groundwater resources.
- Implement appropriate water technologies in waste water treatment.

4.4 EDUCATION

- Identify opportunities for further environmental education / training and scholarships.
- Sharing educational and exchange programmes through co-operation with regional bodies. i.e. EEASA
- Increase public awareness about the need for environmental education.

4.5 AIR

- Recognising that the minimisation of air pollution is essential.

4.6 INFRASTRUCTURE

- Ensuring that the principles and approaches of sustainable development are applied in the planning and delivery of infrastructure.

4.7 ENVIRONMENTAL HEALTH

- Recognition that poor living environments contribute to the increased risk of HIV/AIDS and TB.
- Excessive levels of noise pollution negatively affect the living environment.

ALSO REFER TO GENERIC SUSTAINABILITY INDICATORS TABLE

3. SPECIFIC OPPORTUNITIES

- The Smartt Syndicate Irrigation Scheme situated 25 kilometers west of Britstown, provides water to lucern and wheat farmers [p9 chapter 1].
- Recycling Centre in De Aar takes paper, plastic & glass. Informal recycling is taking place at De Aar landfill site. This can be built on and expanded.
- Tourism opportunity at the Smart Syndicate Dam & Ongers River.

TOURISM OPPORTUNITIES

Tourism	Crafts	Cultural	Nature reserve	Recreation Activities / 4 x 4	Birding	Lodges/ Game farming / Hunting	Heritage / Architecture	War	Other
Britstown	Artists Painters Crafters Woodworkers	Masiphak amisane	Hiking Safari Maritzdam			Elandsfontein Barendsfontein Doornkuil Holdakkies Holplan Maritzdam hunting Lodge Omdraaivlei Rietspoort Guest and holiday farm Soutaar Twyfelhoek			Stargazing
De Aar	Arts and crafts Xhosa beadwork Steel furniture	Sam mooi House of Olive schreiner Arts and crafts beadwork	Safari			Nooitgedacht Guest Farm Potfontein Farm Holiday Wonderboom Guest Farm		Deelfontein Cemetery Memorial Cemetery in the garden of remembrance	
Hanover	Arts and Crafts Crafts tours	Olive Schreiner's house	Safari	Wortelfontein 4x4 route		Hunting and Safari Dwaalfontein Plooyfontein Wortelfontein		Dellfontein cemetery	

4. IDENTIFICATION OF IMPLEMENTABLE PROJECTS

FROM ISSUES

1. Alien Plant Removal Programme with Working for Water and Local Communities (See DWAF Website)

FROM INTEGRATED WASTE MANAGEMENT PLAN

1. Authorise existing Britstown & Hanover for operations (2010) (R500 000)
2. New communal Waste Transfer Station at Britstown township / Clear esiting damaged transfer station (2010) (R225 000)
3. Construction of guardhouse, ablution facilities & fencing at Phillipstown & Vanderkloof Landfill Sites up to 2010 (R225 000)
4. Audit Landfill Sites (twice yearly) (R50 000 per annum – add escalation)

FROM IDP

A **master plan for stormwater in De Aar** is urgently required so that the problem can be addressed systematically when funds are available. [chapter 2, p 31]

De Aar Landfill Site: A detailed report on the lifespan and proposed management of the refuse tip, has been prepared as part of the co-operation agreement between Emthanjeni and Karlstad, Sweden. Funding has been approved for the upgrading of the De Aar landfill and the project has already been started.

Recycling initiatives progress: “local recycles is busy with re-cycling at the tip site. Re-cycling articles are removed on a daily basis from the site and light material is the covered with soil. Appointed a contractor for the first phase, after funds have been received. Keep Emthanjeni Clean Committees have been established.” [chapter 2 p 20, waste management]

REFUSE

- Refuse containers for refuse removal with clear notices to prevent dumping (pay points) in Emthanjeni - Dumping points Malay Camp	RD1	Additional refuse containers at strategic points	Emthanjeni	Social Services / Infrastructure	Erection of notice boards Launching of a clean-up operation in the community Placement of additional refuse containers at strategic points Prevention of uncontrolled dumping	Continuous	Council	R 25 000
- Refuse containers at stopping places along roads in poor condition	RD2	Emptying of the refuse containers at stopping places along main roads Moving of grass along main roads	Emthanjeni	Social Services / Infrastructure	Discussions to be held with the District Municipality on emptying of these refuse containers and moving of grass along main roads To be followed up	2006/7	KDM	R100 000 Completed
- Recycling Station in Emthanjeni	RD3	Awareness campaign Establishment of recycling stations	Emthanjeni	Social Services	To build recycling stations and start the awareness campaign.	2004/5	Council	R 200 000
POLLUTION								

- Moving of brickmaking kilns due to large volume of smoke caused by them in Hanover	P1	Moving of brickmaking kilns	Hanover	Infrastructure	Investigate suitable land for removal of brickmaking kilns to another site in Hanover Investigation to address suitable type of soil location in relation to community and possible future expansion Registration at Minerals and Energy Affairs. Rehabilitation of existing place.	Annually	Council (Job Creation)	R 50 000
- Levels of noise pollution to be lowered in Emthanjeni	P2	Limiting noise pollution in the residential areas	Emthanjeni	Social Services / Corporate Services / SAPS	Enforcement of by-laws already promulgated by the Council Discussions to be entered into with SAPS on enforcement of by-laws already approved	2005/6	None	None

- Water & Conservation Management plan & Demand management study	TP5	Water & conservation management plan	Emthanjeni	Submit application for study Phase 1 Tenders complete. Consultants appoint by Water Affairs	2005/6	DWAF	R 300 000 COMPLETED
- Flood hazard assessment	TP6	To have a flood hazard assessment	Emthanjeni	Applications for funds must be submitted to KDM		KDM	R 350 000
- Waste Management Plan	TP1 4	Waste Management Pilot Project	Pixley Ka Seme DM	To compile an integrated Waste Management Plan	2007/8	Pixley ka Seme DM	R 400 000-00

FROM DEAT SOCIAL RESPONSIBILITY PROJECT APPLICATIONS (from April 2008)

1. Development of the “De Aar Accommodation and Conference Facilities” (R5 million)

ALSO REFER TO OTHER SIMILAR GENERIC ISSUES, STRATEGIES AND OPPORTUNITIES TABLE

KAREEBERG

ENVIRONMENTAL SUMMARY - KAREEBERG MUNICIPALITY

1. PRIORITY ENVIRONMENTAL ISSUES & STRATEGIES

A – ISSUES IDENTIFIED FROM INTEGRATED DEVELOPMENT PLAN		
Specific Environmental Issues	Environmental Consequences	Strategies and legislation to address Issues for the Municipality
1. It is necessary to determine the 1:50 year flood line in Carnarvon and Vosburg. 2. Access between Bonteheuwel and the main town of Carnarvon is also restricted by the river.	Safety Risk Social Issue – Segregation	Determine Floodline Build Bridge over river – see project below The area between the colored and white towns has been earmarked for a housing project. this is the preferred area as it will support integration)
3. Based on the status quo report and the growth figures, about 30 hectares of land are needed to accommodate growth in the next 5 years. The golf course to the south west of the town, between the Williston and Loxton roads also restricts development in this direction (<i>page 102</i>)	If not identified and planned for has huge environmental impacts.	By making land available timeously and involving communities in the processes, the problems associated with squatting and informal land occupation can be eliminated
4. Impact of Carnarvon Town on the River Habitat & Quality.	River is being negatively affected for quality and	River Rehabilitation Programme is proposed.

5. Clay brick kilns close to Carnarvon cause smoke etc.	habitat.	
6. Vanwyksvlei Wetland is under pressure because of town	Human Health	Compliance by DTAC / DME.
7. Vosburg Sewage Works is overflowing	Loss of habitat / biodiversity	Conduct proper wetland delineation study
	Surface Groundwater Health	Funding to rectify and manage and plan for future.
Input from Intergrated Waste Management Plan for PKSDM (Kwezi V3):		
1. 3 Landifll sites – Vosburg, Carnarvon, Vanwyksvlei.	Unlicensed landfill sites	See Integrated Waste Plan for details.
2. Vosburg & Vanwyksvlei authorizations are in process.	have big environmental and	
3. Upgrades and operation improvements require for all three sites in terms of DWAF Minimum Standards.	health risks	
4. Sufficient equipment for refuse removal service		

2. KEY PERFORMANCE (SUSTAINABILITY) INDICATORS FOR THE ENVIRONMENT

FROM IDP (NONE)

ALSO REFER TO GENERIC SUSTAINABILITY INDICATORS TABLE

3. SPECIFIC OPPORTUNITIES

- **SKA/KAT Project** in the area can have job opportunities, positive tourism influx (as in Sutherland Area). SKA/KAT Team must be involved.
- Carnarvon River provides tourism opportunity

TOURISM OPPORTUNITIES

Tourism	Crafts	Cultural	Nature reserve	Recreation Activities / 4 x 4	Birding	Lodges/ Game farming / Hunting	Heritage / Architecture	War	Other
Caernarvon	Handmade Karoo crafts. Artists		Safaris	4x4 trails 4x2 drives.	Nature reserve	Tortoise reserve Safari lodge	Corbelled houses	Fort.	San engravings at Fourieshof
Van Wyksvlei	Verneukpan Van Wyksvlei - dam Jagersberg		Van Wyksvlei - dam Safari		Van Wyksvlei - dam			SA Anglo – boer war camp,	
Vosburg			Safari			Hunting and safari			

4. IDENTIFICATION OF IMPLEMENTABLE PROJECTS

FROM ISSUES

- The construction of an additional, shorter access link between Bonteheuwel and the main town In Carnarvon should be considered. This might have a positive impact on the social as well as economic development.
- It is necessary to determine the 1:50 year flood line in Carnarvon and Vosburg.
- Conduct wetland delineation and rehabilitation study for the Vanwyksvlei.
- Land Audit Plan is being done for new development.
- Identify Projects linked to MeerKAT Project.

FROM INTEGRATED WASTE MANAGEMENT PLAN

1. Construction of guardhouse, ablution facilities & fencing at landfill sites up to 2009 (R480 000)
2. Audit Landfill Sites (twice yearly) (R50 000 per annum – add escalation)

FROM DEAT SOCIAL RESPONSIBILITY PROJECT APPLICATIONS (from April 2008)

1. Development of the “Carnarvon Prinson Rehabilitation” (R25 million)

ALSO REFER TO GENERIC ISSUES, STRATEGIES AND OPPORTUNITIES TABLE

RENOSTERBERG

ENVIRONMENTAL SUMMARY - RENOSTERBERG MUNICIPALITY

1. PRIORITY ENVIRONMENTAL ISSUES AND STRATEGIES

A – ISSUES IDENTIFIED FROM INTEGRATED DEVELOPMENT PLAN		
Specific Environmental Issues	Environmental Consequences	Strategies and legislation to address Issues for the Municipality
1. It is necessary to determine 1:50 year flood line in Petrusville and Philipstown.	Human health / habitat reduction.	Determine floodlines
2. The golf course in Philipstown is hardly ever used and is not well maintained.	None	Golfcourse upgrading project.
3. Groundwater : No groundwater Management plan is in place where groundwater is abstracted for live in the towns of Petrusville and Philipstown.	Can deplete underground water resource.	Ground water modeling study to be done for each town.
4. Natural streams : The natural streams that runs through Petrusville and Philipstown are not protected sufficiently.	Housing developments extends in flood planes of the streams and poses a serious problem.	River Rehabilitation Project.
5. Based on the status quo report and growth figures about 12 -14 hectares of land are needed to accommodate growth in the next 5 years.(page 128)	Habitat loss if not planned.	Proper planning required – project launched long before pressure comes.
Input from Integrated Waste Management Plan for PKSDM (Kwezi V3): 3 Landfill sites – Phillipstown, Petrusville, Vanderkloof. - No authorizations in place. - Phillipstown and Vanderkloof Sites to be authorized and upgraded (fencing, guardhouse) - Petrusville site is close to residential houses – this site must be managed towards closure and a new site identified, authorized and approved. - Equipment is not sufficient to deliver an efficient refuse removal service. - No recycling	Serious groundwater, surface water and health risk	Launch approval process according to waste program recommendations.

2. KEY PERFORMANCE (SUSTAINABILITY) INDICATORS FOR THE ENVIRONMENT

FROM IDP

Sustainability indicators	
Strategy C Disaster management	Ensure that new development will not be constructed within 1:50 year flood line and in areas of unstable soil conditions. <i>(page 80)</i>
Strategy A Avoiding pollution	The current waste disposal system should be upgraded and the community should be educated to be environmentally conscious. <i>(page 84)</i>
Strategy B Protection of groundcovers	Management system for abstraction of water should be in place and the disposal of water in a manner that will pollute the groundwater must be avoided. <i>(page 84)</i>
Strategy C Spatial and infrastructure development must support the environment	Water sources, natural streams, fountains, etc. must be protected through sound planning by the zoning of such areas as "soft" open spaces <i>(page 84)</i>
Strategy D Environmentally Soft Project.	EIA/ Environmental impact Assessment must be conducted for all development projects <i>(page 84)</i>
Strategy E Protect Heritage sites	Heritage sites and places of interest must be identified and a plan must be developed to protect the sites/ places <i>(page 84)</i>
Strategy A Improvement, access and equity	To ensure that people will have sufficient number of toilets, sufficiently close to their dwelling to allow them rapid, safe and acceptable access at all times of the day and night and that integration with other services takes place <i>(page 85)</i>
Strategy B Licensing of sewage waste disposal sites	To license all municipal sewage waste sites with DWAF and to comply with sewage waste disposal legislation <i>(page 85)</i>
Strategy C Upgrading of sewage waste disposal sites	To rehabilitate and upgrading the sewage sites in the municipality to comply with appropriate standards from sewage waste disposal sites and to extend the capacity to handle the expected improved level of services in the municipality <i>(page 85)</i>
Strategy D Prepare sewage waste management and operation plans.	The objective with the sewage waste management plans is to improve the operations and management of sanitation services and sewage waste disposal sites in the municipality <i>(page 85)</i>
Strategy E Environmental and health education	Sanitation is more than toilets, health and hygiene must also receive a high priority in all communities <i>(page 85)</i>
	Develop a storm water management policy <i>(page 89)</i>

ALSO REFER TO GENERIC SUSTAINABILITY INDICATORS TABLE

3. SPECIFIC OPPORTUNITIES

- Development of Resorts / river rafting etc along Orange River
- Emerging farmers Initiative adjacent to Orange River.
- Tourism potential study for the Orange River in this area.

Tourism	Crafts	Cultural	Nature reserve	Recreation Activities / 4 x 4	Birding	Lodges/ Game farming / Hunting	Heritage / Architecture	War	Other
Philipstown			Safari			Rooipoort	Architecture		
Vanderkloof			Rolfontein Nature Reserve Watersports Safari		Rolfontein Nature Reserve	Rolfontein Nature Reserve Mynhard Herholdt hunting	Mud houses		Rolfontein Nature Reserve
Petrusville	DRC Museum	DRC Museum	Safari			Cypherfontein Dooringfontein Bosduiwepkop Jakkalskuil Leeufontein Orange Grove		Trenches	

4. IDENTIFICATION OF IMPLEMENTABLE PROJECTS

FROM ISSUES

Upgrade & restore Phillipstown Golf Course for Tourism purposes.

Ground water modeling study to be done for each town.

Tourism potential study for the Orange River to be done.

FROM INTEGRATED WASTE MANAGEMENT PLAN

1. Authorise existing Petrusville for closure and Phillipstown and Vanderkloof for operations (2010) (R750 000)
2. Construction of guardhouse, ablution facilities & fencing at Phillipstown & Vanderkloof Landfill Sites up to 2010 (R280 000)
3. Closure and rehabilitation of existing Petrusville Landfill Site (2010) (R360 000)
4. Identify, authorize & establish new landfill site for Petrusville (2010) R280 000
5. Audit Landfill Sites (twice yearly) (R50 000 per annum – add escalation)

FROM IDP

- Development of Day Visitor Facilities at Vandekloof (R980 000)
- Upgrading of Sports Stadium Petrusville (R3,1 million)
- Tar of Roads (Pterusville, Greenpoint, Uitsig, Thembinikosi (R740 000)
- Eradication of bucket sanitation system (R4,7 million)
- Upgrading of Sewage System (R3,1 million)
- Upgrading of Water Network (R7 million)
- Development of Landfill Site Petrusville (R217 000)

Other selected environmental needs from community:

Phillipstown:

- Development of small-scale farming / vegetable gardens
- Swimming Pool & Parks
- Clean-up project (litter)
- Public toilets

Petrusville:

- Pedestrian Bridge over Canal
- Parks for kids at Uitsig & Greenpoint

Vanderkloof:

- Upgrading of super-tube
- Upgrading of sports ground – Keurtjieskloof
- Relocation of landfill site
- Public toilets in CBD

FROM DEAT SOCIAL RESPONSIBILITY PROJECT APPLICATIONS (from April 2008)

1. Upgrading and maintaining of the Van Der Kloof Resort and Recreation Complex (R25 million)

ALSO REFER TO GENERIC ISSUES, STRATEGIES AND OPPORTUNITIES TABLE

SIYANCUMA

ENVIRONMENTAL SUMMARY - SIYANCUMA MUNICIPALITY

1. PRIORITY ENVIRONMENTAL ISSUES & STRATEGIES

A – ISSUES IDENTIFIED FROM INTERGRATED DEVELOPMENT PLAN (IDP)		
Specific Environmental Issues	Environmental Consequences	Strategies and legislation to address Issues
- o Weak conservation initiatives - o A need for sports and recreational facilities was identified. - o Illegal alluvial diamond mining is hard to monitor - o Impacts of intensive agriculture on the Orange River Ecosystem. Input from Integrated Waste Management Plan for PKSDM (Kwezi V3): 1. 3 Landfill sites – Douglas, Griekwastad & Campbell. 2. No authorizations in place. 3. Need identified in Schmidtsdrift for a new communal disposal site. 4. Equipment is not sufficient to deliver an efficient refuse removal service. 5. Illegal dumping. 6. No recycling.	Biodiversity targets Human quality of life Impacts on the riverine habitat. Salinity, transformation of river ecosystem. Surface and Groundwater Quality. Human health in close proximity. Littering lowers tourism potential	Identify and map game farms. Conservancies in private hands can make big difference. Compliance & Monitoring (DWAf DME) Compliance Monitoring of water Licenses (DWAf) Formalise, upgrade & monitor (See IWMP)

2. KEY PERFORMANCE (SUSTAINABILITY) INDICATORS FOR THE ENVIRONMENT

FROM IDP

(Table 3.1 page 55)

How Siyancuma will address sustainable development	
Strategic Drive	Environmental Sustainability
Promoting sustainable development economic growth and livelihoods	• Clean Environment programme • Development of IEMP • Clean Towns and Residential Areas and improved image
Community resilience	• Clean Environment programme • Environmental education of pollution, collection of waste, Sustainable Housing • Attractive living environment
Leading Municipality Service excellence and sustainability	• Protecting environmental resources
Civic Leadership and common purpose	• Citizen participation programme • All wards do own plans including environmental dev and economic projects

ALSO REFER TO GENERIC SUSTAINABILITY INDICATORS TABLE

3. SPECIFIC OPPORTUNITIES

- o Nature based tourism on Orange and Vaal Rivers (specifically the confluence of these two rivers because of the different colors of water at Douglas)
- o Rich minerals (Specifically Alluvial Diamonds & Salt)

Tourism	Crafts	Cultural	Nature reserve	Recreation Activities / 4 x 4	Birding	Lodges/ Game farming / Hunting	Heritage / Architecture	War	Other
Belmont									
Salt lake									
Plooyburg									
Douglas	Crafts		Safari Freshwater angling River rafting Die Neus Driekopeiland		Die neus Driekopeiland	Hunting Langplaas Olierivier Riandi Rooidam Sunset Lodge Wildspan			Die neus Driekopeiland
Buckland									
Griekwstad	Crafts Semi precious stone factory Andries waterboer's grave Marry Moffat Museum	Andries waterboer's grave Marry Moffat Museum				Wildebees Guest farming			Witsand nature reserve
Campbell	Eco – Historical Tours Barlett's church Site of 1878 Griqua rebellion	Bartlett's Church	Aloe Nature reserve Wildspan Eco – Historical Tours		Aloe Nature reserve			Fabersput battelfoeld monument Fort – on top of Koëlkop	Aloe Nature Resereve Fossil Sites

4. IDENTIFICATION OF IMPLEMENTABLE PROJECTS

FROM ISSUES

1. Tourist Resorts on Orange River – Douglas can also sustain such projects. (R250 000 each for planning phase)

FROM INTEGRATED WASTE MANAGEMENT PLAN

1. Authorise existing Douglas, Griekwastad and Campbell Landfill sites for operations (2009) (R750 000)
2. Construction of guardhouse, ablution facilities & fencing at Douglas, Griekwastad and Campbell Landfill Sites up to 2010 (R280 000)
3. Identify, authorize & establish new landfill site for Petrusville (2010) R950 000 (includes construction).
4. Audit Landfill Sites (twice yearly) (R50 000 per annum – add escalation)

FROM IDP

IDP DEVELOPMENT PROJECTS		
Project Number	Project Name	Estimated cost
ENV1.1	IEMP to determine state of the environment, priorities and projects	R250,000.00
ENV 1.2a	Increase frequency of waste collection	
ENV 1.2b	Community refuse collection	
ENV 1.2c	Provision of high volume waste lection	R1,6000.00
ENV 1..2d	Establish buy back centres	R350,000.00
ENV 1.2e	Introduce colour coded waste and collect separately	
ENV 1.3	Environmental education (rangers)	R250,000.00
ENV 1.4	Tree planting in townships	R250,000.00
ENV 1.5	Promotion of alternative energy	
ENV 1.6	Monitoring and enforcement of by laws	
ENV 1.7	Maintenance and upgrading of public ablution facilities	R90,000.00

Strategic Tourism Plan – indicating a tour route through the entire municipality – mapping all the tourist sites (R500 000)

FROM DEAT SOCIAL RESPONSIBILITY PROJECT APPLICATIONS (from April 2008)

1. Upgrading and maintenance of parks, open spaces and walk-ways within the Siyancuma Municipality – “Siyancuma Freedom Parks” (R2.5 million)
2. Development of the “Douglas Resort and Conference Centre” (R15 million)

ALSO REFER TO GENERIC ISSUES, STRATEGIES AND OPPORTUNITIES TABLE

SIYATHEMBA & DMA

ENVIRONMENTAL SUMMARY - SIYATHEMBA MUNICIPALITY

1. PRIORITY ENVIRONMENTAL ISSUES & STRATEGIES

A – ISSUES IDENTIFIED FROM INTEGRATED DEVELOPMENT PLAN		
Specific Environmental Issues	Environmental Consequences	Strategies and legislation to address Issues for the Municipality
1. <i>Unrehabilitated Asbestos Mines north-west of Prieska.</i> 2. <i>Lack of Tourism to Prieska (not on Main Route).</i> 3. Salinity of the Orange River 4. Incinerator not working Input from Integrated Waste Management Plan for PKSDM (Kwezi V3): 1. 3 Landfill sites – Niekerkshoop, Prieska, Marydale 2. No authorizations for Niekerkshoop & Marydale 3. Upgrades and operation improvements required for all sites in terms of DWAF Minimum Requirements. 4. Not sufficient equipment for effective refuse removal service 5. No recycling 6. Illegal Dumping	Human Health None River Ecosystem Human health Surface & Ground Water	Rehabilitate with DME & Land Owners Tourism Initiatives such as Die Bos DWAF Monitoring & Compliance Infrastructure Development See IWMP

Summary of District Municipal Area

This is a rural area with no urban areas within its boundaries. The main economical activities in this area are agricultural of nature. There is also mining activities in this area but on a much smaller scale than agricultural activities. The DMA consist of three separate sections with a estimated total surface of 47 308ha. Only one worth-mentioning river flows through this area, namely the Orange River. Smaller non-permanent rivers like the Brakriver also appears here, but it does not really influence the economic activities of the DMA. There are scarcely mountains in this area but many hills. Mountain-ranges that can be recalled is the Asbesmountain and the Doringmountain. The climate of this area is mainly semi-desert with excessive temperature. Rainfall is low and normally during summer. Apart from the Orange River the inhabitants mostly in the Marydale and Niekershoop areas are making use of underground water to provide for their own needs and these of their livestock.

2. KEY PERFORMANCE (SUSTAINABILITY) INDICATORS FOR THE ENVIRONMENT

FROM IDP

The vision of the Environmental Management Plan is as follows:

To manage the development of natural resources in such a way that there will be no negative influence on nature and the environment.

Mission

The mission of the Siyathemba Municipality focuses broadly on service delivery, utilisation of resources, economical development and job creation, a safe and healthy community as well as a friendly environment.

With the above-mentioned in mind the mission of the Environmental Management Plan are as follows:

- To deal with the disposal of waste in an acceptable way.
- To manage and rehabilitate the sites where disposal will take place, effectively.
- To control the exploitation of asbestos and other mining activities.
- To ensure the regulation of all land-uses in the MA
- To establish an effective monitoring- and record keeping programme.
- To secure and utilise the personnel of the Council the optimum
- To protect our on-surface water- and water supply; and
- To find a harmonious balance between economical development and -utilisation of the environment on the one side and the preservation and rehabilitation of the environment on the other side.

To promote sustainable environment in the region. The following environment programmes will be implemented in accordance with the framework of the IDP and relevant planning legislation:

- a. To return, strengthen or add to features, structures and design elements which enhance beauty, attractiveness and overall amenity in the environment of the region.
- b. Assist local municipalities in ensuring that relative proportions of physical development (e.g. buildings) are kept with desirable human scale.
- c. In all areas in towns, we shall also assist municipalities in encouraging high standards of cleanliness and ensure regular and efficient cleaning up and removal of refuse.
- d. Encourage in accordance with the MSA of 2000 and with all relevant enactments, on the creation, retention and proper maintenance of sites and structures of outstanding beauty and historic interest.
- e. In keeping with the need to preserve buildings and other features of historic significance as mentioned earlier in this report, the municipality together with local municipalities take all measures possible to ensure proper conservation and nurturing of any natural or man-made features/ structures within the district in terms of relevant legislation. In particular, we shall put into effect measures for conservation of building of architectural significance as laid down in the historic buildings regulation.

- f. Compile a register/ list of historic buildings/ sites which require to be conserved.

ALSO REFER TO GENERIC SUSTAINABILITY INDICATORS TABLE

3. SPECIFIC OPPORTUNITIES

- Die Bos Resort Upgrading.
- Orange River as Tourism Resource
- Fish Farming
- Nature Based Tourism Potential on Ridges and Orange River in DMA

TOURISM OPPORTUNITIES

Tourism	Crafts	Cultural	Nature reserve	Recreation Activities / 4 x 4	Birding	Lodges/ Game farming / Hunting	Heritage / Architecture	War	Other
Prieska	Tiger's eye fort Arts and Crafts Prieska Museum	Prieska Museum	Die bos Nature Reserve Hiking Trails Safari Ria Hysaman Aloe Garden Wonderdraai	Alongside the orange River at Die bos Nature Reserve	Die bos Nature Reserve Hiking trail Ria Hysaman Aloe Garden Wonderdraai	Die bos Nature Reserve Blaauwbosch Plaaswerf Herberg Preiskaspoort Hunting Farm Who can tell Ondraaivlei Nelspoortjie Karoo Guest House Wonderdraai Guest Farm.		Memorial Garden Fort on top of Prieska Koppie.	Ria Huisman Aloe Garden Die bos Nature reserve Wonderdraai land.
Niekerkshoop									
Marydale			Boegoeberg Dam Kokerboom forest		Boegoeberg Dam Kokerboom forest	Trans Boegoe Eco Resort			Quiver tree forest Rock Formations

4. IDENTIFICATION OF IMPLEMENTABLE PROJECTS

FROM INTEGRATED WASTE MANAGEMENT PLAN

1. Authorise existing Niekerkshoop and Marydale for operations (2009) (R500 000)
2. Construction of guardhouse, ablution facilities & fencing at Phillipstown & Vanderkloof Landfill Sites up to 2010 (R465 000)
3. Audit Landfill Sites (twice yearly) (R50 000 per annum – add escalation)
4. Start recycling initiatives

FROM IDP

1. Asbestos Rehabilitation

Background

The Prieska Area in Siyathemba Municipal Area was richly settled with Asbestos. It was good for the Economy but not for socio-economy. As a result of the former mining of asbestos there is the * of rehabilitating the asbestos areas.

LOGISTICAL FRAMEWORK

Priority	Objectives Verifiable Indicators	Means of Verification	Risks and Assumptions
Goal The rehabilitate the asbestos area for health reasons	To secure a safer environment for the people	Ground still a health threat	-Workers might get sick -Might distributed asbestos into the air/atmosphere Health hazards
Output A safer environment for Siyathemba Municipal community			
Activity The depositing of special sand over the	Responsibility Municipality Dept. of Health	Time Frames	Cost

infused ground	Contractor Consultant		
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2. Upgrading and Greening of Public Spaces. [chapter 4, p 83]

Background

The Siyathemba Municipality is a very big Area. Most of the area is dusty and dry. Upgrading and greening of this spaces will only refresh the outlook of the area.

LOGICAL FRAMEWORK

Priority	Objectives Verifiable Indicators	Means of Verification	Risks and Assumptions
Goal Upgrading and greening of public spaces	To attract tourists that passes by the area	Tourism development	Disturbing nature.
Outputs A more beautiful and refreshed Outlook over the area. Create jobs for the unemployed			
Activity Planting of grass and trees etc.	Responsibility Municipality Dept of Environmental Affairs and Tourism Consultants Contractors	Time Frame	Cost

3. Upgrading of Museum.

Infrastructure improvement (with implies environmental impact) [Chapter 4, p 1 and p 30-40))

- Sanitation - Changed from VIP to full borne systems

- Build Pipeline from Orange River to Niekerkshoop
- Build Pipeline from Orange River to Marydale
- Upgrading of Sewerage Infrastructure
- Upgrading of Landfill in Marydale to DWARF standards

Socio-economi improvement with environmental implication

- Community food garden

Background

Poverty and unemployment brings a problem of food security which causes hunger to many households.

Logical Framework

Priority To address poverty and hunger through food garden	Objectives Verifiable Indicators Assist community to right hunger and poverty	Means of Verification	Risks and Assumptions
Goals To establish sustainable food gardens			
Outputs			
Activity 1. Identify land 2. Identify beneficiaries	Responsibility Municipality Department of Agriculture Social Development Health	Time Frame	Cost

- **Improvement of waste management in the Siyathemba Municipality**

BACKGROUND

The people of Siyathemba are currently in a culture to dump their waste in the streets and open areas.

LOGICAL FRAMEWORK

PRIORITY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	RISKS & ASSUMPTIONS
<u>Goal</u> To create a culture to recycle and reduce informal dumping	To reduce informal dumping		That people shall learn to recycle and stop dumping
<u>Activity</u> To held workshops with people in towns to explain to them to recycle and not dump waste in streets.	<u>Responsibility</u> Local Authority DWAF Karoo District Municipality	<u>Time Frame</u> 2007/08	<u>Cost</u> R1 021 500-00

Economic development

- Identify land suitable for Agriculture development
- Fish farming
- Tiger eye mining

ALSO REFER TO GENERIC ISSUES, STRATEGIES AND OPPORTUNITIES TABLE

UBUNTU

ENVIRONMENTAL SUMMARY - UBUNTU MUNICIPALITY

1. PRIORITY ENVIRONMENTAL ISSUES & STRATEGIES

A – ISSUES IDENTIFIED FROM INTERGRATED DEVELOPMENT PLAN		
Specific Environmental Issues	Environmental Consequences	Strategies and legislation to address Issues for the Municipality
1. Water in Richmond is brack and cannot be consumed by tourists (<i>IDP</i>) 2. Based on the status quo report and growth figures about 12 -14 hectares of land are needed to accommodate growth in the next 5 years.(page 128) 3. A housing backlog of 905 houses exists (<i>IDP review, p 42</i>). This translates to 33 ha of transformed land. 4. Borrow-pit and quarries along the national routes have not been rehabilitated 5. Agro-industry – limited initiatives 6. The riverine rabbit and its habitat is endangered and falls mainly within this municipality. Loss of riverine habitat because of dams 7. Most of the municipality hosts habitat for endemic plant and animal species Input from Intergrated Waste Management Plan for PKSDM (Kwezi V3): 1. 3 Landfill sites – Victoria, Loxton & Richmond. No authorizations. 2. Loxton & Richmond Sites to be authorized and upgraded (fencing, guardhouse) 3. Victoria West site is at end of its lifetime – this site must be managed towards closure and a new site identified, authorized and approved. 4. Equipment is not sufficient to deliver an efficient refuse removal service. 5. No recycling. 6. Illegal Dumping	Human Health Loss of habitat – edge effects of development Erosion, visual impact, loss of habitat Compliance monitoring (DWAF) and environmental education. Land Management specifically on farms must be done with great care. Groundwater / surface water Pollution / Human Health Risk	Refer to WSDPs from DWAF to adress Proper EIA Process to determine correct areas for development These must be mapped and rehabilitation plans done in conjunction with SANRAL Buffer of 50m on tributaries and 150m on large rivers are proposed where no development should be allowed. Floodlines should be determined See Integrated Waste Plan for details.

2. KEY PERFORMANCE (SUSTAINABILITY) INDICATORS FOR THE ENVIRONMENT

FROM IDP

Sustainability indicators	
Strategy C Disaster management	Ensure that new development will not be constructed within 1:50 year flood line and in areas of unstable soil conditions. <i>(page 80)</i>
Strategy A Avoiding pollution	The current waste disposal system should be upgraded and the community should be educated to be environmentally conscious. <i>(page 84)</i>
Strategy B Protection of groundcovers	Management system for abstraction of water should be in place and the disposal of water in a manner that will pollute the groundwater must be avoided. <i>(page 84)</i>
Strategy C Spatial and infrastructure development must support the environment	Water sources, natural streams, fountains, etc. must be protected through sound planning by the zoning of such areas as "soft" open spaces <i>(page 84)</i>
Strategy D Environmentally Soft Project.	EIA/ Environmental impact Assessment must be conducted for all development projects <i>(page 84)</i>
Strategy E Protect Heritage sites	Heritage sites and places of interest must be identified and a plan must be developed to protect the sites/ places <i>(page 84)</i>
Strategy A Improvement, access and equity	To ensure that people will have sufficient number of toilets, sufficiently close to their dwelling to allow them rapid, safe and acceptable access at all times of the day and night and that integration with other services takes place <i>(page 85)</i>
Strategy B Licensing of sewage waste disposal sites	To license all municipal sewage waste sites with DWAF and to comply with sewage waste disposal legislation <i>(page 85)</i>
Strategy C Upgrading of sewage waste disposal sites	To rehabilitate and upgrading the sewage sites in the municipality to comply with appropriate standards from sewage waste disposal sites and to extend the capacity to handle the expected improved level of services in the municipality <i>(page 85)</i>
Strategy D Prepare sewage waste management and operation plans.	The objective with the sewage waste management plans is to improve the operations and management of sanitation services and sewage waste disposal sites in the municipality <i>(page 85)</i>
Strategy E Environmental and health education	Sanitation is more than toilets, health and hygiene must also receive a high priority in all communities <i>(page 85)</i>
	Develop a storm water management policy <i>(page 89)</i>

ALSO REFER TO GENERIC SUSTAINABILITY INDICATORS TABLE

3. SPECIFIC OPPORTUNITIES

- Endangered Wildlife Trust conservation programmes through the Riverine Rabbit Project from Loxton
- Route based tourism on the N1 and the N12
- Loxton and Victoria West areas has significant Uranium deposits – exploration still ongoing

Tourism	Crafts	Cultural	Nature reserve	Recreation Activities	Birding	Lodges/Game /Hunting	Heritage / Architecture	War	Other
Loxton	Replica Dutch castle and windmill		Safari			Jakalsdans farm	Corbelled houses Architecture		San sculptures
Victoria west	Arts and crafts	Musical Mouers family Apollo theatre Apollo film festival Apollo development	Victoria west Nature reserve Safari		Victoria west Nature reserve	Hunting and Safari Vleiplaas Safari Victoria Nature Reserve		Power magazine.	
Richmond			Safari Verborgenfontein game viewing and birdwatching		Rooikop Hiking Trail Verborgenfontein game viewing and birdwatching	De Aar Farm Vlokfontein Van Zylskraal Hunting and Guest Farm Bethal Oufontein	De oude dak Driefontein		Fossil footprint and Bat Cave. Fossil Footprint & Bar cave

TOURIST ATTRACTIONS FROM IDP (page 26)

Richmond	Victoria West	Loxton
Horse Breeders Museum	Apollo Theatre	Hiking Trail Taaibosfontein
Oude Dak	Nablesfontein (mining of mineral water)	Old buildings
War Park	Printing press (old printers machinery)	Castle (van Aswegenfontein)
Dinosarus Museum (soetvlei)	Museum	Largest White Porper (van Aswegenfontein)

4. IDENTIFICATION OF IMPLEMENTABLE PROJECTS

FROM ISSUES

1. Alien Plant Removal Programme with Working for Water and Local Communities (See DWAF Website)
2. Riverine Rehabilitation Programme & Nursery in Loxton (Endangered Wildlife Trust)
3. Uranium Mining – Marketing to big Mining Houses
4. Environmental Awareness Training and Conservation initiatives for endemic species.

FROM INTEGRATED WASTE MANAGEMENT PLAN

1. Authorise existing Victoria West for closure and Loxton / Richmond for operations (2010) (R750 000)
2. Construction of guardhouse, ablution facilities & fencing at all Landfill Sites up to 2010 (R402 000)
3. Closure and rehabilitation of existing Victoria West Landfill Site (2010) (R500 000)
4. Authorisation of new site already in progress.
5. Start recycling initiatives.
6. Audit Landfill Sites (twice yearly) (R50 000 per annum – add escalation)

FROM IDP

1. The Environmental Management Plan, Project 47, is implemented as a short- term project

ALSO REFER TO GENERIC ISSUES, STRATEGIES AND OPPORTUNITIES TABLE

UMSOBOMVU

ENVIRONMENTAL SUMMARY - UMSOBOMVU MUNICIPALITY

1. PRIORITY ENVIRONMENTAL ISSUES & STRATEGIES

A – ISSUES IDENTIFIED FROM INTERGRATED DEVELOPMENT PLAN		
Specific Environmental Issues	Environmental Consequences	Strategies and legislation to address Issues for the Municipality
1. The available records show that Umsobomvu Municipality does not have enough cemeteries. Therefore the municipality will either improve or extend the existing ones or identify new sites for new cemeteries (<i>page 24</i>) Inputs from Workshops with Municipality: 1. Transport, spillage and risk of Hazardous Substances on National Routes through towns is an enormous problem. - accidents and spillages → safety issue for towns → trucks stay over – proper overnight facility → summer very hot – emergency issues 2. Colesberg Sewage Plant has been overflowing for two years. Various problems with the implementation 3. Two rural informal settlements in road reserve at Noupoot and between Steynsburg & Colesberg) Input from Intergrated Waste Management Plan for PKSDM (Kwezi V3): 1. 3 Landfill sites – Colesberg, Noupoot & Norvalspont. 2. No authorizations in place for Norvalspont 3. Norvalspont to be authorized 4. Equipment is not sufficient to deliver an efficient refuse removal service. 5. No recycling 6. Illegal dumping.	Human Health – Groundwater Pollution Human Health / Point Source Pollution Groundwater / Surface Water Pollution Human Health / Point Source Pollution Ground water pollution / Surface Water Pollution / Human Health	Cemetry Planning and Implementation required Detailed Inventory must be kept of all incidences by Municipality. Thereafter project registered to find integrated solutions. Plant to be upgraded Environmental Education / Awareness among Farmers See IWMP Document.

2. KEY PERFORMANCE (SUSTAINABILITY) INDICATORS FOR THE ENVIRONMENT

FROM IDP

Overall Indicators

Performance area		Performance Objectives	Performance indicator
Sanitation (page 129)	Building of new toilets	To build new toilets for the households with no toilets over a period of 5 years	Number of household with access to new toilets in the 5 year period
	Job creation	Building of new toilets to ensure that disadvantaged households have access to improve sanitation in a year.	% of household with access to basic level of sanitation
	Eradication of bucket system	Upgrading of systems over a period of 5 years	Number of the system upgrade in the region
Environmental management (page 136)		- o To compile and implant water service development plan and integrated waste management plants. - o To implement the region's integrated environment management plan	- o Completed and implantation of these plans - o The region's integrated environmental management plant is implemented
Tourism		To promote tourism in collaboration with others stakeholders	- o Number of new tourism information centre's established - o Protected tourist attraction areas - o Rehabilitation of infrastructure and services - o Number of tourist visiting the region - o Effective implantation of environment health plan

ALSO REFER TO GENERIC SUSTAINABILITY INDICATORS TABLE

3. SPECIFIC OPPORTUNITIES

- Gariep Dam Tourism Initiative
- Tourism along river at Norvalspont and potential analysis on farms adjacent to Orange River
- Identifying vacant land for the erection of the park (*page 32*)
- Route base tourism along national routes.

TOURISM OPPORTUNITIES

Tourism	Crafts	Cultural	Nature reserve	Recreation Activities / 4 x 4	Birding	Lodges/ Game farming / Hunting	Heritage / Architecture	War	Other
Noupoort			Brulberg Hiking Trail Mountain Biking Transkaroo Hiking Trail	Rooipoort Guest Farm	Brulberg Hiking Trail 4x4 trails Transkaroo Hiking Trail	De Villers Droëfontein Elandsheuwel Rooipoort game, Guest and conference farm Transkaroo adventures.		Blockhouse Garden of remembrance.	
Colesberg	Traditional Xhosa Clothing and fabric items Artists	Local historian Belinda Gordon	Hiking trails Walking tours Horse trails Mountain biking Safaris		Doornkloof Nature Reserve	Doornkloof Nature Reserve De Poort Grethead Lodge Hunter's Moon safari Orange River Lodge Potfontein Quaggafontein Safaris Riverside hunting Lodge Hunting safaris. Wolwefontein Lodge	Shutz and De Jager Building One of the oldest buildings in Colsberg.	SA Anglo Noer war Sites SA Anglo Boer War Tours.	Doornkloof Nature reserve
Norvalspont								Blockhouse Norvalspont concentration camp and graveyard	

4. IDENTIFICATION OF IMPLEMENTABLE PROJECTS

FROM ISSUES

1. Development and nature based tourism project at Norvalspont and on Orange River in general
2. Upgrading of the Coleberg Cemetery

FROM INTEGRATED WASTE MANAGEMENT PLAN

1. Authorise existing Norvalspont Landfill Site for operations (2010) (R250 000)
2. Construction of guardhouse, ablution facilities & fencing at all Landfill Sites up to 2010 (R465 000)
3. Start recycling initiatives
4. Audit Landfill Sites (twice yearly) (R50 000 per annum – add escalation)

FROM DEAT SOCIAL RESPONSIBILITY PROJECT APPLICATIONS (from April 2008)

1. Development of the Umsobomvu Cultural Village (R25 million) within the Gariep Dam Tourism Initiative

ALSO REFER TO GENERIC ISSUES, STRATEGIES AND OPPORTUNITIES TABLE

THEMBELIHLE

ENVIRONMENTAL SUMMARY - THEMBELIHLE MUNICIPALITY

1. PRIORITY ENVIRONMENTAL ISSUES& OPPORTUNITIES

A – ISSUES IDENTIFIED FROM INTERGRATED DEVELOPMENT PLAN		
Specific Environmental Issues	Environmental Consequences	Strategies and legislation to address Issues for the Municipality
1. Parks (page 29) 2. Sanitation (page 29) 3. Roads (page 29) 4. Cemeteries (page 29) 5. Upgrading of sport grounds. (page 29) 6. A housing backlog of 1372 (IDP review, p 42) is evident. This translates to 22.4 ha. 7. Poor maintenance of public parks was identified as an issue (IDP review, p. 93) 8. Gariep abattoir – effluent spillage into retention dams & dumping 9. Storm water problems in Hopetown and Streydenburg Input from Intergrated Waste Management Plan for PKSDM (Kwezi V3): 1. 2 Landfill sites – Hopetown & Strydenburg. 2. No authorizations in place. 3. Need for new Landfill Site in Hopetown. 4. Equipment is not sufficient to deliver an efficient refuse removal service. 5. Metal is being recycled. 6. Illegal Dumping	Human wellbeing and enhancement of biodiversity Groundwater / surface water Pollution / Human Health Risk Erosion, visual impact, loss of habitat Human health and wellbeing Security Point source pollution Erosion, Groundwater / surface water Pollution	Identifying vacant land for the erection of the park (page 32) Plastic, paper and glass must be added to the metal recycling initiative. Upgrading of oxidation ponds in Hopetown Solid waste site in Hopetown – relocated Resort Development potential

2. KEY PERFORMANCE (SUSTAINABILITY) INDICATORS FOR THE ENVIRONMENT

FROM IDP

Overall Indicators

Performance area		Performance Objectives	Performance indicator
Sanitation (page 129)	Building of new toilets	To build new toilets for the households with no toilets over a period of 5 years	Number of household with access to new toilets in the 5 year period
	Job creation	Building of new toilets to ensure that disadvantaged households have access to improve sanitation in a year.	% of household with access to basic level of sanitation
	Eradication of bucket system	Upgrading of systems over a period of 5 years	Number of the system upgrade in the region
Environmental management (page 136)		- o To compile and implant water service development plan and integrated waste management plants. - o To implement the region's integrated environment management plan	- o Completed and implantation of these plans - o The region's integrated environmental management plant is implemented
Tourism		To promote tourism in collaboration with others stakeholders	- o Number of new tourism information centre's established - o Protected tourist attraction areas - o Rehabilitation of infrastructure and services - o Number of tourist visiting the region - o Effective implantation of environment health plan

ALSO REFER TO GENERIC SUSTAINABILITY INDICATORS TABLE

3. SPECIFIC OPPORTUNITIES

Tourism	Crafts	Cultural	Nature reserve	Recreation Activities / 4 x 4	Birding	Lodges/ Game farming / Hunting	Heritage / Architecture	War	Other
Strydenburg	Arts and crafts		Aloe garden Safari		Aloe Garden	Wildebeeskoi Wittebomen			Aloe Garden
Orania	Arts and craft	Cultural history Museum					Straw houses		
Hopetown	Leather products Convicts stone 33 Church street.		Edgerton Game Ranch and Adventures Abseiling Angling Bird Watching Game viewing Hiking White water rafting	4x4 trails	Edgerton Game Ranch and Adventures Bird Watching Hiking 4x4 trails	Riatra Safari Saaidam Soetfontein Guest farm		Doornbult	

4. IDENTIFICATION OF IMPLEMENTABLE PROJECTS

FROM INTEGRATED WASTE MANAGEMENT PLAN

1. Authorise existing Hopetown for closure and Strydenburg for operations (2010) (R500 000)
2. Construction of guardhouse, ablution facilities & fencing at Hopetown & Strydenburg Landfill Sites up to 2010 (R190 000)
3. Closure and rehabilitation of existing Hopetown Landfill Site (2010) (R600 000)
4. Identify, authorize & establish new landfill site for Hopetown (2010) R950 000
5. Improve recycling programme to include glass, plastic & paper.
6. Audit Landfill Sites (twice yearly) (R50 000 per annum – add escalation)

	Statement of Environmental Problem	Project/solution/opportunity
1.	Lack of branding and marketing of the jurisdictional area of the Pixley ka Seme Municipality	Tourism/ marketing of existing opportunities: Many tourism opportunities exist. These include the developing additional holiday resorts, river rafting and other water sports, construction of guest Houses, race horse breeding, motor rally routes, steam safari, hunting and fishing. Existing applications include the following: • Crafts • Cultural assests • Recreation activities/4x4

		• Birding • Lodges/game farming/hunting • Heritage/Architecture • War
2.	Lack of identity or recognisability of individual towns	Branding and marketing of individual town • Gateway/entrance design • Upgrade of signage
3.		Identification and marketing of mineral resources <i>- These mining opportunities will in turn offer opportunities in terms of beneficiation for of these minerals, for example, cutting and polishing factories, jewellery manufacturing, tigers eye processing plant, uranium as a alternative source of fuel; and table salt manufacturing.</i>
4.	Lack of open space	Open Space and Landscape Plans (OSLP) - decision support tool and a spatial planning tool that can assist in the promotion of sustainable management of open space within the area of each Municipality
5.	Lack of integration between historically divided areas in settlements, normally transected by the N12	Urban Renewal Projects • Reviving the town center projects • Upgrading old abandoned industrial premises • Developing parks • Promoting investment into growth areas

		• Informal markets
6.	Sanitation	Ongoing process of formalizing sanitation to include water borne systems and address the backlog that currently exists. The use of dual flush systems to conserve water should be implemented. The use of municipal and provincial infrastructure grants to eliminate sanitation backlogs have the added advantage in that EPWP can be used to provide much needed employment opportunities for in the district.
7.	Lack of proper storm water management	Design and implementation of storm water management plans for each settlement, as well as catchments.
8.	Pollution: Littering; water pollution	• Clean-up projects • Establishment of formal landfill sites • Recycling initiatives • Waste transfer stations
9.	Water balance- water is a valuable resource in the area and must be conserved according	• Sustainable use of water: promote the recycling of water and application of purified water for irrigational purposes
10.	Low bearing capacity of natural veld	• Implementation of veld management policies to address and improve the slow rate at which the veld improves after miss management. Management strategies are therefore of vital importance

FROM DEAT SOCIAL RESPONSIBILITY PROJECT APPLICATIONS (from April 2008)

1. Development of the Thembehile Holiday Resort (R15 million)
2. Upgrading and maintenance of the Thembehile Municipality Cemetery (1.5million)

ALSO REFER TO GENERIC ISSUES, STRATEGIES AND OPPORTUNITIES TABLE

**GENERIC ISSUES &
OPPORTUNITIES (FOR LOCAL
MUNICIPALITIES)**

Generic Municipal Issues, Environmental Impacts, Strategies & Opportunities/Projects

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
Informal Residential • Low density urban, • Informal, high density urban, • Informal, low density rural, • Informal, high density rural	1. Housing Backlog 2. Lack of availability of land for settlements (most land privately owned). 3. Housing projects 4. Illegal evictions from farms – people move to settlements which can not accommodate them. 5. Dumping due to insufficient refuse removal. 6. Dust Pollution because of little vegetation cover. 7. Burning of wood – removal of vegetation adjacent to informal settlements. 8. Replacement of bucket system – technologies available is not viable & appropriate.	• Destroy indigenous biodiversity; in gardens indigenous flora are substituted with exotic species. • Fragmentation of ecological area, subdividing large populations by causing a barrier. • Scenic impact. • Depletion and degradation of soils may lead to unproductive soils. Decrease of water infiltration and increase the water run-off (flood potential). • Pollution of air – due to open cooking fires • Flooding may occur due to no management of storm water runoff. • Water quality most adversely influenced	Strategies: 1. Sewer system management. 2. Consider soil conditions in particular – no septic system on slate, shale or clay soils. 3. Storm water planning to make storm water available for urban agriculture. 4. Formalize informal settlements. 5. Labour intensive projects in informal settlements Legal requirements: 1. Environmental and Heritage Impact Assessment (EIA and HIA) required for land use changes, under NEMA, ECA and NHRA 2. Expansion and formalization of	1. Small contracts for SMME, regarding maintenance or small capital projects – training required. 2. Urban agriculture such as olive and citrus, harvest on contract to distributors. 3. Small scale urban agriculture production. 4. Cleaning programme currently implemented must be continued and encouraged. 5. Environmental education against wood collection in the adjacent veld to prevent degradation & erosion. 6. Urban renewal and greening for dust prevention. Soil stabilisers can be investigated in crucial areas. 7. Investigation or project

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
		by organic and microbiological pollution due to human activities. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.	settlements to be in accordance with IDP and SDF 3. Water Services Act	to determine most suitable alternatives for bucket system that does not need lots of water.
Formal Residential - Low density (plot sizes > 1500m²), - Formal, normal density (plot sizes 500m² - 1500m²), - Formal, medium density (shared plots, single & double storey), - High density (multi storey units in complex)	1. No land available at this stage	- Destroy indigenous biodiversity; in gardens indigenous flora are substituted with exotic species. - Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences. - Scenic impact. - Pollution of air. - Flooding may occur in floodplains due to construction being too close to the stream or river edge. - Water quality most	Strategy: - Densification rather than expansion, development by subdivision of large residential plots. - Strategic Environmental Plan for local Municipality. Legal requirements: - EIA according to ECA. - Physical Planning Act - Development Facilitation Act - Northern Cape Planning and Development Act - Cape Land Use	- SMME waste removal. - Service and maintain areas through SMME's, side walks etc. in partnership with the municipality – work towards a municipal service contract. - Survey on plot sizes and opportunities for development, densification

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
		adversely influenced by organic and microbiological pollution due to human activities. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.	Planning Ordinance.	
Open Space - Most of the existing soft open spaces, especially in the informal residents areas, are unkempt and therefore creating an unsafe environment - The park in the informal areas of the three towns are mostly overgrown and unkempt, making is attractive dumping sites that lead to unsafe and polluted areas within the residential areas.	- Almost no open space planning has been done in most of the towns. - Lack of Formal Sports field in many of these townships. - Informal settlements in open areas (public open spaces) - Floodplain areas cause a safety risk, as no detailed flood line determinations have been done in most towns. Informal settlement also takes place below the flood line.	- Human Health - Safety		Open Space and Landscape Plans (OSLP) - Decision support tool and a spatial planning tool that can assist in the promotion of sustainable management of open space within the area of each Municipality. (This forms part of Urban Renewal. – Also refer to Urban Renewal Guidelines)
Commercial - Free Trade Zones. - Trade Zones. - Shopping Centres. - CBD Commercial	- CBD Areas have no public toilets. - CBD often lacks identity & legibility	- Destroy indigenous biodiversity; in gardens indigenous flora are substituted with exotic species. - Fragmentation of natural area, subdividing large	Strategies: - Healthy CBD stimulation against decentralization. - Beautification by tree planting etc for	- Olive oil industry, small scale farmers, joint ventures. - Greening of town CBD, growing plants for side walks etc.

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
5. Grain Silos		populations by causing a barrier. 9. Scenic impact. 10. Pollution of air. 11. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.	ecological disadvantages in CBD 3. Spatial planning to make CBD attractive for tourists. 4. Develop ablution facilities for CBD Areas. Legal requirements: 1. Occupational Health and Safety Act 2. EIA for new development 3. Atmospheric Pollution Prevention Act. 4. Hazardous Substances Act 5. Health Act	3. Proper CBD Planning is part of Urban Renewal 4. Manufacturing of street furniture banners and other image creating elements. 5. Security contracts such as organised car protecting services. 6. Link to other regional distribution centres 7. Investigate establishment of free trade zones around airport in the district 8. Continue to investigate re-use of buildings associated with airports for other types of facilities.
Leisure & Tourism 1. Hotel - large (more than 100 rooms), 2. medium (30 - 100 rooms), 3. small (less than 30 rooms), 4. Guest house, 5. Resort - detached units in a rural or natural setting outside urban areas, 6. Caravan Park / Site, Casino,	1. Tourism information in the study area is not always accessible & legible to a tourist moving through the area. Booklets of specific tourist attractions is not being distributed through the country	1. Destroy indigenous biodiversity; in gardens indigenous flora are substituted with exotic species. 2. Trail and disruption caused by vehicles may functionally fragment populations especially insofar small-bodied, less mobile or cryptic species are concerned.	Strategies: 1. Focus on agricultural tourism. 2. Concentrate to conserve what is left, 3. Combine conservation with development. Legal requirements: 1. EIA for new development.	4. Audit L and T facilities – training required for SMME's 5. Maintenance contracts for all monuments and sites. 6. Food oriented tourism development 7. Maintenance of resorts, planning and SMME opportunity. 8. Tourism marketing

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
Golf Course		3. Scenic impact. 4. Pollution of air. 5. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation	2. National Water Act 3. Environmental Conservation Act.	exercise (to the entire country) is required. 9. Gateway / entrance design for each town is required. 10. Tourism info centre is required for each town. 11. Signage must be improved for all tourism facilities. 12. Ramble routes must be developed within each local municipality to link all tourism establishments with the info centre.
Game & Hunting Lodges 1. Game & hunting lodges, 2. Eco-lodge (low impact facilities in a natural environment)	1. Only 1,2% of land cover utilized for game farming. 2. New developments to be done in consultation with IEMP	1. Destroy indigenous biodiversity. 2. Selective hunting of target species alters genetic constitution of natural populations; non-target species may be affected by management practices that favour increased population numbers of charismatic and hunted species. 3. Trail and disruption caused by vehicles may functionally fragment populations especially	Strategy: 1. Not to be stimulated in this area.	

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
		insofar small-bodied, less mobile or cryptic species are concerned. 4. Scenic impact.		
Trails 1. 4x4Trail, 2. Motorbike Trail, 3. Equestrian Trail, 4. Hiking Trail	1. Not present in this area. 2. Potential for hiking trails.	3. Destroy indigenous biodiversity; in gardens indigenous flora are substituted with exotic species. 4. Trail and disruption caused by vehicles may functionally fragment populations especially insofar small-bodied, less mobile or cryptic species are concerned. 5. Scenic impact.	Strategy: 1. Stimulate agricultural related trials, like olive and wine routes etc. 2. Hiking trials within natural areas. Legal requirements: 1. Conservation of Agricultural Resources Act. 2. Environmental Conservation Act	1. Maintenance contracts 2. Trial guides – training 3. Trials linked to agriculture and related initiatives.
Animal Husbandry 1. Cattle farming, 2. Cattle, large (more than 1000ha), 3. Cattle, medium (250ha - 1000ha), 4. Cattle, small (less than 250ha), 5. Cattle, high density feeding lots, 6. Dairy Farming, 7. Poultry farming, 8. Ostrich farm, 9. Sheep farming,	1. Of the total surface area, 29,6% is used for livestock. 2. Informal settlements. Keeping of livestock in urban areas. Possibility of outbreak of pests or diseases. 3. Low carrying capacity makes area extremely vulnerable to land degradation & erosion.	1. Destroy indigenous biodiversity; 2. Non-selective overgrazing and trampling causes the replacement of late successional grasses with less nutritional, early pioneer grasses, the loss of herbaceous annuals, exposure of bare soil and subsequent erosion. 3. High density cattle farming leads to total destruction of indigenous vegetation that may result in subsequent erosion.	Strategies: 1. Avoid ecological sensitive areas such as close to the river. 4. Programs to monitor points of pollution. 5. Stimulate farm labour ownership and/or partnerships. 6. Encourage and provide farm labour training. 7. Stimulate small scale economic viable business enterprises. 8. Situation analyses,	1. Promote utilisation and co-operation with NC research institutes. 2. Leather works from various skins. 3. Small scale poultry farming 4. Small scale breeding operations. 5. Investigate aqua culture link to hydroponics. 6. Broad Scale education on veld management – farmers, land owners and

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
10. Sheep large (more than 1000ha), 11. Sheep medium (250ha - 1000ha) 12. Sheep small (less than 250ha) 13. Pig farm, 14. Crocodile farm, 15. All goats farming 16. Mixed grazing		4. The deposition of abnormal amounts of manure increase soil acidity and prohibits recovery of indigenous species for prolonged periods. 5. Water quality most adversely influenced by organic and microbiological pollution due to animal wastes or activities.	location of small farms, wind direction etc. Legal requirements: 1. ECAct 2. Conservation of Agricultural Resources Act. 3. Fertilizers, Farm Feeds, Agricultural Remedies Act. 4. Health Act. 5. Agricultural Pests Act 6. National Water Act 7. Occupational Health and Safety Act	communities.
Crop Farming Agriculture 1. Irrigated agriculture (all farm sizes), 2. Mono-culture agriculture, large (more than 1000ha), 3. Mono-culture agriculture, medium (250ha - 1000ha), 4. Mono-culture agriculture, small (less than 250ha), 5. Mono-culture agriculture, subsistence. 6. Rain-fed crops. 7. Nurseries	1. throughout the area 2. Seasonal migrant workers working on farms. 3. High water table on farms. 4. Volatility of crop farming. (sudden climatic changes can destroy the whole industry)	1. Destroy indigenous biodiversity. 2. Area is homogenized and ecosystem functioning on cultivated land is essentially simplified to production of bio-mass. 3. Depletion and degradation of soils may lead to unproductive soils. Build up of salts. 4. Water quality most adversely influenced by the use of inorganic fertilizers or pesticides during the cultivation of	Strategies: 1. Do not stimulate water dependent farming. 2. Stimulate farming with indigenous crops such as Aloe. 3. Focus on new irrigation techniques. Water use efficiency. Legal requirements: 1. Conservation of Agricultural Resources Act. 2. Fertilizers, Farm Feeds, Agricultural	1. Focus on dry land production and/or using recycled water in intensive crop production. 2. Encourage current research institutions to do appropriate research on dry land crop production. Make information available to the Municipalities 3. Establish: Medicinal plant, Aloe, Herb, essentials oil plants and cut flower nurseries. – bee (honey and wax)

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
		crops, leaching to underground water.	Remedies Act. 3. Agricultural Pests Act 4. National Water Act	industry link after establishment. 4. Investigate the alternatives of packaging such as making muslin bags for olive packaging 5. Develop policy framework for urban agriculture 6. Take educational programs to schools regarding farming in the area.
Aquaculture	1. Opportunity	1. Destroy indigenous biodiversity. 2. Area is homogenised and ecosystem functioning on cultivated land is essentially simplified to production of bio-mass. 3. Water quality most adversely influenced by either organic and microbiological wastes due to the raising of animals or the use of inorganic fertilizers or pesticides during the cultivation of crops.	Strategy: 1. Stimulate small scale aquaculture projects. 2. Stimulate water re-use projects	1. Aqua culture can be located in any municipality where waste water can be utilised

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
Game Farming 1. Game farming, large (more than 4000ha), 2. Game, medium (600ha - 1000ha), 3. Game, small (less than 600ha)	1. Game farming on small scale.	1. Destroy indigenous biodiversity. 2. Selective hunting of target species alters genetic constitution of natural populations; non-target species may be affected by management practices that favour increased population numbers of charismatic and hunted species. 3. Trails and disruption caused by vehicles may functionally fragment populations especially insofar small-bodied, less mobile or cryptic species are concerned.	Not to be encouraged.	1. Concentrate on domestic animals. 2. Goat milk and meat production for small farmers.
Mixed Agriculture 1. Mixed agriculture (livestock & crops), large (more than 1000ha), 2. medium (250ha - 1000ha), 3. small (less than 250ha), 4. subsistence, 5. Communal Grazing system	1. Expansion of urban area could have impact on agricultural land bordering urban areas. See under informal and formal settlements.	1. Destroy indigenous biodiversity; 2. Non-selective overgrazing and trampling causes the replacement of late successional grasses with less nutritional, early pioneer grasses, the loss of herbaceous annuals, exposure of bare soil and subsequent erosion. 3. Area is homogenised and ecosystem functioning on cultivated land is essentially simplified to production	Strategy: 1. Planning areas for communal use. (Permit system etc.) 2. Stimulate small scale permaculture and vegetable production. Legal requirements: 1. As with crop and animal farming	1. Establish local compost and organic soil industry linked to earth worms industries. 1.

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
		of bio-mass. 4. Depletion and degradation of soils may lead to unproductive soils.		
Forestry 1. Large scale forestry, 2. Small scale commercial forestry (less than 10ha), 3. Subsistence forestry (firewood etc.)	1. Although areas are electrified households still use wood fires for cooking and heating which leads to air pollution – subsistence forestry. 2. Alien invader species along the riverine areas.	1. Destroy indigenous biodiversity. 2. Scenic impact. 3. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.	Strategy: 1. Stimulate selective harvesting. 2. Concentrate on exotic or invader plants. 3. Stimulate small business ventures such as charcoal production and furniture industry. 4. Link to “Working for water” program. Legal requirements: 1. Nature and Environmental Ordinances. 2. National Forest Act	1. Promote working for water programs. 2. Promote removal of alien vegetation – link to fuel for cooking and heating, charcoal, furniture and basket weaving industries. Note - indicate the legislation requirements. 3. Link up with Working for Water – DWAF initiative against alien species invasion.
Industrial 1. Heavy industrial - metal smelting, 2. chemical processing, assembly plants, other, 3. Medium industrial- chemical processing, other, 4. Light industrial, Workshop, 5. Agricultural processing	1. Local communities partnerships lacking.	1. Destroy indigenous biodiversity. 2. Fragmentation of natural area, subdividing large populations by causing a barrier that is difficult to cross. 3. Scenic impact. 4. Materials used may be toxic to fauna and flora	Strategy: 1. Business plans for small enterprises. 2. Environmental audit on all businesses. Compliance with legislation 3. Capacity building programs. 4. Investigate alternative	1. Investigate waste recycling for new innovative products. 2. Promote collection of paper and cans for recycling. 3. Manufacturing of ready-made furnishings and building elements from waste material.

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
plants on agricultural land		and may also induce genetic changes between generations. 5. May lead to pollution caused by emission of by-products. 6. Air and noise pollution. 7. The possibility of leakage/ spillage may pollute the soil, surface and groundwater. 8. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.	use of waste products. 2. Infrastructure analyses to support industry.(e.g. roads, water etc.) 3. Stimulate processing plants, e.g. olive and other oil plants etc. Legal requirements: 1. ECAct 2. Conservation of Agricultural Resources Act. 3. Health Act. 4. Agricultural Pests Act 5. National Water Act 6. Occupational Health and Safety Act 7. Atmospheric Pollution Prevention Act.	
Mining 1. Open cast mine, 2. Open cast mine with drag line, 3. Underground mine, 4. Sand works, 5. Clay quarry associated with brickworks, 6. Other clay quarries, 7. Gravel quarry for road fill,	1. Very little mining is being done although huge mineral resources exist.			1. A mining marketing study must be done to assess viability of mineral resources. 2. These viable mining options must be further investigated and big mining houses invited for partnerships in the area. 3. These mining opportunities will in turn offer opportunities in terms of beneficiation for of these

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
8. Rock quarry for construction aggregate, 9. Rock quarry for blocks or slabs of rock, 10. Salt works				minerals, for example, cutting and polishing factories, jewellery manufacturing, tiger's eye processing plant, uranium as an alternative source of fuel; and table salt manufacturing.
Airports 1. International airports. 2. Regional airports, 3. Small airports. 4. Public and private landing strips	1. Air field at ammunition depot. Not utilized infrastructure. 2. Air field only used for private light aircraft.	1. Destroy indigenous biodiversity. 2. Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences. 3. Cause increase mortality in birds of prey if incorrectly designed. 4. Pollution of air. 5. The possibility of leakage/ spillage may pollute the soil, surface and groundwater. 6. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation.	Strategy: 1. Stimulate growth and market as tourism opportunity. 2. Stimulate as export opportunity for products such as flowers etc. 3. Avoid the destruction of high bio-diversity areas for new landing strips. Legal requirements: 1. Environmental Conservation Act 2. Shipping and Civil Aviation Laws Rationalisation Act. 3. Airport Company Act. 4. South African Civil Aviation Authority Levies Act.	1. Investigate optimum utilisation of airports for tourism, export of products. 2. Promote fly in tourism linked to agri-tourism and scientific research. 3. Establish free trade zones around airport – link to other industries in the region – such as Upington.

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
Power Stations Alternative Power 1. Electricity generation facilities, 2. Coal powered stations, 3. Hydro electricity generators, 4. Wind electricity generators (commercial only), 5. Bio-electricity generators (commercial only)	1. Not applicable to this municipality			
Parking, Related Structures & Facilities 1. Parking lot, 2. Taxi rank, 3. Bus or heavy vehicle depot, 4. Filling station, 5. Vehicle service facility, 6. Traffic control centre, 7. Dirt road with high traffic loads, 8. Dirt road with low traffic loads.	1. Taxi ranks along the main roads.	1. Destroy indigenous biodiversity. 2. Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences. 3. Roads and other tourism related structures may cause fragmentation of large populations (especially of cryptic animals) and behavioral changes induced by tourism activity. 4. May lead to pollution caused by emission of by-products. 5. Pollution of air	Strategy: 1. Audit all taxi stands, upgrade facilities.	1. SMME contracts for the maintenance and construction of new facilities. 2. Construction of labour intensive paving and roads

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
Roads 1. Roads 2. Double carriageway highway, 3. Tarred road with 120km/h speed limit, 4. Tarred road with 80km/h speed limit, 5. Tarred roads with speed limits below 80km/h	1. Road upgrade at other towns such as Pampierstad etc. 2. Construction of roads necessitates gravel borrow pits. 3. Road construction leads to deforestation. 4. New roads lead to higher volume of storm water run off. 5. Lack of integration between historically divided areas in settlements, normally transected by the N-routes. 6. Storm Water Management not up to standard – risk for human health & erosion.	1. Destroy indigenous biodiversity; 2. Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences. 3. Roads and other tourism related structures may cause fragmentation of large populations (especially of cryptic animals) and behavioral changes induced by tourism activity. 4. Prevention of natural floods leads to the alternation of natural flow of rivers that may cause deposition of silt that shallows river bed and may have consequences for aquatic species that are dependent on deep or fast flowing water. 5. Scenic impact. 6. May lead to pollution caused by emission of by-products. 7. Pollution of air	Strategy: 1. Road audit within the municipal area. 2. Road upgrading by labor intensive methods. Legal requirements: 1. Mineral and Petroleum Resources Development Act (quarries) 2. Advertising on Roads and Ribbon Development Act. 3. Environmental Conservation Act	1. Lack of integration should be addressed by urban renewal projects such as gateway design, signage, general upliftment of previously disadvantaged communities etc. 2. Storm water management plans required for all towns.

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
Railways, Related Structures & Facilities 1. Railway structures, 2. Railway lines, 3. Stations, 4. Shunt yards & workshops, 5. Railway bridges	1. Main railway line through Municipal area. 2. Mainly used to transport cargo	1. Destroy indigenous biodiversity. 2. Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences. 3. Roads and other tourism related structures may cause fragmentation of large populations (especially of cryptic animals) and behavioral changes induced by tourism activity. 4. Prevention of natural floods leads to the alternation of natural flow of rivers that may cause deposition of silt that shallows river bed and may have consequences for aquatic species that are dependent on deep or fast flowing water. 5. Scenic impact. 6. May lead to pollution caused by emission of by-products. 7. Pollution of air	Strategy: 1. Make trains more user friendly. 2. Link to tourism potential.	1. Servitude – investigate utilisation for biking, hiking and horse trials.

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
Pipelines, Cable Networks 1. Pipeline for the transportation of hazardous substances including petroleum products, 2. Water bulk supply pipelines, 3. Cable networks, 4. Telephone lines and associated structures, 5. Industrial cable way and associated structures, 6. Tourism cable way and associated	1. Electrification of informal settlements/residential areas deforested for high voltage cables and servitudes 2. Water pipes for bulk water old. 3. Storage reservoirs needs attention, old and leaking.	1. Destroy indigenous biodiversity. 2. Fragmentation of natural area, subdividing large populations by causing a barrier that is extremely difficult to cross, with genetic consequences. 3. Prevention of natural floods leads to the alternation of natural flow of rivers that may cause deposition of silt that shallows river bed and may have consequences for aquatic species that are dependent on deep or fast flowing water. 4. Scenic impact.	Strategy: 1. Audit water and sewage networks and capacities. 2. Demand and supply audit in co-operation with Eskom for the Municipality's future needs. Legal requirements: 1. EIA's for new networks necessary.	1. SMME maintenance and installation contracts. 2. Focus on extended DPW programmes.
Water storage 1. Water storage and supply structures as well as structures affecting the flow of water in rivers, 2. Bulk water supply/storage dam, 3. Farm dam, 4. Inter catchments water transfer scheme, Reservoirs for public water supply, 5. Levees, 6. Weirs	1. Upgrade bulk water at 2. Canal leaking and very old 3. All reservoirs are old and capacity not sufficient.	1. Destroy indigenous biodiversity. 2. Prevention of natural floods leads to the alternation of natural flow of rivers that may cause deposition of silt that shallows river bed and may have consequences for aquatic species that are dependent on deep or fast flowing water. 3. Scenic impact.	Strategy: 1. Water audit and strategic plan in relation to Water Services Plan (WSDP) 2. Small projects to repair canal and other bulk supply network. 3. Audit all boreholes. 4. Regular water testing from boreholes Legal requirements: 1. National Water Act.	1. SMME maintenance and installation contracts. 2. Focus on extended DPW programmes.

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
			2. Water Services Act. 3. Water Act.	
Towers and masts, Conveyors 1. Microwave towers (telecommunications), 2. Radio transmission towers and masts, 3. Cellular phone network masts, 4. Wireless loop telecommunication masts, 5. Radar masts, 6. Reception dishes and structures, Industrial conveyor - long distance (>1km), Industrial conveyor	1. Visual impact of cellular base stations is often negative. 2. By-laws and regulations required regarding positioning of base stations especially in rural areas.	1. Destroy indigenous biodiversity. 2. Cause increase mortality in birds of prey if incorrectly designed. 3. Scenic impact.	Strategy: 1. Strategic plan for site selection in and around towns. 2. Avoid natural areas such as ridges etc. Legal requirements: 1. EIA assessments for cellular base stations.	1. Promote utilisation of masts for raptor and large bird nesting – artificial nesting.
Conservation 1. All conservation area, 2. National park, 3. Provincial nature reserve, 4. Regulated natural area, 5. Natural heritage site, 6. National monument, 7. Marine reserve, 8. Local authority conservation area, 9. Private nature reserve, 10. Urban open space area	1. No areas conserved. Game farming only 1,2% which can be seen as conservation of land.	1. Destroy indigenous biodiversity.. 2. Trail and disruption caused by vehicles may functionally fragment populations especially insofar small-bodied, less mobile or cryptic species are concerned.	Strategy: 1. Develop a conservation strategy for the municipal area. 2. Identify natural areas to be protected. 3. Identify no-go development areas. Legal requirements: 1. All legislation as for Game farming etc. EIA's are important.	1. Conserve areas such as ridges and other sensitive areas. 2. Promote the conservation of all wetland areas.

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
Waste sites, Sewage treatment - Household waste landfill, - Class 2 waste landfill, - Class 1 waste landfill, - Waste indicator, - Radioactive waste site, - Sewage disposal structures, - Sewage treatment plants, - Off- shore disposal pipelines, - Sewage pipelines (MAIN)	- Waste management plan - Upgrade bulk sewerage works - Landfill Sites without approvals and in close proximity to human settlement. - Littering has negative effect on tourism. - Problems with the sewage treatment plant. reached its full capacity.	- Destroy indigenous biodiversity.. - Prevention of natural floods leads to the alternation of natural flow of rivers that may cause deposition of silt that shallows river bed and may have consequences for aquatic species that are dependent on deep or fast flowing water. - These materials may be toxic to fauna and flora and may also induce genetic changes between generations. - May lead to pollution caused by emission of by-products. - Pollution of air. - The possibility of leakage/ spillage may pollute the soil, surface and groundwater.	Strategy: - Investigation and viability study on the total sewage system. - Refer to IWMP recently completed	- Ongoing process of formalizing sanitation to include water borne systems and address the backlog that currently exists. The use of dual flush systems to conserve water should be implemented. - Refer to IWMP recently completed.
Hazardous Materials Handling, and manufacturing - Hazardous materials transportation route, - Hazardous materials handling facility, - Hazardous materials processing facility, - Hazardous materials storage	- Waste management plan. - Hazardous waste being transported on N-Routes and spilled in towns.	- Destroy indigenous biodiversity. - Radioactive elements are carcinogenic and cause genetic mutations between generations. - May lead to pollution caused by emission of by-products.	Strategy: Refer to integrated waste management plan just completed.	- All hazardous waste spillages or emergencies must be properly documented before any action can be taken to determine the exact extent and frequency. - Safe sleepover areas must be designed and built away from the residential

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
facility, 5. Hazardous materials manufacturing facility		4. Pollution of air. 5. The possibility of leakage/ spillage may pollute the soil, surface and groundwater. 6. Overall very high impact on vegetation that usually result in the complete or partial destruction of both the vegetation and the top layers of soil often further exacerbated by inadequate rehabilitation. 7. Scenic value destroyed.		area of each town. 3. Determine the main companies transporting waste of this nature and do spot checks of their permits as they enter each town in liaison with Traffic Dept. 4. In serious instances whistle blowing to DTEC or even DEAT can become necessary.
Advertisement 1. All advertisement. 2. Posters and other general signs. 3. Signs on buildings, structures and premises. 4. Signs for the tourist and traveller. 5. Mobile signs, 6. Billboards and other high impact free standing structures	1. Not currently addressed in IDP or other policy statements	1. Destroy indigenous biodiversity. 2. Scenic impact.	Strategy: 1. Abide by the requirements; SA manual for outdoor advertising control (DEAT)	1. SMME manufacturing of unique, wood, fabric or painted local signs.
Fuel Stations 1. Petrol/Diesel Filling Stations, 2. Fuel Storage Facilities, 3. Fuel Refineries,	1. Full EIA assessment for new filling stations. 2. Location of new filling stations/ fuel storage facilities/refineries to be addressed in Spatial	1. Destroy indigenous biodiversity. 2. These materials may be toxic to fauna and flora and may also induce genetic changes	Strategies: 1. Storm water planning in all towns. 3. Oil handling and disposal audit needed.	

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
	Development Frameworks in conjunction with IEMP.	between generations. - May lead to pollution caused by emission of by-products. - Pollution of air. - The possibility of leakage/ spillage may pollute the soil, surface and groundwater.	- Encourage recycling initiatives. Legal requirements: - Full EIA assessment for new filling stations. - Location of new filling stations/ fuel storage facilities/refineries to be addressed in Spatial Development Frameworks in conjunction with IEMP.	
Heritage - Structures - National Monuments - Artifacts - Rock Paintings - Battlefields - Museums - Mission Stations	- Historical sites - Archaeological sites - Cultural sites - Scientific and ecological sites	- Roads and other tourism related structures may cause fragmentation of large populations (especially of cryptic animals) and behavioral changes induced by tourism - Destroy indigenous biodiversity. - May cause pollution, littering etc by visitors.	Strategy: - Assessment of all possible historic sites, ruins, structures and graves. - Inventory of all archaeological artifacts in the area. - Heritage site, such as bushman paintings, must be identified. - Scientific important ecological sites must be identified and registered. - Focus of above should be to link this with tourism exploitation possibilities. Legal requirements:	- Complete audits as required – training. - Liase with agriculture to develop strategy for agri-tourism, heritage sites. - Promote links to tourism industry. - Complete conservation plans as required. - SMME's maintenance of monuments and sites. - Identification of new sites to be listed under the NHRA.

Categories of Development	Some Specific Municipal Issues	General Environmental Consequences	Strategies and legislation to address environmental issues for the Municipality	Opportunities / Projects
			1. National Heritage resources Act 2. Environmental Conservation Act 3. National Environmental Management Act	

PIXLEY KA SEME IDP PROJECTS

Pixley Ka Seme IDP Projects

IDP – Capital Project and Financial Plan for 2007/08 Financial Year

Table 58: Capital project by municipality: Infrastructure

Municipality	Priority	Capital project	Project cost	Financial year(s)	Source of Finance					Total year budget
					IDP Allocations by PkS District Municipality and Institutions/ Grants					
					Financial year(s)					
					2007/08	2008/09	2009/10	2010/11	2011/12	
Siyancuma	1.	Eradication of the bucket system at Rainbow in Griekwastad and Douglas	R6 300 000	2007/08	MIG		MIG			
	2.	Water reticulation – Salt Lake, Belmont, Witput and Graspan.	R800 000	2007/08						
	3.	Sewerage treatment plant in Campbell.	R1 200 000	2007/08						
			R 1 500 000	2007/08						
	4.	Oxidation ponds in Schmidsdrift	R10 000 000	2005-2008						
	5.	Taxi route through Breipaal – over a 3year period	R2 800 000	2007/08						
6.	Upgrading bulk water pipeline: Douglas prison									
Thembelihle	1.	Upgrading of electricity in Hopetown and Strydenburg	R1 500 000	2007/08	R200 000	R125 000				
	2.	Bulk water supply in	R3 100 000	2007/08						

Municipality	Priority	Capital project	Project cost	Financial year(s)	Source of Finance					Total year budget
					IDP Allocations by PkS District Municipality and Institutions/ Grants					
					Financial year(s)					
					2007/08	2008/09	2009/10	2010/11	2011/12	
	3.	Hopetown and Strydenburg	R600 000	2007/08						
	4.	Upgrade sewer purification in Hopetown and Strydenburg	R2 000 000	2005/06						
	5.	Upgrade sewer network in Strydenburg	R700 000	2007/08						
		Upgrade and improve internal streets in Hopetown and Strydenburg								
Kareeberg	1.	Upgrading of streets (phase 2)	R200 000	2007/08	Dept of Sience and Technology					
	2.	TV channels Van Wyksvlei and Vosburg	R200 000	2007/08						
	3.	Upgrading of water network	R250 000	2007/08						
	4.	Upgrading of dumping sites	R350 000	2007/08						
	5.	Upgrading of dumping sites	R2 400 000	2007/08						
	6.	Eradication of buckets	R12 billion	2005-2014						
		SKA/KAT near Carnavon								

Municipality	Priority	Capital project	Project cost	Financial year(s)	Source of Finance					Total year budget
					IDP Allocations by PkS District Municipality and Institutions/ Grants					
					Financial year(s)					
					2007/08	2008/09	2009/10	2010/11	2011/12	
<i>Ubuntu</i>	1.	(7) 600 erf services (water, electricity and measurements)	R4 000 000	2007/08						
	2.	Upgrading sewerage pump station	R700 000	2007/08						
	3.	Area lightening in town	R3 200 000	2007/08						
Subtotal			R3.2 million							
<i>Renosterberg</i>	1.	Upgrading of water system	R7 000 000	2007/08						
	2.		R2 000 000	2007/08						
	3.	Eradication of buckets	R424 000	2007/08						
	4.	Supplying electricity and upgrading of network	R94 000	2007/08						
	5.	Development of erfs	R80 000	2007/08						
	6.	Upgrading of dumping sites	R280 000	2007/08						
	7.	Upgrading of streets and stormwater systems	R100 000	2007/08						
		Development of parks								

Municipality	Priority	Capital project	Project cost	Financial year(s)	Source of Finance					Total year budget	
					IDP Allocations by PkS District Municipality and Institutions/ Grants						
					Financial year(s)						
					2007/08	2008/09	2009/10	2010/11	2011/12		
Siyathemba	1.	Upgrading of oxidation ponds in Prieska	R6 500 000	2007-2008	MIG					MIG	
	2.	Patching and upgrading of existing roads		2007-2008	MIG						
	3.	Upgrading of electrical network in extension 9 in Prieska		2007//08							
Umsobomvu	1.	Provision of water	R33m	2005-2008							
	2.	Norvalspont sewerage network	R270 000	2007/08							
	3.	Noupoort electricity	R832 000	2007/08							
	4.	Rehabilitation of high mast lights	R250 000	2007/08							
	5.		R270 000	2007/08							
Subtotal		Norvalspont electricity	R34 622 000								

Municipality	Priority	Capital project	Project cost	Financial year(s)	Source of Finance					Total year budget
					IDP Allocations by PkS District Municipality and Institutions/ Grants					
					Financial year(s)					
					2007/08	2008/09	2009/10	2010/11	2011/12	
Pixley ka Seme DM	1.	Building of a railway line between Douglas and Belmont	R35 million		Dept Economic Affairs					
	2.	Karoo bulk water supply project in (Vanderkloof, Petrusville, Phillipstown, De Aar, Britstown and Vosburg)			MIG DWAF					
	3.	Commissioning of a feasibility study on uranium deposit in the region								
Emthanjeni	•	Upgrading of electrical network in industrial area	R800 000	2007/08						
	•	Eradication of buckets	R1 548 000	2007/08	MIG					
	•	Upgrading of existing toilet structures	R2 300 000	2007/08						
	4.	Water purification at De Aar	R4 500 000	2007/08						
	5.	Construction of a taxi rank in De Aar	R3 035 677	2007/08	Upon approval of business plan by Dept of					

Municipality	Priority	Capital project	Project cost	Financial year(s)	Source of Finance					Total year budget
					IDP Allocations by PkS District Municipality and Institutions/ Grants					
					Financial year(s)					
					2007/08	2008/09	2009/10	2010/11	2011/12	
					Public Works					

Capital project by municipality: Housing

Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2006/07	2007/08	2008/09	2009/2010	
Ubuntu	1.	(6) 500 houses with services	R14 250 000	2007/08						

Siyathemba	1.	Measurements and services of environ-economics housing ABSA project in economics hosuing		2007/08	PkS					
	2.	ABSA project in economic housing		2007/08	ABSA					

Capital project by municipality: Local Economic Development (LED)

Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2008/09	2009/10	2010/2011	2011/2012	
Pixley Ka Seme District Municipal Area	1.	Lake Gariep LED initiative		2007/08	DM NC Dept of Agriculture					
	2.	Commercialisation of goats		2007/08						
Siyathemba	1.	Fish Farm	R500 000	2007/08	DEAT				DEAT	

Capital project by municipality: Social Development

Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2008/09	2009/10	2010/2011	2011/2012	

Ubuntu		Conservancy project commonage and parks in Looton	R15 million	2007/08	DEAT					
	2.	Upgrading and establishment of cemeteries	R5.5 million	2008/09	DEAT					
Renosterberg	1.	Upgrading of community halls	R100 000	2007/08						
	2.	Upgrading of clinics	R50 000	2007/08	Dept Health					
	3.	Development of parks open spaces and walkways	3.5 million	2007/08						
	4.	Lightening of sports grounds	R100 000	2007/08	Dept Health					
	5.	Phillipstown Clinic	R2 million	2007/08						
Subtotal			R310 000							
TOTAL			R560 000							
Emthanjeni	1.	Upgrading and maintenance of parks, open spaces and walkways	R500 000	2007/08	DEAT					
	2.	De Aar new hospital	R350 million	2006-2010	Dept of Health					
	3.	Nonzwakazi clinic	R2 million	2007/08						
	4.	Upgrading ARV site		2007/08	Dept of Health					
	5.	72 hour mental health unit		2007/08						
	6.	Renal unit		2007/08						

Siyathemba	1.	Upgrading of sports grounds in Prieska, Marydale and Niekershoop		2007/08	Lotto					
	2.	Building of a memorial park in Prieska	R18 500	2007/08	DEAT					
Siyancuma	1.	Upgrading and maintenance of parks, open spaces and walkways in Douglas	R2.5 million	2007/08 2008/09	DEAT					
	2.	Bongani clinic	R2 million	2007/08	Dept of Health					
Umsobomvu	1.	Upgrading and maintenance of cemeteries	R2.5 million	2007/08 2008/09						
	2.	Upgrading and maintenance of parks, open spaces and walkways	R3.5 million							
	3.	Hospital revitalisation at Manne Dipico hospital in Colesberg	R1.8 million							
	4.	Building of new clinic in Noupoot								
Thembelihle	1.	Upgrading and maintenance of cemeteries	R1.5 million	2007/08 2008/09	DEAT					
Kareeberg	1.	Rehabilitation of Carnavon prison	R2.5 million	2007/08	DEAT					
	2.	Rehabilitation of parks in Van Wyksvlei	R2 million	2007/08	DEAT					
	3.	Rehabilitation of parks in Vosburg		2007/08	DEAT					

Capital project by municipality: Environment

Capital project by municipality: Environment										
Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2008/09	2009/2010	2010/2011	2011/2012	
<i>Pixley Ka Seme District Municipal Area</i>		Upon management decision			R50 000	R50 000				
<i>Umsobomvu</i>	1.	Establishment of a waste management recycling plant	R10 million	2007/08 2008/09	DEAT					
<i>Emthanjeni</i>	1.	Establishment of a waste management recycling plant in De Aar	R10 million	2007/08	DEAT					
<i>Ubuntu</i>	1.	Erecting of a waste management recycling plant and home beatification	R19 million	2007-2009	DEAT					

Capital project by municipality: Rural Development – DMA’s and rural areas

Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2008/09	2009/2010	2010/2011	2011/2012	
DMA		Upon Council decision								

Capital project by municipality: Poverty Alleviation

Capital project by municipality / Every innovation										
Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2008/09	2009/2010	2010/2011	2011/2012	
District Municipal Area		Upon management decision								

Capital project by municipality: Gender

Capital project by municipality - 2008/09										
Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2008/09	2009/2010	2010/2011	2011/2012	

District Municipal Area		Upon management decision								
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Capital project by municipality: HIV/ Aids

Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2008/09	2009/2010	2010/2011	2011/2012	
District Municipal Area		Upon Council decision								

Capital project by municipality: Safety and Security – Crime Prevention

Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2008/09	2009/2010	2010/2011	2011/2012	

District Municipal Area		Upon management decision								
Umsobomvu	1.	Entrance gate reception building	R800 000	2007/08						
	2.	Construction of staff accommodation units at Doornkloof nature reserve	R3 149 000	2007/08						

Capital project by municipality: Tourism

Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2008/09	2009/2010	2010/2011	2011/2012	
District Municipal Area		Upon Council decision								

Umsobomvu	1.	Upgrading of Norvalspont lodge	R1.5 million	2007/08 2008/09						
	2.	Establishment of Umsobomvu cultural village in Colseberg	R2.5 million							
	3.	Upgrading of the main access and tourist road of the Doornkloof Nature Reserve	R27 million	2007/08						
Siyathemba	1.	"Die Bos" development	R37 million	2007-2009						
Siyancuma	1.	Upgrading the Douglas resort and conference facilities in Douglas	R15 million	2007/08	DEAT					
Emthanjeni	1.	Upgrading of De Aar accommodation and conference facilities in De Aar	R5 million	2007/08	DEAT					
Renosterberg	1.	Upgrading of the Vanderkloof resort and recreation complex	R25 million	2007/08 2009/10	DEAT					
	2.	Upgrading of Rolfontein nature reserve	R751 218	2007/08	DEAT					
Thembelihle	1.	Upgrading of Thembelihle holiday resort in Hopetown	R15 million	2007-2010	DEAT					
Ubuntu	1.	Establishment of tourist routes in Victoria West	R1.6 million	2007-2009	DEAT					

Capital project by municipality: Innovative Fund

Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2008/09	2009/2010	2010/2011	2011/2012	
<i>Pixley Ka Seme District Municipality</i>		To be decided by Executive Mayor/ Speaker			R259 000	R343 000				

Capital project by municipality: Youth

Municipality	Priority	Capital project	Project cost	Financial year(s)	IDP Allocations by PkS DM					Total year budget
					Financial year(s)					
					2007/08	2008/09	2009/2010	2010/2011	2011/2012	
District Municipal Area		Upon management decision			R50 000	R25 000				

Capital investment programme

Project name	Total year budget	Financial years				
		2007/08	2008/09	2009/2010	2010/2011	2011/2012

35. Project B

Table 58: Identified Projects by District Municipality for (2006/7-2008/9 financial years)

Municipality	Capital Project	Project Cost	Financial Years			Source of Funding		
			2006/07	2007/08	2008/09	IDP allocations	Inst/Grants	Total Year Budget
	WATER							
Renosterberg	Petrusville: Upgrading of water treatment plant in Vanderkloof and supply line between Vanderkloof and Petrusville	R12 151 303	2006/07	2007/08	2008/09		MIG	
	Phillipstown: Construction of reservoir, pipeline and installation of pumps	R5 million	2006/07	2007/08	2008/09		Drought relief	
Thembelihle	Hopetown: Upgrading of water treatment plant	R21 420 000	2006/07	2007/08	2008/09		MIG	
Siyathemba	Prieska: Upgrading of water treatment plant		2006/07	2007/08	2008/09		MIG	
Siyancuma	Schmitsdrift: Water reticulation	R1 million	2006/07	2007/08	2008/09		MIG	
Emthanjeni	De Aar: Upgrading of bulk water supply – borehole development	R23 712 000	2006/07	2007/08	2008/09		MIG	
	De Aar: Enhancement of water quality in De Aar	R2 154 315	2006/07	2007/08	2008/09		MIG	
	De Aar: Water network for 324 stands Ext 22	R2 664 146	2006/07	2007/08	2008/09		MIG	

	Britstown: Bulk water supply	R14 062 223	2006/07	2007/08	2008/09		MIG	
Kareeberg	Vanwyksvlei: Bulk water supply from Copperton		2006/07	2007/08	2008/09		MIG	
Umsobomvu	Colesberg: Supply line from purification works to reservoir	R2 400 700	2006/07	2007/08	2008/09		MIG	
	Colesberg: Bulk water supply from Orange river	R15 706 493	2006/07	2007/08	2008/09		MIG	
	Colesberg: Operation vula water reticulation	R386 855	2006/07	2007/08	2008/09		PIG& MIG	
	Colesberg: Norvalspont Mazizaki bulk water supply	R465 632	2006/07	2007/08	2008/09		MIG	
	Noupoort: Bulk water supply	R4 943 530	2006/07	2007/08	2008/09		MIG	
Ubuntu	Richmond: Construction of reservoir		2006/07	2007/08	2008/09		MIG	
	Victoria West: Construction of reservoir		2006/07	2007/08	2008/09		MIG	
Renosterberg	SANITATION		2006/07	2007/08	2008/09			
	Phillipstown: Construction of toilet structures	R300 000	2006/07	2007/08	2008/09		PIG	
	Phillipstown: Installation of toilets and erf connections	R300 000	2006/07	2007/08	2008/09		PIG	
Thembelihle	Hopetown: Installation of VIP toilets in informal settlement near Steynville	R1 446 000	2006/07	2007/08	2008/09		PIG	
	Strydenburg: Installation of bulk water sewer network and construction of toilet structures	R3 492 000	2006/07	2007/08	2008/09		MIG	
Siyathemba	Prieska: Upgrading of sewage ponds	R7 800 000	2006/07	2007/08	2008/09		MIG	
	Marydale: Bucket eradication		2006/07	2007/08	2008/09		MIG	
Siyancuma	Douglas: Sewer rising main	R6 598 556	2006/07	2007/08	2008/09		MIG	
	Griekwastad: Eradication of buckets – erf connections and structures		2006/07	2007/08	2008/09		MIG	
Emthanjeni	De Aar: Waste water collection system	R5 272 497	2006/07	2007/08	2008/09		MIG	
	De Aar: Sewer network for 324 stands ext 22	R4 666 875	2006/07	2007/08	2008/09		MIG	
	Hanover: Eradication of bucket system phase 1 Kwezi	R3 830 958	2006/07	2007/08	2008/09		MIG	
	Hanover: Eradication of bucket system phase 2 Tornadoville	R3 440 075	2006/07	2007/08	2008/09		MIG	
	Britstown: Eradication of bucket system phase 1 Mziwabantu	R3 923 681	2006/07	2007/08	2008/09		MIG	
	Britstown: Eradication of bucket system	R4 201 504	2006/07	2007/08	2008/09		MIG	

	phase 2 Proteaville							
	De Aar: Eradication of buckets in Malaycamp	R2 016 375	2006/07	2007/08	2008/09		MIG	
Kareeberg	Carnavon: Eradication of 650 buckets in Bonteheuwel bulk sewer network	R10 199 575	2006/07	2007/08	2008/09		PIG& MIG	
	Carnavon: Eradication of 650 buckets in Bonteheuwel House connections and structures	R4 000 000	2006/07	2007/08	2008/09		PIG& MIG	
	Carnavon: Upgrading of oxidation ponds	R8 000 000	2006/07	2007/08	2008/09		MIG	
	Vosburg: Eradication of buckets		2006/07	2007/08	2008/09			
Umsobomvu	Colesberg: Upgrading of wastewater treatment works	R7 249 262	2006/07	2007/08	2008/09		MIG	
	Noupoort: Replacement of sewer pumps	R742 666	2006/07	2007/08	2008/09		PIG& MIG	
	Colesberg: Lowryville & Zwelitsha bucket eradication	R4 264 650	2006/07	2007/08	2008/09		MIG	
	Norvalspont: Masizakhe oxidation ponds	R479 236	2006/07	2007/08	2008/09		MIG	
Ubuntu	Victoria West: Eradication of buckets	R1 596 000	2006/07	2007/08	2008/09		MIG	
	Richmond: Eradication of 174 buckets		2006/07	2007/08	2008/09			
	Victoria West: Eradication of 130 buckets		2006/07	2007/08	2008/09			
	Loxton: Eradication of 58 buckets		2006/07	2007/08	2008/09			
	Victoria West: Rehabilitation of existing oxidation ponds		2006/07	2007/08	2008/09		MIG	
	Richmond: Rehabilitation of existing oxidation ponds		2006/07	2007/08	2008/09		MIG	
Renosterberg	OTHER INFRASTRUCTURE		2006/07	2007/08	2008/09			
	Pertusville: Solid waste disposal site	R2 346 856	2006/07	2007/08	2008/09			
	Phillipstown: Upgrading of gravel access roads	R4 208 200	2006/07	2007/08	2008/09			
	Phillipstown: Construction of overflow for Rietfontein dam	R50 000	2006/07	2007/08	2008/09		DM	
	Petrusville: Upgrading of sport complex	R3 800 000	2006/07	2007/08	2008/09		MIG	
Thembelihle	Hopetown: Upgrading of gravel access roads in Steynville	R3 163 579	2006/07	2007/08	2008/09			
	Hopetown: Construction of Steynville sports complex	R1 600 000	2006/07	2007/08	2008/09		MIG	

Siyathemba	Prieska: Community waste disposal	R2 058 931	2006/07	2007/08	2008/09			
	Prieska: Upgrading of gravel roads	R4 948 651	2006/07	2007/08	2008/09		MIG	
Siyncuma	Douglas: Construction of access roads in and into townships	R20 466 572	2006/07	2007/08	2008/09			
	Douglas: Construction of access roads in and into townships	R1 532 000	2006/07	2007/08	2008/09		MIG	
	Douglas: Sport facilities	R4 987 791	2006/07	2007/08	2008/09		MIG	
	Campbell: Sport facilities	R2 891 910	2006/07	2007/08	2008/09		MIG	
	Griekwastad: Sport facilities	R3 268 836	2006/07	2007/08	2008/09		MIG	
Emthanjeni	De Aar: Upgrading of waste disposal site	R1 883 628	2006/07	2007/08	2008/09		MIG	
	De Aar: Upgrading of landing strips of De Aar airport	R11 350 225	2006/07	2007/08	2008/09		MIG	
	De Aar: Stormwater channel between Nonzwakazi and Barcelona	R735 015	2006/07	2007/08	2008/09		MIG	
	De Aar: Stormwater masterplan	R429 250	2006/07	2007/08	2008/09		MIG	
	De Aar, Hanover and Britstown street lightning	R3 541 182	2006/07	2007/08	2008/09		MIG	
	De Aar: Upgrading of merino park sport complex	R4 252 863	2006/07	2007/08	2008/09		MIG	
Kareeberg	Carnavon: Upgrading of gravel roads	R422 468	2006/07	2007/08	2008/09		MIG	
Umsobomvu	Noupoort: Kwazamuxolo sport complex		2006/07	2007/08	2008/09		MIG	
Ubuntu	Victoria West: Solid waste site	R1 444 380	2006/07	2007/08	2008/09		MIG	
	Victoria West: Area lightning	R684 000	2006/07	2007/08	2008/09		MIG	
			2006/07	2007/08	2008/09			
	FLOOD DAMAGE		2006/07	2007/08	2008/09			
Pixley ka Seme	MR 791 Petrusville – Colesberg	R1 655 189	2006/07	2007/08	2008/09		MIG Disaster Funds	
	MR 798 & MR 812 Vanderkloof – Keurtjieskloof	R785 067	2006/07	2007/08	2008/09		MIG Disaster Funds	
	MR 802 & DR 3111 Witput – Wanda	R1 494 917	2006/07	2007/08	2008/09		MIG Disaster Funds	
	DR 3103 Douglas – Strydenburg	R326 805	2006/07	2007/08	2008/09		MIG Disaster Funds	
	Minor road 27/5Ht	R163 882	2006/07	2007/08	2008/09		MIG Disaster Funds	
	MR 606 Richmond – Graaff-Reinette	R1 782 929	2006/07	2007/08	2008/09		MIG Disaster Funds	
	DR 2442 Colesberg – Noupoort	R180 968	2006/07	2007/08	2008/09		MIG Disaster Funds	

	Minor road 65R Richmond – Vergelegen	R191 439	2006/07	2007/08	2008/09		MIG Disaster Funds	
	Minor road 20P & 21P Prieska – De Duinen	R1 245 266	2006/07	2007/08	2008/09		MIG Disaster Funds	
Pixley ka Seme	HEAVY ROAD MAINTENANCE		2006/07	2007/08	2008/09			
	MR767 Carnavon – Prieska km 76-156	R170 000	2006/07	2007/08	2008/09		Roads	
	MR 809 Griekwastad – Douglas km 39-48	R100 000	2006/07	2007/08	2008/09		Roads	
	DR 3023 Huishoek – Swemkuil km 15-16	R10 000	2006/07	2007/08	2008/09		Roads	
	MR 801 Prieska – Hopetown km 0-14	R100 000	2006/07	2007/08	2008/09		Roads	
	TR 69/01 Prieska – Niekershoop km 31-44	R75 000	2006/07	2007/08	2008/09		Roads	
	DR 3126 De Hoek km 0-8	R50 000	2006/07	2007/08	2008/09		Roads	
	DR 3122 Saltlake – Hayfield km 9-26	R20 000	2006/07	2007/08	2008/09		Roads	
	MR 791 Petrusville – Colesberg km 42-43	R20 000	2006/07	2007/08	2008/09		Roads	
	DR 3124 Katlani km 0-17	R100 000	2006/07	2007/08	2008/09		Roads	
	DR 3024 Reedsdrift km 105-110	R50 000	2006/07	2007/08	2008/09		Roads	
Pixley ka Seme	ROAD CONSTRUCTION		2006/07	2007/08	2008/09			
	DR 3103 Douglas – Strydenburg	R326 000	2006/07	2007/08	2008/09		Roads Flood damage	
	Minor road 27/5Ht	R160 000	2006/07	2007/08	2008/09		Roads Flood damage	
	Minor road 20P & Prieska – De Duien	R160 000	2006/07	2007/08	2008/09		Roads Flood damage	
	MR 767 Carnavon – Prieska	R325 000	2006/07	2007/08	2008/09		Roads Flood damage	
	DR 3083 Sodium	R150 000	2006/07	2007/08	2008/09		Roads Flood damage	
	DR 3107 Hopetown – Perskadam	R200 000	2006/07	2007/08	2008/09		Roads Flood damage	
	DR 3067 De Aar – Strydenburg	R150 000	2006/07	2007/08	2008/09		Roads Flood damage	
	DR 3052 De Put – Thomasgat	R150 000	2006/07	2007/08	2008/09		Roads Flood damage	
	DR 2441 Colesberg – Oorlogspoort	R270 000	2006/07	2007/08	2008/09		Roads Flood damage	

	MR 606 Richmond – Murraysburg	R270 000	2006/07	2007/08	2008/09		Roads Flood damage	
	TR 69/01 Prieska – Niekershoop, Kransfontein km 27-29	R200 000	2006/07	2007/08	2008/09		Roads regravelling	
	MR 811 Douglas – Smidtsdrift km 14-21	R500 000	2006/07	2007/08	2008/09		Roads regravelling	
	MR 803 Hopetown – Douglas km 50-55	R500 000	2006/07	2007/08	2008/09		Roads regravelling	
	DR 3123 Hayfield – Heuningskloof km 6-38	R1 700 000	2006/07	2007/08	2008/09		Roads regravelling	
			2006/07	2007/08	2008/09			

- 6 -

**URBAN RENEWAL
GUIDELINE DOCUMENT**

PIXLEY KASEME INTEGRATED ENVIRONMENTAL MANAGEMENT PLAN:

URBAN RENEWAL PROJECTS AND PRINCIPLES FOR TOWNSHIPS AND HUMAN SETTLEMENTS

TABLE OF CONTENTS

1	Specific project proposals: SMALL-SCALE INTERVENTIONS.....	2
1.1	Children Play Areas	2
1.2	Sidewalk Improvements	2
1.3	Safe Road Crossings	3
1.4	Social Areas at Commercial Centres	4
1.4.1	Larger Towns and Urban Centurms.....	4
1.4.2	Township Areas.....	5
1.5	Active recreation areas	5
1.5.1	Township Areas.....	5
1.5.2	Picnic Areas	6
1.5.3	Social Facilities Such as Outdoor Performance Areas or Community Halls.....	7
1.6	Urban Agriculture	8
1.7	Policing of Public Use Areas	10
1.8	Stream Rehabilitation and Channel Improvements	11
1.9	Hiking and Bicycling Trails	11
1.10	Street Furniture Design	14
2	Specific project proposals: MEDIUM TO LARGE-SCALE INTERVENTIONS.....	15
2.1	Pilot Project #1: Provision of Multi-functional Hall and Buildings and Upgrade of Existing Sport Facilities.....	15
2.2	Pilot Project #2: Upgrade of Major Commercial Corridor.....	16
2.3	Pilot Project #3: Upgrade and Expansion of Existing Community Service Building Grounds	17
2.4	Pilot Project #4: Street Upgrades.....	18
3	Xeriscaping	20
3.1	Principles of Proper Site Planning.....	21
3.2	Soil Analysis	24
3.3	Appropriate Plant Selection.....	25
3.4	Practical Lawn Areas	26
3.5	Efficient Irrigation	28
3.6	Use of Mulches.....	30
3.7	Appropriate Maintenance	31

1 SPECIFIC PROJECT PROPOSALS: SMALL-SCALE INTERVENTIONS

The following small-scale interventions have been identified for implementation in public open spaces within towns and especially townships and informal settlements within the Pixley Ka Seme District Municipality (PKSDM). These projects have been selected based on past experience from open space development and urban renewal projects in Galeshewe in Kimberley and the PKSDM Local Municipality and have been developed in conjunction with both the relevant municipalities and communities and interest groups from both these areas. It is however important to note that these proposals are conceptual only and intended to guide thinking and design efforts for the remaining open spaces within the various settlements within PKSDM. Minimum and general guidelines for each project type are as follows:

1.1 CHILDREN PLAY AREAS

- A minimal area of paving of approximately 100 square metres of non-slip paving material with adequate drainage should be provided for general play and as a potential multi-purpose area where other recreational activities can take place.
- A minimal set of play equipment for pre-school children.
- A minimal set of play equipment for primary school children
- Two benches set on the paving and in close proximity and close to pre-school play areas for mothers to keep eye on their children.
- A minimum of three shade trees – one set in the paved area and two adjacent. Additional shade trees can be allowed along the periphery of larger spaces, which will help with spatial delineation. However care must be taken that sight lines around street corners, as well as to entrances to the park (both pedestrian and possibly vehicular) are not obscured.



1.2 SIDEWALK IMPROVEMENTS

- Due to the drought, harsh sunlight and lack of vegetation, shade trees should be provided wherever feasible, along all sidewalks along roads and streets – one approximately every 10 metres. Hardy species that are adapted to this region should be used and should preferably be indigenous, although non-invasive exotics such as *Schinus molle* may also be utilised. In urbanised areas it is beneficial if the trees are arranged in patterns and alternate with the

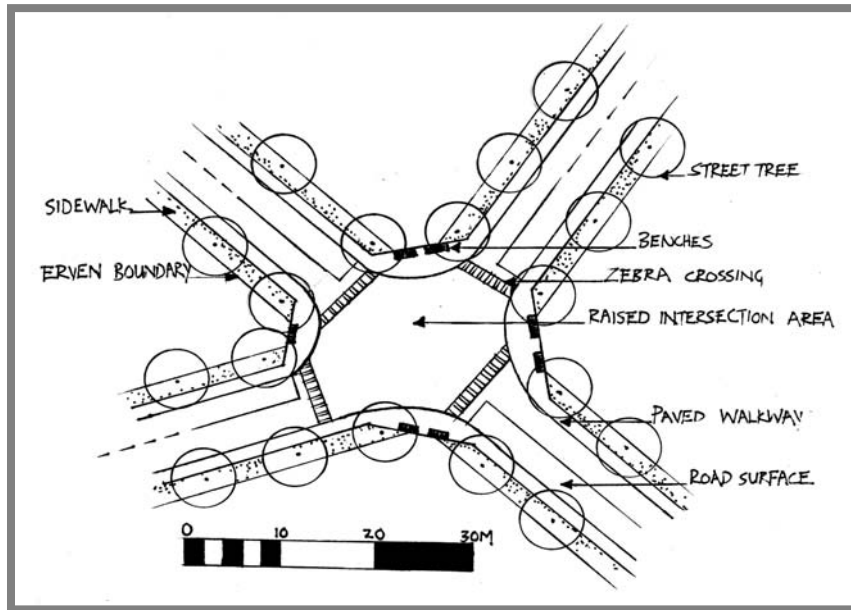
streetlights, however along larger roads or in more rural areas and where roads transect or border natural areas, trees should be irregularly spaced or clumped to simulate more natural groupings.

- Where financially feasible paved walkways should be provided along all streets and roads frequently used by pedestrians. This is specifically important within the rural township areas, since the streets are extremely dusty here and washed away due to bad storm water management programmes.
- One seating area should be provided every 200 meters along major pedestrian and vehicular routes.
- Adequate lighting for evening comfort and user safety is essential. Especially in the rural townships, adequate night time lighting is crucial as often informal settlements expand at a faster rate than at which services are implemented. In these areas high-mast lighting are effective at illuminating large areas, especially public areas. During a survey done for the Galeshewe Open Space and Landscape Plan (GOSLP; 2004) a significant number of residents indicated that although these lights are not particularly attractive, they prefer these lights to standard street lights, or a combination of standard and high mast lights to standard street lights only, as safety is often greater in such areas.

1.3 SAFE ROAD CROSSINGS

- Road crossings can form an integral part of the open space network of any neighbourhood or city, especially in instances where pedestrian activity is prevalent. Often street corners are significant social interaction areas within townships and rural settlements. Street vendors use these spaces to peddle their wares, commuters wait for taxis and people meet each other here to go to mutual destinations. Subsequently these spaces should be both safe and accommodating to the needs of pedestrians and vehicle users.
- Sidewalks should ideally be provided on all four corners of intersections, to increase pedestrian safety and usability. These elements should be considered a minimum where high amounts of pedestrian and vehicular traffic have to interact.
- Signage that indicates to the drivers to stop at the stop sign must be provided.
- Seating areas should be provided near at least two sides of the intersection, with litterbins and adequate lighting.
- Raised areas should be created in the intersection of the two streets. This is again true where large amounts of pedestrian traffic must interact with vehicular traffic, such as busy streets in the rural townships.

- Zebra crossings should be painted on the road surface. In busy streets where vehicles travel at high speeds, the raised area can be created from another material, to enhance its visibility.



1.4 SOCIAL AREAS AT COMMERCIAL CENTRES

1.4.1 Larger Towns and Urban Centurms

- Ideally commercial centres and shopping complexes should be placed in close proximity to public parks, so that people have the option of enjoying lunch, strolling or recreating in other ways before or after they go shopping. It is much more likely that especially larger parks or passive recreation places will be more frequently used if they are associated with activity centres, than if they are located far from public amenities. It is therefore crucial that the remaining public parks or open spaces within all towns within PKSDM be retained and properly maintained and that where feasible, small retail outlets or other attractions be provided close to these spaces.
- All remaining indigenous trees and larger non-invasive exotic trees should be retained in these spaces however invader species, vegetation that excessively obscure views through these spaces and may potentially pose hiding places for criminals, should be removed. Furthermore small, secluded pockets of planting that attract littering should be avoided.

1.4.2 Township Areas

- In rural townships social areas at commercial centres are particularly important as they often play a significant role in communal life, and should be within walking distance of the commercial centre.
- A minimal area of paving of approximately 100 square metres should be provided at an open area close to the shops, to allow for a variety of different social activities. If feasible small lawn areas should be provided adjacent to the paved sections, to facilitate mothers and children, or more leisurely recreation. Where lawn cannot be established due to lack of irrigation water, small areas of synthetic playing surfaces or sandpits may be considered.
- Vehicular access to such spaces should be restricted by bollards or non-mountable kerbs, in order to prevent misuse as taxi ranks or washing areas. However adequate provision for taxis should be made in close proximity to such areas.
- Adequate seating should be set on the paving areas of smaller spaces and should be provided with litterbins and adequate lighting.
- At least one shade tree should be provided per seating area.
- Larger open areas close to significant commercial centres are often used for informal vending, sport, performances and playing music from car stereos. These activities should be catered for by providing adequately paved surfaces. Where vehicular access is required or desirable the areas used by vehicles should be clearly demarcated and separated from areas that may be used by children or for sports activities, with bollards. The distinction between adjoining hard and soft surfaced spaces can be further reinforced by using trees along the periphery, which will increase their appeal.

1.5 ACTIVE RECREATION AREAS

1.5.1 Township Areas

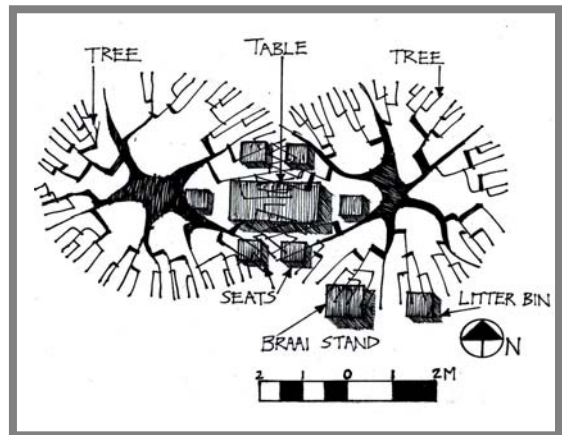
- **Informal soccer field:** The site surveys of some of the township areas within the study area revealed that soccer fields within most of these townships are often in a poor condition and lack lawn, due to a lack of irrigation water and poor soil conditions. Construction of these fields should therefore be of levelled, rolled dirt with a curb installed all around the play area but set back from the play area. Shade trees just outside of the playing area are essential.
- **Netball court with hoops:** Wherever there is space, netball courts should be provided adjacent to or near soccer fields, as often there are very few areas that cater for female sports.

Construction of court should be of rolled dirt with a curb installed all around the play area but set back from the play area.

- A spectator area with adequate trees for shading should be provided at all sports venues. A maximum of approximately fifty spectators must be accommodated at all soccer fields and ten to twenty spectators at netball fields.
- One tree per ten spectators or part thereof must be provided.
- Water facilities such as basins and drinking fountains are important at public sport facilities. These should be designed as robust as possible and all pipes and other working parts must not be accessible by users, save for the fountain nozzle and button.
- Where more frequently used sports facilities are concerned, provision should be made for informal vending. This should be in the form of an appropriately placed hard-surfaced area and possibly permanent vending stands. However these structures should be designed to be robust, vandal proof and must not be removable.
- Benches must be grouped under shade trees.
- Paving areas at the street curb to link with public transportation.
- Trash receptacles should be provided at the seating areas.
- Lighting should also be provided along walkways where possible. High-mast lighting will be particularly effective at larger sports complexes or multiple sports fields.

1.5.2 Picnic Areas

- Picnic areas are essential to any sizeable public park as this is one of the main activities that will ideally take place here. Such areas should be incorporated into all existing parks within the PKSDM and planned for all new parks.
- Larger public parks should have a covered structure of a minimum size of five by eight metres to allow for a variety of uses. Ideally such a structure should also have, or be directly adjacent to, seats and tables.



- The structure should be so located that prevailing cross-winds ventilate it and it should be fully shaded by trees, especially during mid-day and afternoons. Failure to do so will result in uncomfortably hot places that will not be used.
- Where such structures occur in parks / public areas close to centres of significant commercial activity, these structures should be provided with an electricity point, with pay-by-the-minute meters. These must be locked inside a vandal proof box. Keys for these are to be obtained from

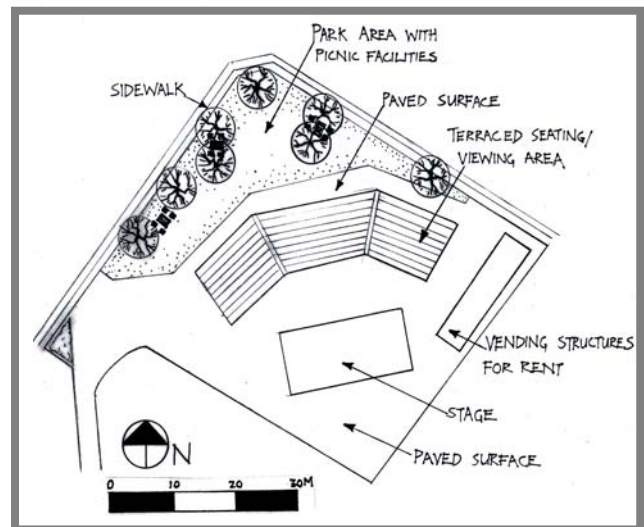
municipal representative or park attendants, after payment has been made for use. In this fashion the park can generate a small amount of revenue, which may help to subsidise maintenance.

- Water point with a lockable tap can also be provided. Keys are to be obtained from a municipal representative or park attendant after payment has been made for use.
- Trees should be scattered throughout the space and should have lawn in at least some locations for informal seating on blankets.
- In larger parks a shaded lawn area to allow for large group gatherings should be provided. Trees are to be planted in the lawn areas to prevent informal soccer activities from destroying lawn. In very large parks several spaces of this size can be created, by separating them with rows of trees and other planting. However care should be taken to preserve sufficient visibility to ensure the safety of users.
- Braai areas should be provided on the edge of the lawn areas under the trees to accommodate approximately ten groups of five to ten people.
- For larger parks, a paved road surface should ideally be provided all around the lawn area to allow access to braai facilities. A curb or low fence must be provided to prevent cars from driving onto the lawn.
- Trash receptacles must be provided at every braai stand.

1.5.3 Social Facilities Such as Outdoor Performance Areas or Community Halls

- The versatility and robustness of most large parks can be significantly increased if they are provided with facilities to accommodate ancillary activities, such as performances or gathering areas. This is particularly true for most rural townships, as often there are few structured venues where events such as performances, community gatherings, meetings and larger parties can be facilitated. By providing such facilities in larger parks or near sports venues, the potential uses of the open space are greatly increased.
- A roofed stage area should be provided to accommodate approximately twenty people. For larger facilities electricity points should be provided, for which access can be obtained from a central office, for a refundable deposit. Well-known venues such as a local Tourism Office or Information Centre can provide such services, to avoid the need for additional offices to be built.
- A raised seating area should be provided, to allow for viewing access to the stage area. These structures can be built to accommodate approximately 200 people, although for smaller stages a maximum of approximately 50 people should be catered for.
- A paved area should be created around the stage and seating area to prevent erosion and to provide informal vending and entertainment activities.
- Informal vending stalls should be available to rent for specific events.

- Picnic areas should be created under trees, to allow for multiple uses of the space.
- Safe access routes for pedestrian, cyclists and vehicles are essential and places should be provided where cyclists can secure their bicycles.
- Fencing must be provided around the stage facility area, to allow for the safe locking of the facility when not in use.
- Safe off-street parking areas must be provided where possible.
- An access point on all street intersections must also be provided to allow access to public transportation systems.



1.6 URBAN AGRICULTURE

- Often in townships and rural areas urban agriculture is practiced by individuals in a corner of their yard. Due to the very low average arability of the soil in the region, large scale crop production is not feasible and thus small-scale subsistence and commercial farming should be encourage. Thus the opportunity exists for greater communal urban agriculture and greater co-operation between individual residents.
- Fertilized soil areas that can accommodate approximately five to ten people working on plots of approximately ten by ten metres can be established between two or three individual homes. Thus an area of approximately 100 square metres can be established that are managed and maintained by two or three households. Produce can be grown for own consumption and the surplus sold at local markets or at vendor stands.
- It is essential that urban farmers be assisted financially and in terms of experience in order for organised urban agriculture projects to succeed. Where new townships or extensions of existing ones area planned, the municipality should allocate areas for urban agriculture as described above and provide subsidies to farmers willing to utilise and care for these plots. Subsidies should ideally be in the form of seed and fertiliser with inputs from trained persons, to assist the



farmers in establishing the plots. These patches of farmland will form an integral part of the open or “green” space network within townships and contribute to making them more sustainable.

- Communal water points will be required for successful urban agriculture to take place. Treated effluent water should not be used for the production of crops that will be consumed, as it is very difficult to ensure that the water is properly treated, especially in rural townships where quality control and maintenance cannot be ensured. Instead fresh municipal water must be provided, or grey water from kitchens must be filtered and cleaned. Water from roof collection points can also be utilised and stored in large containers. These containers can be located next to each residence or at a central position serving several residences.

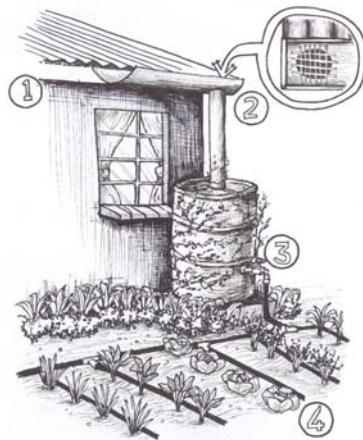


FIGURE 1

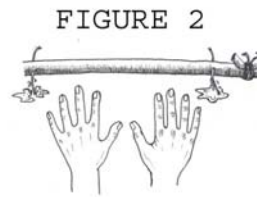


FIGURE 2



FIGURE 3

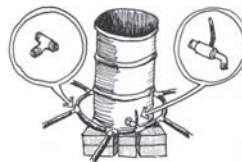


FIGURE 4



FIGURE 5

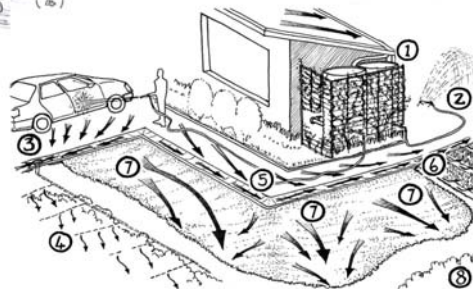


FIGURE 6

FIGURE 5

- Trees for shading of workers should be planted at intervals of approximately twenty meters on the periphery or close to the farm plots, thus at least one tree per plot. These trees could be fruit-bearing trees such as Olives or Oranges. However care must be taken to ensure that the trees do not shade the crops, which will hamper their growth and result in a lower yield.
- Permanent seating areas and structures could be provided under the trees to increase the usability of these spaces.
- Secure, vandal proof, lockable sheds should also be provided for each plot, for storage of tools and equipment.

1.7 POLICING OF PUBLIC USE AREAS

In order for public open space to be viable and useful to the communities that they intend to serve, it is of paramount importance that these spaces are made safe. Even the most attractive and well cared for park will eventually fall into disrepair, if criminal or unsavoury elements are not kept out of them. Often parks that are otherwise appealing and functional, are not used by the public as they are perceived as unsafe, which eventually leads to them falling into disrepair. It is therefore crucial that the public open spaces in the greater PKSDM be made safe for the people that are to use them. The following steps, where appropriate, should be employed:

- Visibility through and into any park is of crucial importance. Thus dense vegetation along the border of any park or public open space should be avoided, especially at entrance points.
- Tree species that have canopies that are well clear of the ground should be selected. Low, dense, multi-stemmed species should be avoided or pruned, and should not be used with clumps of smaller shrubs, as these pockets of vegetation may afford ill doers hiding places.
- It is important that access into especially larger parks or open areas occur only at certain entry points specifically created for that purpose. However the method of enclosure selected should be as opaque as possible, to allow ample visual penetration.
- Access to large nature areas or conservation nodes, should be controlled and monitored by security personnel. Several successful examples of this method of public open space security are found in larger cities such as Pretoria, where security guards keep a logbook of people entering and exiting public hiking trails or conservation areas. If all people are not accounted for by closing time, they know to inform the police or at least search for the missing person/s. This method of public open space policing also has the benefit of job creation and the wages of the guards and any required infrastructure such as guard huts etc. can be partially subsidised by local interest groups, or homeowners associations in the area.
- The municipality must investigate the potential of establishing a park police corps that are responsible for patrolling public open space areas and relaying all necessary information to

the police. This unit can also work in collaboration with neighbourhood watch organisations, to ensure a more effective and integrated approach to safeguarding public open spaces.

1.8 STREAM REHABILITATION AND CHANNEL IMPROVEMENTS

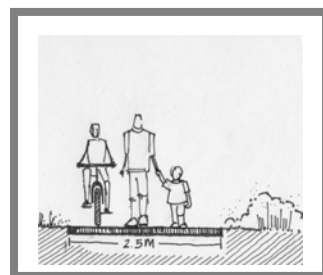
The study area is characterised by a great abundance of streams and waterways, which contribute greatly to its scenic quality and appeal. However unfortunately rivers and streams are often some of the most infested habitats and are clogged with alien vegetation and littered with debris and household rubbish. It is very important that these habitats be protected and rehabilitated wherever possible as they form a vital part of any open space or ecological framework.

Generally river courses and riparian habitat in conservation and remaining natural or rural areas are in a more pristine condition than water bodies within urban and settled areas. Here invader species such as *Melia azedarach*, *Arundo donax*, *Lantana camara*, *Eucalyptus* species and exotic *Acacia* species have often along many river courses. Heavy littering also usually occurs along and in streams in the vicinity of residential and urbanised areas. Unlicensed (and therefore illegal) farm dams in larger rivers are a common occurrence and have serious detrimental environmental consequences.

The National Environmental Management Act (NEMA), the National Water Act and the Biodiversity Bill require the responsible management of ecological and biophysical resources of the country. Urban ecological areas are also of concern in the acts and must be managed in a responsible manner. It is therefore essential that stream, wetland and ground water management and rehabilitation programmes be established.

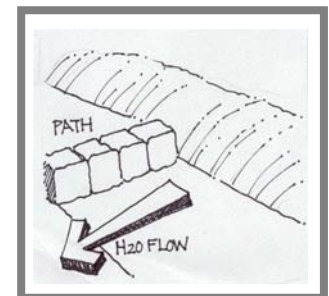
1.9 HIKING AND BICYCLING TRAILS

Apart from passive recreation and sports, many of the open spaces within PKSDM itself require well-established hiking and biking trails running throughout towns. These activities should be facilitated by providing paved walkways that connect the various green / open spaces throughout the city, in order for users to be able to commute on foot from one such area to the next with ease. In this fashion a series of interlinking “meanders” can be created, which will greatly improve the potential for these places to be experienced as being integral to a town and not merely a random collection of isolated spaces that do not form a part of the larger planned structure. The following guidelines should be followed wherever



walkways and cycle routes are established:

- Sightlines – ensure that paths have good longitudinal visibility, avoiding sharp bends.
- Margins – paths should have open space to both sides. Where the vegetation comes up to the path it should be opened to allow visibility through it. Where feasible open verges are also recommended for habitat creation and visual variation.
- Lighting – adequate lighting is appropriate in some areas, especially where there is high activity after hours. Lamp poles should be of a human scale but high enough that the light fittings are out of reach of ill doers, thus approximately 4.5 meters high. In order for the various pedestrian/ cycle routes or meanders to be visually recognisable, it is suggested that slightly different lamp-poles, litterbins and other street furniture be used along each route. This will heighten the degree of visual variation within the city and help to create visually recognisable routes.
- Path widths – they should be wide enough or have passing places so that people can pass comfortably, 2 to 2.5 metres.
- Thinning – Where space is sufficient, differentially thin treed areas can be created, and provided with seated rest areas and possibly tables for picnicking. However these spaces must have low stem densities and good visibility to the pathway to ensure safety.
- Undergrowth – shrubs and tall herbaceous vegetation are viewed with great suspicion by many townspeople. Mown verges and low vegetation is preferred close to activity areas. Keep areas specifically designed for wildlife away from high activity areas.
- Concentrate uses – active areas are safe areas. Group activities of similar nature and provide short distances from access roads to these activities.
- Patrol the area – neighbourhood watches on foot, or better yet, on bicycles, mounted police, or environmental wardens provide a presence that deter vagrants and that ensure surveillance and monitoring. Also areas where vagrants tend to congregate must be mowed continuously and planted with tall trees only, to ensure clean views and sight lines into these sites.
- Slope – to accommodate elderly people, wheelchairs and small children on bicycles, the pathways should not be steeper than 5%.
- Drainage – Drainage is of the utmost importance in all trail and walkway construction. Dispose of water to the side of the walkway without causing erosion. Where required construct water diversion bars into the longitudinal section of the walkway.



- Surface material – all surface material must be of a rough texture to prevent slippage. High traffic areas must have a durable paving material, such as interlocking blocks, rough finished concrete, or broken brick paving.
- Informal crossings of the stream should not be removed, but should be made safe for crossing. An elementary steel or timber bridge could be installed that is made of flat timber poles covered with chicken wire to prevent people from slipping. Handrails must be provided at all stream crossings. This type of construction must be low in the stream bed as to not be an obstruction during flooding conditions. The flood will pass over the bridge.
- Handrails – in areas where the walkways may be treacherous a single handrail should be installed. The handrail must be approximately 900 mm high.
- Interpretative signage – Where ecological features are located, or where bird nesting sights or indigenous trees are growing, informative signage could be installed. The signage must be weather proof, vandal proof, durable and display information in an easily understood manner. It is especially important that signage such as this should be introduced within town areas, in order for its residents and visitors to realise that nature is not confined to areas outside of the city and that by conserving and highlighting these areas within cities, their appeal is greatly enhanced.
- Resting areas – provide resting areas along the pedestrian meanders at intervals of approximately 200 metres, or closer if affordable. The seating could be in the form of benches or seating walls. Along pedestrian routes within urban conservation areas or larger parks, large rocks that fit into the environment more readily should be considered. Rocks are also less easily vandalised. Provide trash receptacles and a light post at the seating or resting areas.
- Links – provide links with public transportation routes, and public facilities such as clinics, commercial centres, sports centres, and institutions such as schools.
- Vehicle access – prevent vehicle access into resting areas along the meanders in all cases. In most cities and densely populated areas, pedestrians are being ostracised by city planning that is almost exclusively planned to accommodate vehicular traffic. This results in pedestrians feeling unsafe, especially along very busy roads, where sidewalks are often included as an afterthought, or are completely insufficient to accommodate the amount of pedestrian traffic that it must. It is thus vitally important that vehicles area kept out of public areas that are intended for pedestrian use.



Within the townships the guidelines mentioned above are also especially significant as a large percentage of the population commute by foot or cycle. Especially women, children and older people use such routes increasingly as the townships expand. Under the current conditions of unpaved surfaces, lack of shading,

vast open areas, and illegal dumping, these users are most likely to feel uncomfortable in most of the areas. Thus it is of the utmost importance to design the facilities to alleviate the anxieties of users and to provide a safe environment for all user groups.

1.10 STREET FURNITURE DESIGN

Street furniture and small projects must be constructed and completed by the people of PKSDM and especially the townships and rural settlements. Significant skills are available within the townships to ensure that most of the project could successfully be completed by the residents. The project manager and the project Co-ordinator can identify the persons to be employed as SMME contractors to be trained for the execution of specific projects.

2 SPECIFIC PROJECT PROPOSALS: MEDIUM TO LARGE-SCALE INTERVENTIONS

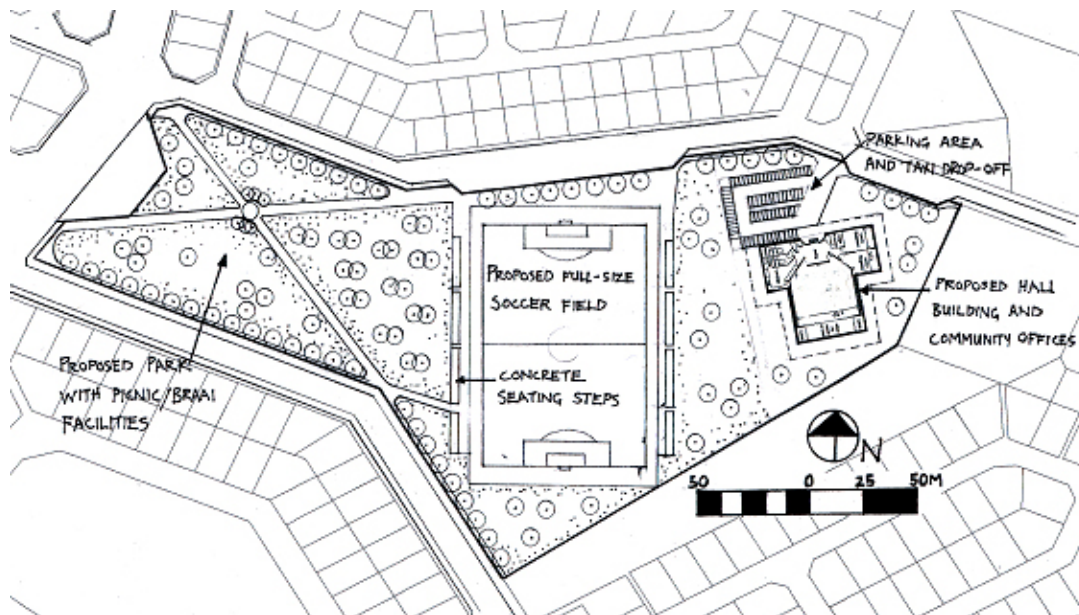
In this section written and sketch plan descriptions are presented for several concept developments as examples of possible improvements to existing open spaces within the townships within the PKSDM. It is important to note that these conceptual improvement plans are intended as guidelines only, based on past experiences and the wishes of community members interviewed during other similar projects. Detailed plans and designs have to be created for each individual project, based on its specific requirements and for the circumstances within which it occurs.

2.1 PILOT PROJECT #1: PROVISION OF MULTI-FUNCTIONAL HALL AND BUILDINGS AND UPGRADE OF EXISTING SPORT FACILITIES

During the field survey it was established that there are many open spaces within the townships that currently have a rudimentary soccer field consisting only of two goal posts and a level playing-surface, with no other facilities or amenities that will stimulate more intensive use of the spaces within which they are situated. In especially larger lots of approximately 2 to 3 hectares, this is not effective use of land yet such spaces are not uncommon. Subsequently the following upgrades are suggested for relatively large open spaces that have little else than a basic soccer field to offer users. A similar layout can also be adapted for parks planned as part of the open space network of new extensions or suburbs of PKSDM, in which case the soccer field should be substituted for a rugby field or tennis and netball courts:

- Provision of the following buildings should be considered for such spaces:
 - o Recreational centre and community hall, probably as one multi-functional and multi-spaced building, with community offices and electricity vending facilities. This should be situated opposite the soccer field and other sport facilities with enough distance between them that both facilities can be utilised simultaneously without disturbing each other, yet close enough that during larger sports events use can also be made of the building:
 - o Provision of a separate clinic and crèche building can also be considered in such spaces.
- Provision of the following support infrastructure for this building complex:
 - o Parking with trees for about 10 to 15 vehicles and safe access to the parking areas situated close to the complex so that possible deliveries can be made. Overflow parking must also be provided for spectators at the soccer field,
 - o A taxi stop with a shelter and adequate lighting so that spectators have access to public transport,
 - o Adequate pedestrian circulation provision to and around the complex,

- o Additionally vending facilities may be provided near the taxi stop, or alternatively they may be located in the adjacent park area mentioned below.
- Upgrade the soccer field by providing a decent playing surface and nets, flood lighting around it, seating structures or well-tended lawn viewing areas and pedestrian circulation to these areas. Trees can also be placed intermittently between the seating structures for shade.
- Where irrigation water is available provision of a park area adjacent to the soccer field, consisting of paved pedestrian circulation routes, high-branching trees, a small lawn area and several benches. A market area can also be considered as part of the park area.



2.2 PILOT PROJECT #2: UPGRADE OF MAJOR COMMERCIAL CORRIDOR

Public spaces become more frequently used if they are associated with other attractions such as commercial corridors or shopping complexes. Furthermore especially in communities where pedestrian commuting is predominant, such as the townships and rural settlements, streets become significant open spaces in themselves. Taxi stops become social gathering places, parking lots may serve as vending areas or playing fields, and sidewalks may become impromptu performance areas. Thus it is important that these linear spaces be viewed as part of the open space framework of a city and upgraded as and when required:

- Creation of speed bumps or other traffic calming devices along the entire length of the commercial corridor,
- Upgrade of existing taxi stop inlets by providing a shelter structure, seating, street lights and litterbins,

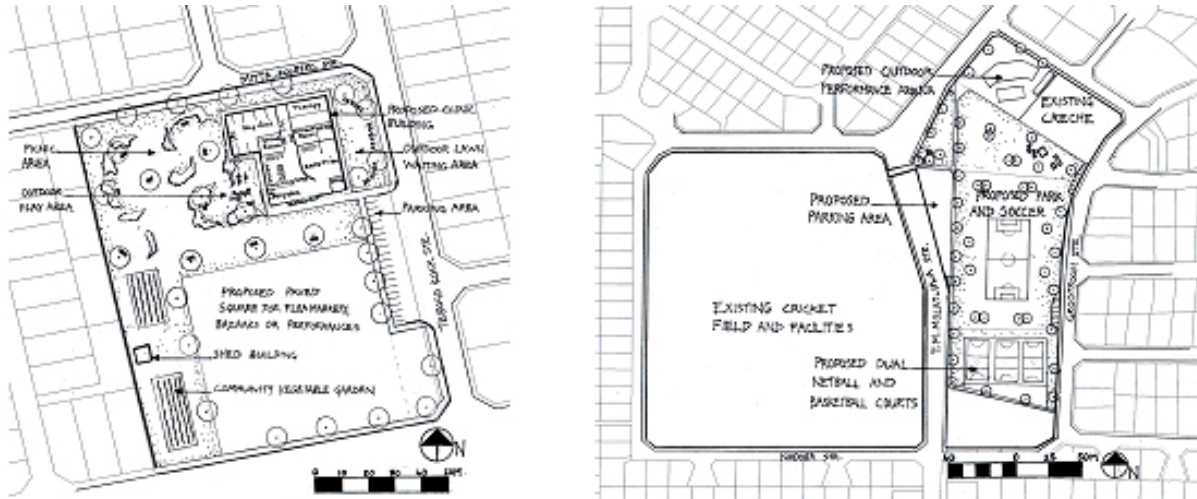
- Provision of at least one more fully facilitated taxi/bus stops on both sides of the main road, in front of the shop buildings, and a raised pedestrian crossing from one side to the other,
- Provision of paved parking with trees, safe entry/exit points, lighting, and a pedestrian walkway on both sides of the road.
- Storm water management system for the entire parking area through a channel and/or pipe system, to a suited of-site location, where infiltration trenches are to be constructed.



2.3 PILOT PROJECT #3: UPGRADE AND EXPANSION OF EXISTING COMMUNITY SERVICE BUILDING GROUNDS

- Provision of paved/tar parking space serving both the clinic and recreation hall. Physical barriers, e.g. a low fence, should be erected between the waiting/play area (see below) and parking area to prevent accidents.
- Outdoor waiting and play area for the clinic on one section of the property, in front of the clinic entrance. This should include seating structures, tables, litterbins, trees and lawn. Paved pedestrian areas should also be provided around the entire building, serving the entrances on both sides.
- Pedestrian access linking the clinic/recreation centre with the street.

- The remainder portion of the property aside of the clinic/hall building should also be planted with trees and lawn.
- A focal feature, in the form of a sculptural name structure or signage device should be erected on the corner in front of the property. This structure and associated landscaping must integrate with the existing paved walkway and should not hinder pedestrian circulation.



2.4 PILOT PROJECT #4: STREET UPGRADES

- Upgrade of existing road surfacing by providing a tarred surface. Adequate streetlights and signage should also be provided.
- Provision of a paved pedestrian walkway alongside, with clear distinction between it and the vehicular entrance.
- Paved parking in front of any existing shop building located along the street.
- Provision of concrete drainage channels alongside the streets to manage rainwater. These channels should join the drainage swale in adjacent parks where possible or lead to infiltration trenches created in suitable locations.
- Stabilisation of sidewalks, through planting, paving or combinations of both.
- Planting of additional trees, and provision of lights in these areas. Robust seating structures should also be provided under the trees.



3 XERISCAPING

A successful open space system is dependant both on sound planning and appropriate design and maintenance principles. In this respect landscaping choices are an important part of any city's greening programme. By making good planting choices and using appropriate management and maintenance principles, time and money are saved and the beautiful natural environment of PKSDM is protected.

The PKSDM region consists of several soil and climate combinations which mean that landscape decisions should be specific to each site. Each area has different soil types with different planting requirements. The native and adaptive plants (adaptive plants are non-native plants that thrive in this climate) that will thrive on these soils are also very different. Before planting, test the soil type and choose the landscape to fit. Each improvement area should be evaluated for the dominant soil type, and in this respect it should be considered obtaining a soil analysis from a specialist.

Where public use areas, especially parks and rehabilitated natural areas are designed and implemented, it is important to consider site-specific conditions related to soil and climate. Planting zones should be created in the landscape according to the various existing or improved soil conditions found over the site. Plants that have similar soil and water needs should be grouped together. For instance sites along moderately sloping areas, are likely to have shallower and possibly poorer soils than sites situated near streams or lower-lying areas.

Considering the prevailing climatic conditions in the PKSDM area, which can be especially dry during the winter, it is important to create public spaces that do not require much water to remain attractive and appealing to users. Often public parks fail to attract people simply because they do not look attractive and inviting. Plant species that require significantly more water than that which is provided by rain will not grow well, unless they are frequently watered. When this does not happen (due to financial and ecological considerations) the park will eventually appear neglected and unattractive and will eventually become disused. Therefore it is important to keep high water use plants to a minimum and group these together to make miniature "oasis" areas.

It is also beneficial to be aware of different microclimates that exist even on a single site. For example, reflected heat from walls or patios can create pockets of warmer temperatures for more tender plants, while plants exposed to cold winds need to tolerate colder winter temperatures. Native and adaptive plants thrive the best to the conditions found locally, and are low maintenance. Low maintenance alternatives to traditional landscaping are becoming the norm. In the PKSDM area, with its hot, mostly dry summers and predominantly dry winters, native and adaptive plants require very little water to thrive.

In the 1980's, the word Xeriscape was coined from the Greek word "xeros" for dry. Xeriscape is defined as "quality landscaping that conserves water and protects the environment." It is not a style of gardening, but a method of gardening. It is based on the following seven principles:

Developing a plan is the first and most important step in a successful low water, low maintenance park or urban green space. Consider the regional and microclimatic conditions of the site; existing vegetation and topographical conditions; how you intend to use your landscape; and the zoning or grouping of plants by their water needs.

The Xeriscape landscape takes into account the regional and microclimatic conditions of the site, existing vegetation and topographical conditions, the intended use and desires of the owner, and the zoning of plant materials according to their water needs. The landscape plan should allow the landscaping to be phased in, with initial phase installation and a future phasing-plan as part of the process. For instance where funds to fully implement a design for a park are not immediately available, trees, seating, braai structures and lighting should initially be installed. This will immediately create a space that is useable and appealing. Other elements such as play structures, paving areas and shrubs or lawn can be added as funds become available and a sufficient tree canopy has been established. Furthermore if trees are allowed to mature somewhat they can protect smaller, frost tender plants from frost when they are eventually planted.

3.1 PRINCIPLES OF PROPER SITE PLANNING

- Design of floor plans and foundations of public use buildings and structures should reflect the site topography.
- Split level plans, terracing, and decks can help integrate built features into site conditions and minimize the cost and effects of grading.
- Building orientation on an east-west axis with glass area minimized on walls with maximum solar exposure will decrease energy demands for cooling, particularly when combined with proper placement of shade producing plants.

Preserve and Protect as Much Existing Vegetation as Possible

- Incorporate existing trees when locating structures and power lines, allowing room for them to grow if they are not at mature size. If retained where possible, trees help to establish a strongly recognisable character for the city. Furthermore by retaining larger trees, a landscape can immediately attain a well-established look, which is not financially feasible if all the existing

vegetation on site is removed and replaced with new plants. According to several surveys conducted, retaining large trees can increase the value of a property by up to 15 %.

- Protect trees from damage during construction with clearly visible fencing located below the outermost branches (see Figures 1 & 2) and flags in overhanging branches. See illustrations for where to locate fences. Much of the damage that occurs to trees during the construction process is due to soil compaction from heavy equipment and materials being driven or stored under trees.
- Roots, which extend out far beyond the trunk are damaged when soil becomes compacted. This will cause trees to go into a gradual decline, and eventually die.
- Filling or cutting in tree root areas will also kill trees. Use tree wells or decks to work around tree trunks, roots and slopes.

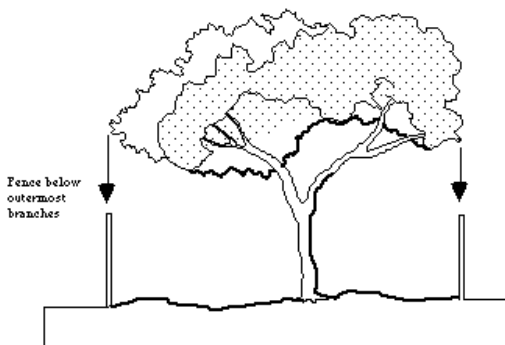


Figure #1 Tree Protection Fencing

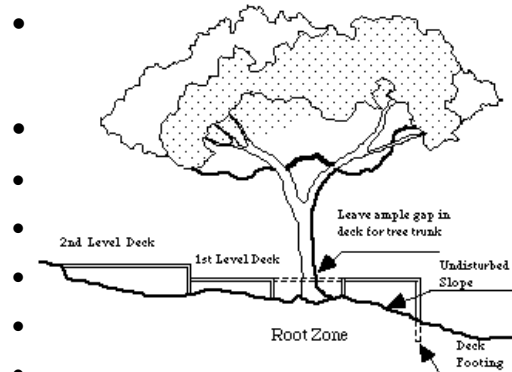


Figure #3 Terraced Deck on Slope with Tree

- Avoid trenching in tree root zones; try tunnelling instead to locate buried utility lines.
- If areas around trees must be paved, use pervious materials or, at a minimum, leave large holes spaced at regular intervals in the tree's root zone (openings will help give trees needed air and water). Never dump paints or solvents near trees. These cause plant death and soil contamination. Dispose of all waste materials properly.

Preserve and Protect Topsoil on Construction Sites

- Topsoil is a valuable resource, which can only be replaced with expensive hauling from other sites, or with many years of the natural process of soil formation. In areas where topsoil must be stripped, collect and stockpile the topsoil for future use on the site.
- Place erosion control devices such as hay bales or erosion control fencing in all areas where construction disturbs the soil. (Such devices will help prevent the loss of topsoil during rainfall, when soil can be washed downstream causing site losses and non-point-source pollution.

Stabilize or Cover all Bare Soil Areas by the Time Construction is Completed

- Extreme slopes, hillsides, and stream banks can be stabilized with vegetation, terracing, dry stack limestone, rubble, or rip-rap.
- In landscaped areas, a thick layer of organic mulch should be applied to planting beds.
- Planted slopes can be covered with erosion control fabrics or jute netting before groundcover or other plantings are added. This will help hold soil in place during the plant establishment period. Shredded mulch, which tends to form a mat should be used in sloping areas, as it tends to wash out less than other types.

Landscaping for Energy Conservation Should be an Integral Part of any Landscape Design

- Plant deciduous trees on the west and northwest sides of structures. Such trees can create enough shade to lower roof and wall temperatures of buildings by up to 10 degrees. This factor can be effectively utilised in public open spaces that have function halls, recreation centres or institutional buildings.
- Deciduous trees that lose their leaves in winter will create summer shade and allow sunlight through open branches to warm and light the home during winter. Even when bare, there can still be significant shading from the branches of large trees.
- Shade can also be created by using a combination of landscape features, such as shrubs and vines on arbours or trellises.
- Shade the outdoor compressor unit of an air conditioning system. This can help save up to 10% on summer cooling bills. Be sure to leave room (at least 1 metre) for airflow and service access.
- Natural cooling without air conditioning can be enhanced, by locating trees and shrubs to channel summer breezes. Cooling breezes will be able to pass through the trunks of trees placed for shading. For this technique to be effective it is crucial to establish the prevailing wind directions for that space. This factor can be utilised to control the climate of buildings located in public open spaces, but can also ameliorate temperatures within the spaces themselves. By situating rest areas so that breezes are channelled through them they can provide respite from hot summer conditions. If deciduous trees are used, these spaces can still be pleasantly warm in winter, as sunlight will reach them for most of the day.
- Living windbreaks can be created to block cold winter winds. By placing dense strips of vegetation perpendicular to prevailing wind directions during winter and locating recreation spaces downwind of these windbreak, they can provide recreation areas in the winter, provided that they receive enough sunlight.
- Public buildings can also be screened from cold winds during winter. Plant evergreen shrubs and/or trees on the north and northwest sides of a building. Varieties that branch all the way to the ground are most effective. Several staggered rows of plantings should be located on the

leeward side of the wind. For best wind protection, plant windbreak trees a distance from the building equal to 5 to 7 times the height the trees will be when mature.

3.2 SOIL ANALYSIS

- Soils will vary from site to site and even within a given site. Be aware of the acid/alkaline state of soils on site and what nutrients are lacking, a condition which can generally be expected throughout most of PKSDM. Soils should be analysed to help determine suitable plants and the need for any soil amendments.
- Add organic matter to planting soil to enhance plant health. This improves soil texture and moisture retention. (Soil rich in organic matter provides nutrients and micro-organisms beneficial to plants.) For planting beds, spread 5 mm of organic matter and mix it in 150mm deep. For soil to fill a hole for planting shrubs or trees, mix 1/3 organic matter into the soil. (Some native plants may not require this, as they are well adapted to poor soils.) Compost and composted sludge products such are excellent sources of nutrients for ornamental landscapes. Such products release nutrients slowly to the plants, making frequent fertilizing unnecessary and minimizing the risk of fertilizer washing out of sites and becoming non-point source pollution.
- Add other amendments as necessary. A soil test is an important first step in determining whether fertilizer is needed, and if so, what type.
- To reduce the need for fertilizer on established turf, use the "Don't Bag It" program: leave clippings in place to decompose after mowing. This recycles important nutrients back into the soil.
- The addition of gypsum and sand can improve the workability and drainage capacity of soil. Soils with large amounts of clay and stones are difficult to work with. If little soil is available and bedrock is in evidence on the site, planting holes are sometimes dug in solid rock. If this occurs, be sure all planting holes drain thoroughly before planting. Standing water on plant roots can be lethal.
- Choose topsoil wisely. If topsoil is imported from off-site, be sure it is of high quality. (There are many grades of topsoil, and the end use will determine what type of topsoil to use. For example, the best material for grading and filling may not be good for planting.)
- The locally occurring soils are suitable for many native plantings. (Native plants are naturally adapted to such soils, and may not thrive on soil blends, which don't mimic the natural conditions.)

3.3 APPROPRIATE PLANT SELECTION

The design will determine the overall effect of the landscape. The actual selection of plants should come from those species that are native or adaptive to the site. Deviation from the appropriate selections creates the need for more soil amendments, more maintenance, and different watering schedules. In any public open spaces for which funds to maintain are usually limited, choices have to be made that ensure maintenance is kept to the minimum. A significant part of the success of low-maintenance gardens is choosing the correct species for the situation and location.

Select Plants that Require a Minimal Amount of Supplemental Watering

- Use plants that will need no supplemental watering after an establishment period, unless there is an extreme drought. The establishment period after installation may require from 18 to 24 months.
- Almost any plant can be used if grouped according to its water needs. Annual and exotic plantings can be located in small, easily accessible areas to make maintenance easier. Irrigation can then be zoned according to plant water needs to make efficient irrigation possible.
- Many native plants are well adapted to the natural soil and rainfall conditions of the area. They have protection mechanisms that cause them to go dormant during periods of stress. They may appear brown, but will turn green again when temperatures improve and it rains.

Choose a Diversity of Plant Species

- Avoid planting large numbers of only one plant species, which can create a monoculture susceptible to pest or insect problems. (A variety of plant species occurs in nature, making more stable and diverse plant populations.)
- The abundance of local – or endemic plants - trees, shrubs, perennials, groundcovers, vines and grasses make it possible to choose plantings which give colour and interest (flowers, fruits, berries, and foliage) year-round.

Buy from Reputable Suppliers and Nurseries

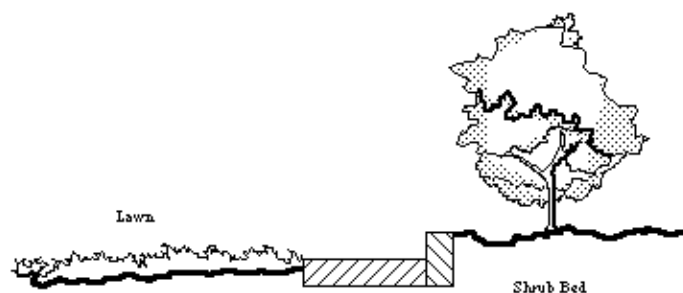
- Well-established plant suppliers know the exact sources of their plant materials. Information on where plants are nursery-grown or field-dug should be available.
- For field collected specimens, environmentally sound collection techniques should be used and permission of the landowner obtained. Rare plants should never be collected from the wild.
- Where locally indigenous species have to be removed from a site due to construction, an attempt should be made to re-locate these specimens to another suitable location on site. If handled and stored properly, these plants should re-establish relatively quickly and without excessive care and maintenance.

Use Locally Grown or Sourced Plants if Possible

- Using plants that have been grown by nurseries within the PKSDM cuts down on transportation costs and increases the viability of plant materials.
- By encouraging the local nurseries to adopt a consumer awareness program, which labels plants "Locally Grown" with a special tag, the local economy may benefit significantly. If trade agreements are established between the municipality and local nurseries, especially ones owned by previously disadvantaged individuals, the landscaping industry could play a significant role in economic development in the area.
- A list of plants suitable to the PKSDM climatic region should be compiled and made available at Local Municipal Offices, participating nurseries and other selected institutions.
- It is furthermore suggested that a list of preferred plant species for all open spaces, which form part of private residential estates, resorts and other developments, be compiled and kept at the Municipal Offices. Such a list will not be enforceable save for instances where specifications of a project-specific EMP, conducted as part of the EIA process, require the use of selected indigenous species. However by establishing awareness programs that seek to educate developers on the benefits of using locally indigenous plants, it is possible to retain and enhance the indigenous character of PKSDM. By possibly coupling such programs with a nominal incentive program for the use of preferred tree species, the effectiveness of the program can be significantly increased.

3.4 PRACTICAL LAWN AREAS

Practical lawn areas mean lawn areas, which have sizes suited to the intended uses. Lawn grass usually covers more of the landscape than is needed for entertaining or recreation. Huge lawns of exotic grasses will require more maintenance and care than any other type of landscape plant and excessive amounts of water. Lawns may be needed as children's play areas, for pets, sports, or simply for the aesthetic appeal of turf, which some people prefer. For more interesting and manageable landscapes, use lawn only as a fill-in plant. Increase the area of decks, porous paving, paths, indigenous grass areas and mulched planting beds to reduce lawn. Be sure to select drought-tolerant grass varieties such as *Cynodon* sp., in the sunny lawn areas.



Design Lawn Areas Appropriate to their Function

- The maintenance needs of lawn can be minimized by the design of the area, the irrigation equipment used, and the turf type selected.
- Design turf areas in rounded, compact shapes to water and mow more efficiently.
- Curving borders of plant beds around turf areas and the use of mowing strips can make mowing and edging easier.
- Avoid long narrow areas of turf, which are difficult to water efficiently.
- Locate turf areas close to associated structures and public buildings such as libraries, clinics, multi-purpose centres, entertainment venues and performance stages, and lower-maintenance areas near the edges or rear of the open space.
- Design turf areas so they can be watered separately from other landscape plants.
- If using an automatic irrigation system, the grass areas can be zoned in order to be watered according to the needs of the grass type.
- For non-automatic systems, use hose-end efficient sprinklers for grass areas and soaker hoses for beds. Watering times will vary by plant type.

Avoid Planting Grass on Slopes

- Sloping areas are difficult to mow and difficult to water without runoff.
- Terracing of slopes can help slow down water. Plant groundcovers, shrubs, and perennials to minimize the maintenance problems of slopes. Alternatively planted retaining walls can be created.
- Many slopes can be left in their natural state. This is especially true in public areas that are adjacent to or within natural areas. Alternatively sloped areas, which usually are not high-use areas, can be rehabilitated to the expected natural condition if they occur on transformed sites. This will both decrease maintenance costs and increase the ecological value of the site, as well as its aesthetic appeal.

Minimize Grass Areas by Using Alternatives

- There are many alternatives to grass lawn areas, which are aesthetically pleasing and low-maintenance.
- Planting beds are a logical alternative to grass if the appealing green and “soft” appearance of plants is still desired.
- Wild flowers can be incorporated into native groundcovers and grasses.
- Mulch beds of bark, stone or gravel can be used as pathways, or around driveways and utility areas. Currently some landscape designers are creating highly aesthetic landscapes for private developments such as shopping complexes and office parks, by replacing excessive areas of

lawn with beds of rocks and gravel, interspersed with indigenous flowering bulbs and shrubs, attractive tree species and accent plants such as Aloes. Such landscapes require far less water than conventional lawn areas and are an attractive alternative to utilise in areas that are not frequently used.

- Children's play areas can be covered with sand or bark mulch to create inexpensive "safety" zones. Paving products made of recycled tires are available to create a ground surface that minimizes injuries.

3.5 EFFICIENT IRRIGATION

Water infrequently, but when you do, water deeply. Plants and grasses develop deeper, drought-tolerant roots when forced to find deeper moisture. Frequent, light watering results in shallow roots, leading to water stress during periods of drought.

Use an Efficient Irrigation System Designed by a Licensed Irrigator

- The type of watering equipment best suited to the situation depends on the landscape, design, layout and budget. The irrigation design should be integrated with the design of the landscape. A simple hose and sprinkler system with a few soaker hoses, or simple sprayer system may be the best way to water landscapes that can be more closely monitored and where theft or vandalism is less likely, such as open areas associated with multi-function halls, libraries, clinics, crèches or small public performance areas. These facilities usually have smaller public spaces associated with them and can be maintained and irrigated by a few persons. Underground drip irrigation and pup-up systems may be more appropriate for larger landscapes such as sports facilities. Larger public parks and landscapes of civic centres. However in such landscapes the design should be such that only frequently used and highly visible or prominent areas require frequent watering.
- It is important to note that a newly installed landscape will require more water during an establishment period of one to two years. After this time, the landscape may require no irrigation except during a drought period.

Install a Water Efficient Automatic Irrigation System, this Includes:

- A timer that allows for scheduling every 5-7 days (14 or 15-day programming) and independent zone programming capability.
- Features such as multi-cycling (or multiple start times) will help in watering areas which may need several short irrigation cycles to avoid runoff.
- An inexpensive rain shut-off device, which will prevent unnecessary irrigation during rain.

- A soil moisture sensor. Unlike the rain shut-off device, the soil moisture sensor actually measures soil moisture, and overrides programmed irrigation when the soil moisture level is adequate.
- Non-mist type low trajectory nozzles and pressure-compensating devices for spray systems in turf areas. Alternatively micro-spray heads should be used for spray systems in turf areas.
- A zoned approach whereby plants of similar water requirements are grouped together in the same zone capable of independent station programming (i.e. turf areas separate from shrub areas, sunny areas separate from shady areas).

Use Low-flow Irrigation Equipment

- Evaporation losses can be minimized by drip irrigation, soaker hoses, or bubblers.
- Drip irrigation systems are ideal for watering plants in beds and garden areas.
- Drip lines require no expensive underground trenching, and are easy to utilize in a retrofit of an existing landscape.
- Drip irrigation uses a flexible hose system, which can be easily modified, to apply water at the ground surface to individual plants. Emitters are punched into the supply line where they are needed. A variety of types and flow rates for emitters are available.
- If water pressure at the source exceeds pre-determined pressure levels, a pressure regulator may be necessary. Filters to remove sediment should be installed at the water source. Flush caps should be installed at the ends of the drip supply lines so that the entire system can occasionally be flushed of contaminants.
- Drip lines should be secured to the soil surface and covered with organic mulch to improve appearance and protect them from sunlight.

Water Only When Plants Need It and Water Deeply

- Deep, more drought tolerant root systems will develop from a weekly deep soaking.
- Irrigate in the coolest part of the day (early mornings and evenings) to avoid evaporation loss and wind drift.
- Night time watering can encourage diseases in plants and during the winter, excess water in the ground may freeze overnight, damaging root systems and killing more tender plants.
- Wet the soil to a depth of fifteen or twenty centimetres, and allow it to dry out between watering events.
- As a general rule, during the growing season most grass needs about 25mm of water per week. This will vary depending on soil type and depth, sun, plant conditions, and rainfall occurrence.
- Watering can taper off gradually as autumn arrives and can gradually increase again in spring.
- Plants don't need as much water in winter, but will still benefit from monthly irrigation if there is no rainfall.

Maintain the System

- Irrigation systems need regular maintenance to ensure proper working order and to adjust irrigation scheduling.
- A complete system audit should be conducted annually, and irrigation schedules adjusted quarterly at a minimum. (A training program for Irrigation Auditors should be offered by the Parks Department of the PKSDM or alternatively by an outside appointed specialist or consultant.)
- Irrigation lines should be flushed and all stations, heads, nozzles, and/or emitters checked for proper functioning.

Staff Should be Trained

- Copy and file a plan with the project file at the Municipality of how the system is built, and instructions for use of the system.
- Post the current irrigation schedule inside the controller box. (Be sure to note that seasonal adjustments to the irrigation schedule will be necessary.)
- Give the operators and maintenance staff an orientation session on how to operate the system. Many irrigation systems that are efficiently designed are never used efficiently because the owner is unaware of the importance of his/her role in scheduling and maintenance after the system is installed.

3.6 USE OF MULCHES

- A 150 to 200 mm layer of organic material should cover all exposed soil areas. Replenish it twice a year. Mulch retains moisture, controls soil temperature, discourages weeds, and prevents erosion.
- Use a deep layer of mulch in planting beds to help retain moisture, slow weed growth, and prevent erosion.
- The use of mulches on sloped areas along with terracing and plantings can help prevent runoff and erosion problems.
- Examples of organic mulch material include: shredded bark, wood chips, pine needles, straw, nut hulls, olive seeds, composted leaves, shredded exotic plants without the seedpods or other reproductive matter.
- The depth of mulch needed will depend on the type used. As a general rule, the coarser the material, the deeper it should be applied. A 150 to 200 mm layer of bark mulch should be sufficient. Mulch needs to be reapplied as it decomposes.
- Use inorganic mulches such as gravel, crushed granite or pebbles in unplanted areas.
- Such areas can become inexpensive pathways, utility areas, or decorative border strips.

- Don't use stone mulches in areas immediately adjacent to buildings, as they can heat up and cause glare.
- Brown or grey coloured stone is preferred over white for use as mulch, as very light colours cause glare. Conversely dark colours or black absorb heat, which may damage less robust plants and groundcovers.
- Use mulches from locally or regionally derived materials. This decreases transportation costs, and utilizes local resources.
- Organic mulches can be the by-product of local tree trimming, land clearing or agricultural activity. Agriculture is a significant industry in parts of the PKSDM, especially to the south, and farmers can sell by-products, which aren't used for other purposes to the municipality or private maintenance contractors. Urban agriculturalists within the townships can also benefit in this fashion.
- Stone mulches can be produced from regional quarries. Mining which is the primary industry in the PKSDM, produces vast quantities of material, which may be suitable for this purpose. Aggregate and crusher run produced by granite mines in the area may also be used for ornamental xeriscaping of public spaces.

3.7 APPROPRIATE MAINTENANCE

Even in the most self-sustaining landscapes maintenance cannot be totally eliminated, especially where people frequently use these places. However by following the first six principles of xeriscaping, it is possible to reduce manpower and cost spent on maintaining public landscapes. After they are established, xeriscapes require less fertilizer, chemicals, and less water than conventional landscaped areas. This is due to a reduction in lawn area and un-adapted plants that might have more diseases and require insect control, more watering and have higher fertilizer demands. However, there is no such thing as a maintenance-free constructed landscape. In general, a properly maintained landscape is hardier and better able to withstand drought, freezing and pest problems. Obviously, landscape maintenance is up to the owner or custodian of that space. However, there are things that can be done during installation to make maintenance easier.

Provide a Composting Area and Encourage Its Use

- Garden waste can be recycled into high-quality compost. This minimizes the load on landfills and encourages wise resource use. Large composting facilities can be operated as a SMME venture and can generate an income for several people. If the garden refuse and clippings (which are not used as mulches) from several parks are taken to a central facility and converted into compost, it

may be possible to cut down on some of the maintenance costs of public parks by producing the compost for the parks from its own garden refuse.

- A well-drained area on the site should be chosen to locate the composting facility – it can be utilized by the entire community for garden and kitchen waste composting. Make sure to clear the area to expose the soil prior to dumping composting materials.
- Smaller compost bins are easy to build and can be effectively utilised in township areas, to improve the quality of soil used for urban agriculture. Remember to use inexpensive materials, allow for air circulation and make the bin wide enough to turn and lift compost. For individual house use by the community, they could use chicken wire, woven wire, or inexpensive fencing to build a bin. Wood stakes, wire, or chain snaps to support and fasten the bin. Discarded wood pallets can be put together with wire to make an inexpensive rectangular bin. A portable bin can be built of wood slats and wire mesh. Cinder blocks or brick can be used if gaps are left to allow air circulation.

Mow Correctly

- Mow the grass when it is about 1/3 higher than the desired height.
- Clippings can be left where they fall, recycling nutrients into the soil.
- If clippings are collected, compost them with raked leaves and organic waste.
- Never mow lawns too short. (Proper mowing heights can help lawns use less water. Grass cut too short is stressed and dries out quickly.)

Fertilize Wisely

- Many native plants do not need fertilizer since they are adapted to natural soil conditions.
- Other plants, such as non-native grasses, need additional nutrients for healthy growth.
- Use recycled lawn clippings, compost, or slow-release encapsulated nitrogen on lawns.

Use Least-toxic Methods of Insect and Disease Control

- Such techniques, otherwise known as Integrated Pest Management (IPM), take advantage of natural methods of control. This protects soil from contamination, inhabitant wildlife from harm, and waterways from being polluted with non-point source pollution.
- Old-fashioned methods such as installing a birdhouse can help encourage natural insect control.
- Chemical controls will destroy beneficial insects as well as harmful ones and should only be considered in instances of serious infestation.
- Organic pest control such as insecticide soaps and manual methods such as pulling weeds or using sand barriers will usually be sufficient and has little or no impact on the environment.
- Beneficial insects such as ladybugs and beetles should be encouraged and can even be introduced into a landscape.

- Over watering and night-time watering may actually cause some diseases such as brown patch on lawns.

- 7 -

**CIVIL WORKS – IMPACTS
AND MITIGATION
MEASURES MATRIX**

HOW TO USE THIS DOCUMENT

The document set is comprised of two separate document types:

The **first is a set of three matrixes** for the Construction, Operation and Maintenance for the various municipal infrastructure types. The main column headings identify the various aspects relating to the construction, operation and maintenance of various types of municipal infrastructure respectively, whilst the impacts appear on the left-hand side of each table. These are grouped into the various categories Air, Earth, Surface Water, Ground Water, and Fauna and Flora, and indicate the types of impacts that the construction, operation and maintenance of infrastructure may have on these various natural elements. Where a specific activity, or infrastructural component may potentially have a specific environmental impact, this impact is then identified within the matrix with a code. By way of example, as illustrated in the “**Civil Municipal Infrastructure Construction Potential Impacts Relational Matrix**”, cooking fires may potentially cause chemical or smoke pollution and this impact is identified in the matrix with the code CAa-4. The code is a reference to the matrix on which it is identified (Construction –C, the category of infrastructure or activity (in this case Construction Camp –A), and the cross reference between the specific activity / item (cooking, fires –a) and the specific (air chemical/smoke pollution -4) – CAa-4.

This code then refers to the impacts in the **second** document set, namely the detailed “**EMP Masters**”. There is a specific EMP Master for each of the various categories of environmental impacts, i.e. Air Impacts, Earth Impacts, Surface Water Impacts, Ground Water Impacts, and Fauna and Flora Impacts (with an additional EMP for diverse additional impacts which does not refer to any of the Impact Matrixes).

The “EMP Masters” documents list, in order from left to right:

- The Specific Impacts identified in the matrix. Thus by way of example Smoke/chemical pollution during construction, potentially caused by cooking fires (derived from the Impact Matrix Tables) is listed with the reference code from the Impact Matrix – CAa-4. All impacts are further separated into construction, operation maintenance and overall design parameters.
- Photo/s of the impact where available,
- Potential mitigation measures that may be applicable,
- Photo/s of the mitigation measure/s where available, performance indicators to verify whether the desired results are being achieved,

- Whose responsibility the mitigation measures are,
- And other notes if applicable.
- Additional columns that also appear allow for relevant legislation/standards, and reference to project drawings to be captured, and successful implementation to be checked and signed off.

Many of the activities and components of both the construction and maintenance phases are similar for the different infrastructure categories, therefore the impact matrixes for the construction and maintenance phases are generic and can be applied to any of the different infrastructure categories.

However the different construction and maintenance activities or aspects will be of differing relevance to different infrastructure categories according to the scale and nature of the project. For instance even though both an electrical substation and sewage treatment plant may require a construction camp, the construction camp for a sewage treatment plant will be much more extensive than for the substation. Thus the impact matrix for the construction phase must be interpreted within the context of each specific project.

The same applies to the maintenance impact matrix. No municipal infrastructure project would include all the issues addressed in this guideline document and each project must be evaluated within its specific context and the requirements presented by the brief, or terms of reference.

This system allows each environmental impact to be viewed separately in terms of its potential causes, and then evaluated in terms of a set of proposed mitigation measures. It must however be kept in mind that the success of any mitigation measure is dependant on the quality of the workmanship and the adherence to the EMP as a whole. Often negative environmental impacts arise from sufficient and appropriate designs that are simply not executed well.

**Final**[illegible]



Date: 2007-12-14	Project No: A1289	Client: PKSDM	Consultant: African EPA
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Final

Impacts of Infrastructure (either by direct cause or by significantly promoting thereto)	Infrastructure Design and Operations																								
	A Roads			B Stormwater								C Waste Water			D Potable Water							E Refuse		F Electricity	
	a) Cut/ Fill Slopes	b) Roadside Planting	c) Roadside Edges	a) Inlets	b) Outlets	c) Detention Structures	d) Retention Dams	e) Pollution Control	f) Artificial Wetlands	g) Pipes	h) Channels	a) Waste Water Collection	b) Waste Water Treatment	c) Basic Sanitation Provision	a) Internal Reticulation (Mass Housing)	b) Bulk Water Pump Stations	c) Bulk Water Lines	d) Connections to Rand Water	e) Purification Works	f) Boreholes and Springs	g) Reservoir-Sites	a) Refuse Removal	b) Storage Dumps/ Landfill Sites	a) Substations	b) Powerlines Servitudes
Air																									
1) Dust Pollution		DAb-1	DAC-1																					DEb-1	
2) Noise Pollution																DDb-2			DDe-2					DEb-2	DFa-2
3) Odours													DCb-3									DEa-3	DEb-3		
4) Air Chemical/ Smoke Pollution																									
Earth																									
5) Erosion/ Topsoil Loss	DAa-5	DAb-5	DAC-5		DBb-5						DBh-5										DDg-5		DEb-5		DFb-5
6) Significant Sedimentation	DAa-6			DBa-6	DBb-6	DBc-6	DBd-6		DBf-6		DBh-6														
7) Soil Compaction/ Impermeability			DAC-7								DBh-7														
8) Soil Contamination												DCA-8	DCb-8	DCC-8								DEa-8	DEb-8		
9) Slope Collapse	DAa-9			DBa-9	DBb-9	DBc-9	DBd-9				DBh-9												DEb-9		
Surface Water																									
10) Surface Water Physical Pollution (Litter, Refuse, Rubble)			DAC-10	DBa-10	DBb-10	DBc-10	DBd-10	DBe-10	DBf-10		DBh-10												DEb-10		
11) Surface Water Sewage Pollution												DCA-11	DCb-11	DCC-11											
12) Surface Water Biological Pollution (Pathogens, Organic Solvents)												DCA-12	DCb-12												
13) Surface Water Chemical Pollution													DCb-13										DEb-13		
14) Drainage Problems			DAC-14	DBa-14	DBb-14	DBc-14	DBd-14		DBf-14	DBG-14	DBh-14														
15) Anaerobic Conditions						DBc-15	DBd-15		DBf-15				DCb-15												
16) Increased Runoff Rate			DAC-16								DBh-16														
Ground Water																									
17) Ground Water Biological Pollution												DCA-16	DCb-16	DCC-16									DEb-17		
18) Ground Water Chemical Pollution													DCb-17										DEb-18		
Fauna and Flora																									
19) Habitat and Vegetation Loss	DAa-19	DAb-19		DBa-19	DBb-19								DCb-19						DDe-19		DDg-19		DEb-19		DFb-19
20) Habitat Fragmentation													DCb-20						DDe-20		DDg-20		DEb-20		DFb-20
21) Habitat Degradation/ Disturbance		DAb-21		DBa-21	DBb-21	DBc-21	DBd-21	DBe-21	DBf-21		DBh-21		DCb-21				DDc-21				DDg-21		DEb-21		DFb-21
22) Poaching																									



PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES
CIVIL MUNICIPAL INFRASTRUCTURE MAINTENANCE POTENTIAL IMPACTS RELATIONAL MATRIX

Date: 2007-12-14	Project No: A1289	Consultant: African EPA	Client: PKSDM
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Final

IMPACTS OF MAINTENANCE (either by direct cause or by significantly promoting thereto)	INFRASTRUCTURE MAINTENANCE											
	A Mowing	B Pruning	C Weeding	D Alien Vegetation Clearance	E Re- Planting	F Watering/ Irrigation	G Sediment Removal	H Litter/ Refuse Removal	I Embankment Structural Maintenance	J Road Resurfacing	K Trenching/ Pipe Repairs	L Sewage Spill Cleanup
Air												
1) Dust Pollution	MA-1			MD-1			MG-1			MJ-1		
2) Noise Pollution	MA-2	MB-2		MD-2			MG-2			MJ-2		
3) Odours						MF-3	MG-3			MJ-3		ML-3
4) Air Chemical/ Smoke Pollution				MD-4						MJ-4		
Earth												
5) Erosion/ Topsoil Loss	MA-5			MD-5		MF-5					MK-5	
6) Significant Sedimentation				MD-6						MJ-6	MK-6	
7) Soil Compaction/ Impermeability				MD-7			MG-7			MJ-7	MK-7	
8) Soil Contamination	MA-8			MD-8			MG-8			MJ-8	MK-8	ML-8
9) Slope Collapse									MI-9			
Surface Water												
10) Surface Water Physical Pollution (Litter, Refuse, Rubble)	MA-10	MB-10	MC-10				MG-10	MH-10				
11) Surface Water Sewage Pollution												
12) Surface Water Biological Pollution (Pathogens, Organic Solvents)												
13) Surface Water Chemical Pollution			MC-13	MD-13				MH-13		MJ-13		
14) Drainage Problems						MF-14					MK-14	
15) Anaerobic Conditions							MG-15					ML-15
16) Increased Runoff Rate										MJ-16		
Ground Water												
17) Ground Water Biological Pollution												ML-17
18) Ground Water Chemical Pollution			MC-18	MD-18				MH-18		MJ-18		
Fauna and Flora												
19) Habitat and Vegetation Loss	MA-19	MB-19		MD-19								
20) Habitat Fragmentation												
21) Habitat Degradation/ Disturbance			MC-21	MD-21	ME-21		MG-21		MI-21	MJ-21	MK-21	
22) Poaching							MG-22					



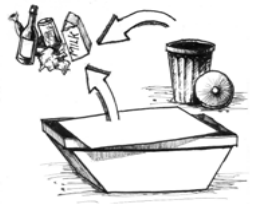
Date: 2007-12-14	Project No: A1289	Consultant: African EPA	Client: PKSDM
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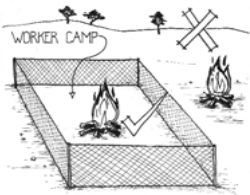
		1 Dust Pollution (Operations)	Borrow Pits (DCe-1)		Roads: All access roads and other roads on the site are to be wet with water dowsers as and when the need arises. Caution is to be taken by the operator not to wet surfaces excessively.		Successful dust suppression i.e. limited dust in the air. Planting in the vicinity of the construction activities is not covered in dust. No run-off from the dust suppression activities is evident. Successful revegetation of areas where alien species have been removed.	Operator	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM. Further site specific conditions according to the EMP are to be noted.	
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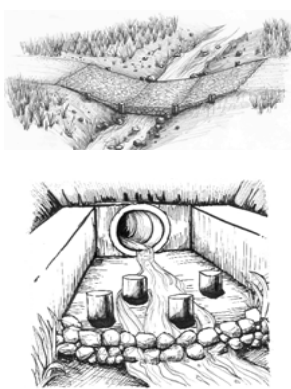
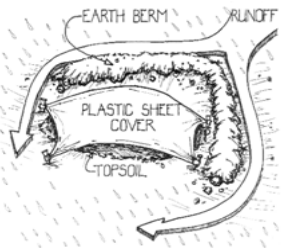
RELEVANT LEGISLATION/ STANDARDS	REFERENCE DRAWING/ SHEET NO.	SPECIFIC IMPACTS	POTENTIAL CAUSE	IMPACT PHOTO/ DRAWING EXAMPLE	MITIGATION MEASURE	MITIGATION PHOTO/ DRAWING EXAMPLE	PERFORMANCE INDICATOR/ VERIFICATION	RESPONSIBILITY	NOTES/ GENERAL	SIGN. + DATE
					Stockpiling of soil: If the material is to be stockpiled for a period longer than 6 months, the stockpile is to be vegetated. When the soil is being moved from the stockpile, water dowsers are to wet the area where vehicular access occurs. General: Large areas of the site that have been stripped of vegetation are to be avoided. If this cannot be avoided dust suppression is to be undertaken by water dowser. The operator of the water truck is to wear the correct PPE.		No dust pollution from stockpiled soil or material. No dust pollution from unavoidable bare or unvegetated areas. Planting in the vicinity of the construction activities is not covered in dust. No run-off from the dust suppression activities is evident.	Contractor Contractor		
		1 Dust Pollution (Maintenance)	Mowing (MA-1) Alien Vegetation Clearance (MD-1) Sediment Removal (MG-1) Road Resurfacing (MJ-1)		Roads: Where appropriate, the areas that are being re-surfaced can be wet with water dowsers as and when the need arises. Caution is to be taken by the operator not to wet surfaces excessively. Vegetation clearing: In areas where alien vegetation is to be removed, the area is to be revegetated as quickly as possible with indigenous grass and tree species (which ever is most appropriate). General: Large areas where vegetation has been removed or has died are to be identified and revegetated with indigenous trees and grasses (as appropriate).		Successful dust suppression i.e. limited dust in the air. Planting in the vicinity of the construction activities is not covered in dust. No run-off from the dust suppression activities is evident. Successful revegetation of areas where alien species have been removed. Successful revegetation of areas where alien species have been removed. Successful revegetation of unvegetated areas.	PKSDM personnel Contractor/ maintenance personnel Contractor	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	
		1 Dust Pollution (Design)	Lack of sufficient roadside planting (DAb-1) Roadside edges (DAc-1) Landfill sites (DEb-1)		Establish the location of the site and accordingly determine the site specific mitigation measures that are to be adhered to in the construction phase. Ensure that the aspect of dust pollution is addressed in the tender documents and state the requirements.		Appropriate mitigation measures in relation to the context. Dust pollution addressed in the tender documents.	Engineers	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	

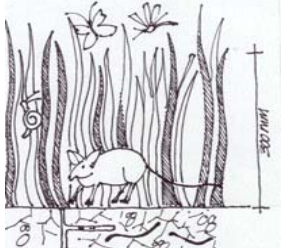
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					Sufficient planting of all roadside embankments, medians and sidewalks are to be done to prevent dust pollution. Species with sufficiently strong roots should be used, that provide coverage throughout the year. Preferably indigenous species should be used. Where possible unused sections of landfill sites should be re-vegetated with indigenous veld grass species, or alternatively dust suppression by water dowser should be done when appropriate.		No dust pollution from roadside edges, embankments or medians. Limited dust from landfill sites.	Contractor Contractor/ maintenance personnel		
		2 Noise Pollution (Construction)	Worker activity at the construction camp (CAb-2) Heavy vehicles on access roads (CAAd-2; CBf-2; CCf-2; CDc-2) Mixing of materials (CDa-2)		Ensure that the contractor adheres to the construction times as stated in the contract documents or EMP (usually 7:00 - 18:00). Where applicable all equipment must be SABS approved and use of noise generating equipment shall take place in accordance with the Gauteng Noise Regulations. Silencers must be fitted on all construction machinery. All construction vehicles must have baffled exhaust systems and comply to national noise regulations.	 	Construction hours are in accordance with the EMP. Maintenance logs of the plant and equipment are to be available on request. Suitable location for the Construction Camp. Noise levels are within acceptable limits.	Contractor Contractor	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	
					Ensure that all plant, vehicles and equipment is regularly maintained. Locate the construction camp in such a position that it does not interfere with residential areas. The contractor is required to adhere to SABS 1200 safety measures during construction. Loud noise and yelling will not be tolerated.		No noise pollution caused due to faulty or poorly maintained equipment or machinery. No complaints received about noise from adjacent or affected persons.	Contractor Contractor		

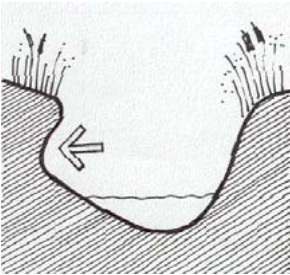
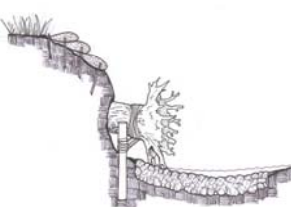
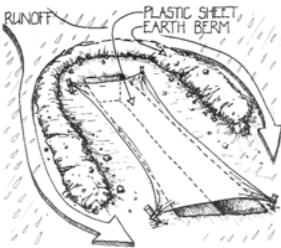
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		2 Noise Pollution (Operations)	Bulk water pump stations (DDb-2) Water purification works (DDe-2) Substations (DFa-2)		Ensure that the contractor adheres to the operation times as stated in the contract documents or EMP (usually 7:00 - 18:00). Ensure that all plant and equipment is to be regularly maintained. Where applicable all equipment must be SABS approved and use of noise generating equipment shall take place in accordance with the Gauteng Noise Regulations.		Operation hours are in accordance with the EMP. Maintenance logs of the plant and equipment are to be available on request. No complaints received about noise from adjacent or affected persons. No noise pollution caused due to faulty or poorly maintained equipment or machinery. Noise levels are within acceptable limits.	Operator Contractor Contractor	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	
		2 Noise Pollution (Maintenance)	Mowing (MA-2) Pruning (MB-2) Alien vegetation Clearing (MD-2) Sediment removal (MG-2) Road resurfacing (MJ-2)		Ensure that the contractor adheres to the maintenance times as stated in the contract documents or EMP (usually 7:00 - 18:00). Ensure that all plant and equipment is to be regularly maintained. Where applicable all equipment must be SABS approved and use of noise generating equipment shall take place in accordance with the Gauteng Noise Regulations.		Maintenance hours are in accordance with the EMP. Maintenance logs of the plant and equipment are to be available on request. Noise levels are within acceptable limits.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	
		2 Noise Pollution (Design)	General location of facilities - bulk water pump stations, purification works, landfill sites, substations (DDb-2; DDe-2; DEb-2; DFa-2)		Establish the location of the site and accordingly determine the site specific mitigation measures that are to be adhered to in the construction phase. Ensure that the aspect of noise pollution is addressed in the tender documents and state the requirements.		Appropriate mitigation measures in relation to the context. Noise pollution addressed in the tender documents.	Engineers	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	

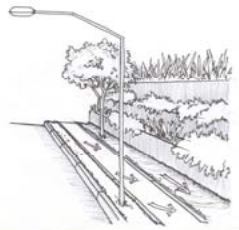
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		3 Odours (Construction)	Cleaning, sanitation, worker activity at construction camp (CAb-3)		Construction Camp: Ensure that the dustbins are cleaned out on a regular basis. Ensure that the chemical toilets are sufficient and maintained as stated by the supplier. If a French drain and septic tank system is utilized, ensure that anaerobic conditions do not arise. If pit latrines are used, ensure that the hole is deep enough and situated in a suitable location.	 	Dustbins are not overflowing with refuse. Chemical toilets are clean. No smells emanating from the septic tank and French drains.	Contractor Contractor	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	
		3 Odours (Operations)	Waste Water Treatment (DCb-3) Refuse Removal (DEa-3)		Landfills: Ensure that the refuse that is disposed of on a daily basis at the waste disposal site is covered with a layer of soil daily. In areas where refuse is removed, the operator is to ensure that all the refuse is collected. Where spillage of refuse has occurred, it is to be collected and disposed of accordingly.		No refuse remaining at the collection point once the operator has collected the material. Verify that the daily arisings are covered with a layer of soil.	Operator Operator/ maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM. Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	
		3 Odours (Maintenance)	Irrigation (MF-3) Sediment Removal (MG-3) Road resurfacing (MJ-3) Sewage spill clean - up (ML-3)		Irrigation: Irrigation is to be undertaken in a controlled manner to ensure that no areas of stagnant water are created.		No stagnant water.	Operator/ maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	

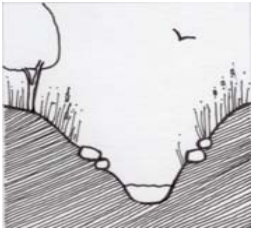
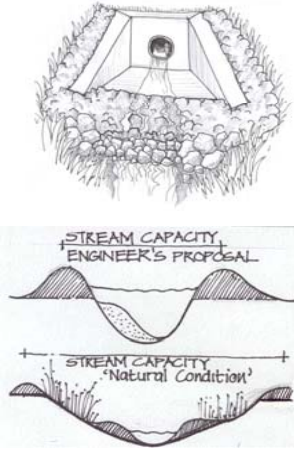
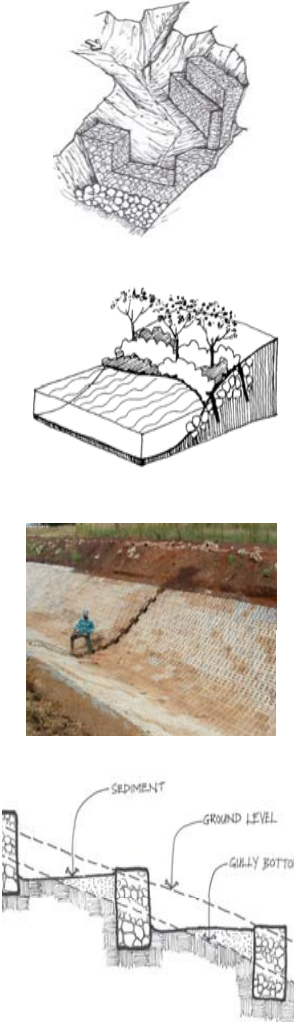
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					Sewage clean up: In areas where a sewage spill has taken place, the clean-up procedures are to be undertaken as quickly as possible to minimize the effect of odours.		Prompt response to sewage spill.	Operator/ maintenance personnel		
		3 Odours (Design)	Landfill sites (DEb-3) Waste water treatment works (DCb-3)		General: Establish the location of the site and accordingly determine the site specific mitigation measures that are to be adhered to in the construction phase. Ensure that the aspect of odour is addressed in the tender documents and state the requirements.		Appropriate mitigation measures in relation to the context. Odour is addressed in the tender documents.	Engineers	Precautions are to be undertaken to the satisfaction of the PM, the Environmental Health Division and Environmental Management Division of the PKSDM.	
		4 Air Chemical/ Smoke Pollution (Construction)	Cooking fires (CAa-4)		No cooking fires will be allowed on site other than designated areas within the construction camp.		No sign of cooking fires.	Contractor		
		4 Air Chemical/ Smoke Pollution (Operations)								
		4 Air Chemical/ Smoke Pollution (Maintenance)	Alien vegetation clearing (MD-4) Road Resurfacing (MI-4)		No alien vegetation may be burnt on site. Plant material is to be taken to an appropriately permitted waste disposal site.		No sign of burning of alien vegetation on site.	Contractor		
		4 Air Chemical/ Smoke Pollution (Design)								

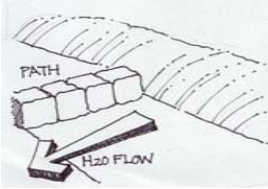
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					Crossing of drainage channels by site access roads and all permanent roads is to include culverts / pipes with energy dissipation / dispersion mechanisms integral to the design of the crossing. Stormwater: Storm water control during construction to be in terms of a submitted stormwater management plan submitted to PM for approval. Stormwater shall, where possible not be allowed to be concentrate and flow down cut or fill slopes or along pipeline routes without erosion protection measures in place.		Temporary drainage channels do not erode or degrade due to vehicles crossing over it. Storm water management plan has been drafted, is approved and being adhered to.	Contractor Contractor		
					Overflow channels shall be lined with stone pitching along the length and at the points of discharge. Stormwater channels shall not discharge straight down the contours but shall be aligned at such an angle to ensure that erosion does not take place. In the discharge area dense natural vegetation is to be planted where appropriate. Furthermore where appropriate all sections of the channel should be vegetated with indigenous, riverine vegetation. Excavations: Excavate, close, compact and rehabilitate trenches as soon as possible after the pipes have been installed. Avoid any open trenches for any extended period of time. If the excavation should be filled with water, this water is to be pumped from the trench in the appropriate manner and discharged in a responsible manner. Excavations and stored topsoil or other excavated material should be protected from heavy rain and runoff by means of cut-off berms and/ or sheet covering.	  	No erosion of channel or discharge point occurs. Storm water discharges oblique to contours in steep areas and do not erode laterally or overflow. Drainage channels remain vegetated with indigenous vegetation. Stormwater attenuation occurs through vegetation at discharge points. Trenches are not left open for extended periods of time. Trenches are properly back filled, compacted and revegetated. Stockpiled material for the purpose of backfilling trenches is properly protected against erosion from rain and runoff.	Contractor Contractor Contractor		

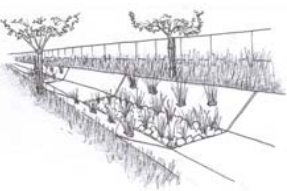
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					General: Erosion caused by severe rain storms must be rehabilitated as soon as possible after the damage has occurred. Limit the extent of the vegetation removal on a site. Re-vegetate all exposed surfaces as soon as is practically possible with indigenous grasses, shrubs and trees (which ever is most appropriate). Water usage during construction is to be closely monitored, especially for leaking pipes, taps etc. Where roots can act as erosion protection, tress should be cut as close as possible to the ground level and the rootball retained.		Areas where erosion is taking place are being rehabilitated. No extensive areas of exposed soil. Revegetation is successful. Water usage on site is closely monitored i.e. no leaking pipes etc. Root ball retained where appropriate.	Contractor		
		5 Erosion/ Topsoil Loss (Operations)	Landfill sites (DEb-5) Powerlines servitudes (DFd-5) Reservoir sites (DDg-5)		All exposed areas are to be revegetated as soon as practicably possible. Areas where erosion is evident are to be repaired as soon as erosion problems are evident. All access roads are to be of such a nature that run-off will not cause erosion. Drainage channels are to be constructed in appropriate locations and kept unblocked. A storm water management plan is to be established for the site and approved bu the PKSDM.		Limited areas of exposed soils. Remediation and maintenance of areas affected by erosion. Access roads aligned in such a manner as not to contribute to erosion. Sufficient drains are installed and maintained as necessary.	Operator/ maintenance personnel		
		5 Erosion/ Topsoil loss (Maintenance)	Mowing (MA-5) Alien Vegetation clearing (MD-5) Irrigation (MF-5) Trenching associated with pipe repairs (MK-5)		Mowing: The blades of the mowers are to be set at the appropriate height to ensure that the grass is not cut too short.		No exposed soil resulting from vegetation being mowed too short.	Contractor / maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					Alien vegetation clearing: A rehabilitation plan is to be established and approved by the Environmental Planning Section prior to the eradication of the alien vegetation. Extensive areas of exposed soil are to be avoided. The area where the alien vegetation has been removed is to be re-vegetated with the appropriate grass, shrub and tree species as soon as possible.		Approved rehabilitation plan. No estensive areas of exposed soil. Re-vegetation of area that has been cleared.	Contractor / maintenance personnel		

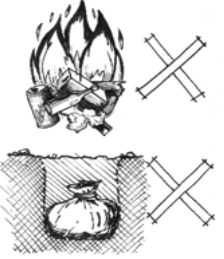
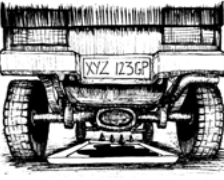
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					Where the removal of alien vegetation within stream channels is causing or may potentially lead to soil erosion, The stumps and root balls of trees and larger shrubs should be left in-situ to act as soil stabilisation and treated for coppicing. Large root balls can also be used as energy dissipaters alongside steeper embankments. Additional soil stabilisation with earth-filled hessian bags containing a mix of indigenous pioneer grass species seeds, securely staked into the earth, can also be used.		Alien vegetation removal is not causing erosion of the stream bank. Retained root balls do not propagate or cause recurrence of alien plants.	Contractor / maintenance personnel		
					Trenches: All trenches are to be backfilled, compacted and re-vegetated as soon as possible after the pipes have been repaired.		No sagging of areas where pipes have been repaired. No evidence of soil erosion where water has been pumped from the trenches.	Contractor / maintenance personnel		
					Topsoil is not to be used for the purposes of backfilling of any trenches or temporary excavations. Only subgrade or other excavated material as approved is to be used for the purpose of backfilling.		Topsoil is not being used for backfilling.	Contractor		
					Trenches that must be left open for extended periods of time, must be protected from surface runoff and rain by cut off berms and/ or sheet covering as approved by the PL. If the trenches should be filled with water, this water is to be pumped from the trench in the appropriate manner and discharged in a responsible manner.		No erosion of trenches or excessive ponding occurs.	Contractor		
					Irrigation points are not to be located in positions where they cause excessive runoff along steep embankments, especially where such slopes are being vegetated and do not yet have sufficient vegetation cover to prevent soil erosion.		Irrigation activities are not causing erosion.	Contractor / maintenance personnel		
		5 Erosion/ Topsoil loss (Design)	Cut/ fill slopes (DAa-5) Roadside planting (DAb-5) Roadside edges (DAC-5) Outlets (DBb-5) Drainage channels (DBh-5) Any structures with large foot-prints		All cut and fill slopes adjacent to roads are to be properly stabilised and where possible vegetated, as soon after construction has been completed as possible. Where steep slopes are required, plant species with strong root systems which will anchor the soil are to be used.		Speed of run-off is controlled in an appropriate manner so as not to result in erosion downstream of the inlet / outlet. Appropriate road alignment. Appropriate footprints for the extent of the proposed development. Erosion control is addressed in the tender document.	Engineers	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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					Where embankments alongside roads have to be steep, measures are to be undertaken to limit erosion of the banks, such as constructing a retaining wall. These structures are to be planted where possible.		Steep embankments do not erode or collapse.	Engineers		
					In instances where the construction of retaining walls are not neccessary, plantable concrete blocks should be used to stabilise slopes. These should be planted with indigenous veld grass species where appropriate or otherwise with indigenous lawn species.	 	Embankments do not erode.	Engineers		
					Roadside edges are to be so designed that they do not canalise water unnecessarily. Where steeper gradients occur, roadside edges must be designed and constructed so as to prevent erosion. Energy dissipation/ dispersion mechanisms are to be provided at all outflow points or where roadside edges end. Where roads are required along steep slopes, roadside edges must be protected from erosion by means of drainage channels with appropriately designed energy dissipating devices. Outlet points must be protected against erosion by means of energy dissipating structures and proper surface treatment.	 	Roadside edges do not erode and accumulated sediment is removed effectively.	Engineers		
					Crossing of drainage channels to include culverts/pipes with energy dissipation/dispersion mechanisms integral to the design of the crossing.		Drainage channel crossings cause the minimum possible disturbance to runoff. Erodion is prevented at outlets.	Engineers		
					Roads are to be aligned in such a manner as to avoid crossing the contours at acute angles, the road should cross contours as obliquely as possible.		Road alignment does not unnecessarily cause increased runoff rates. Erosion is avoided.	Engineers		
					The footprint for any proposed development is to be kept to a minimum to limit the extent of exposed soil that could result in erosion.		Minimal erosion of soil due to the extent of the building footprint.	Engineers		
					Erosion control is to be included in the tender documentation.			Contractor		

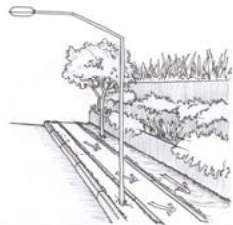
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				 	Ensure that the edges surrounding the stormwater structure are detailed in the appropriate manner to ensure that erosion does not take place e.g. floor, embankments etc. Where feasible stream channels should be re-shaped to have as natural a profile as possible. A shallower profile is less likely to erode and greatly reduces the channeling effect caused by a narrow, deeper profile, decreasing the risk of flooding. The sectional volume of the channel should be culculated by a hydrological engineer.		Erosion does not occur around storm water outlet structures. Shallower stream channel profiles are maintained where possible, reducing runoff rates.	Engineers Engineers	Hydrological engineer design to ensure that flooding or erosion of stream channel does not occur.	
				   	Where stormwater channels are being eroded due to heavy runoff and/ or steep embankments, appropriate mitigation measures such as gabion reinforcing should be installed. In areas where stream channels are being eroded due to a loss of vegetation, slope stabilisation and re-vegetation should be done. Soil-filled hessian bags containing a mix of indigenous pioneer grass species seeds, securely staked into the earth, can be used. Where appropriate, riverine tree species should also be planted. In instances where large volumes of water must be accommodated stream channels should, where appropriate, be properly stabilised and protected from erosion by means of plantable concrete unit pavers or gabion mattresses. Where appropriate, severe gully erosion must be rehabilitated through the introduction of successive gabion sedimentation devices, to create a terraced longitudinal stream profile. These structures must however not restrict the flow of runoff or reduce the stream capacity. Accumulated sediment must be used in the rehabilitation of the stream channel. The design of these devices must be undertaken by a hydrological engineer.		Erosion of storm water channel is halted and successful mitigation occurs. Erosion of storm water channel is halted and successful mitigation occurs. Erosion of storm water channel does not occur and stabilisation structures remain intact in heavy runoff conditions. Erosion of storm water channel is halted. Stabilisation structures remain intact in heavy runoff conditions. Sediment can be easily and effectively removed and is applied during rehabilitation.	Engineer / Contractor Contractor Engineer Engineer / contractor		

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		6 Significant Sedimentation (Construction)	Access roads (CAAd-6; CBf-6; CCf-6; CDC-6) Sedimentation as a result of erosion e.g. building footprints, vegetation loss		Ensure that a stormwater management plan is adhered to. Prevent extensive areas of exposed soil. Where soil is exposed, ensure that it is revegetated as soon as possible. Where soil will be stockpiled for more than one season, the stockpile is to be located in an appropriate place, vegetated and haybales placed along the perimeter of the stockpile. To reduce sedimentation of water courses or streets adjacent to the site place hay bales or earth-filled sand bags at the lowest point to trap the sediment.		Approved Stormwater management plan & compliance thereto. Limited areas of exposed soil. Successful re-vegetation. Hay bales or sand-filled bags placed at the lowest point, sediments regularly removed.	Contractor Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		6 Significant Sedimentation (Operations)	Sedimentation as a result of erosion e.g. building footprints, vegetation loss		Prevent extensive areas of exposed soil in the vicinity of the stormwater management structures. Where soil is exposed in the vicinity of the exposed stormwater management structures, ensure that it is revegetated as soon as possible.		Limited areas of exposed soil. Successful re-vegetation.	Maintenance Personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		6 Significant Sedimentation (Maintenance)	Sedimentation as a result of erosion caused by maintenance activities e.g. Alien vegetation clearance (MD-6) Resurfacing of roads (MJ-6) Trenching and pipe repairs (MK-6)		Prevent extensive areas of exposed soil in the vicinity of the stormwater management structures. Where soil is exposed in the vicinity of the exposed stormwater management structures, ensure that it is revegetated as soon as possible. The maintenance of stormwater structures, particularly with regard to sediment removal is to be undertaken at regular intervals to prevent blockage. Where resurfacing of roads is taking place, install hay bales at the lowest point to trap the sediments.		Limited areas of exposed soil. Successful re-vegetation. Stormwater infrastructure is free of significant sediment that would obstruct the effective functioning of the structure. Hay bales are in place.	Maintenance Personnel Maintenance Personnel Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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					The maintenance specifications for these structures are to be written and communicated to the personnel responsible for maintenance. The proposed stormwater structures are to be approved by a hydrological engineer.		Maintenance specifications are understood and adhered to.	Maintenance Personnel Engineer		
		7 Soil Compaction/ Impermeability (Construction)	Compaction of the areas where the following temporary functions are situated: Temporary buildings (CAc-7) Materials and building rubble storage areas (CBa-7; CBc-7) Access roads (CAAd-7; CBf-7; CCf-7; CDc-7)		Areas that have been compacted are to be ripped and scarified to a depth of 300mm. Remove all rubble such as concrete slabs, bricks, etc. and dispose thereof appropriately. The prepared area is to be re-vegetated with indigenous grasses, trees, or shrubs (which ever is most appropriate)		Successful revegetation of the compacted area.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		7 Soil Compaction/ Impermeability (Operations)								
		7 Soil compaction/ Impermeability (Maintenance)	Compaction of the areas such as maintenance camps, temporary access roads to maintenance areas e.g. Alien vegetation removal (MD-7) Sediment removal (MG-7) Road resurfacing (MJ-7) Trenching and pipe repairs (MK-7)		Areas that have been compacted are to be ripped and scarified to a depth of 300mm. Remove all rubble such as concrete slabs, bricks, etc. and dispose thereof appropriately. The prepared area is to be re-vegetated with indigenous grasses, trees, or shrubs (which ever is most appropriate)		Successful revegetation of the compacted area.	Maintenance personel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		7 Soil Compaction/ Impermeability (Design)	Design aspects of: Roadside edges (DAc-7) Stormwater channel design (DAh-7)		Limit the areas that will be compacted by the construction activities. Locate the areas that will be compacted in an appropriate place, i.e. not at the lowest section of the site where revegetation may be problematic. Ensure that the tender document addresses the requirements for the remediation of compacted areas. Where feasible and appropriate, sections of existing concrete drainage channels should be replaced with gabion mattresses or plantable concrete blocks. This shold only be done where slopes are gentle and the design of these structures should be carried out a by a hydrological engineer.		Limited compaction areas. Logical location for areas that will be compacted. Soil compaction addressed in tender documentation. Where feasible the impermeability of existing concrete storm water channels is reduced. These areas do not deteriorate or erode from heavy runoff.	Engineer Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		8 Soil Contamination (Construction)	Cleaning, sanitation & worker activity (CAb-8) Storage of: Chemicals and fuels (CBb-8) Wastes and refuse (CBd-8) Plant & equipment (CBe-8)		Refuse collection and removal: Dustbins and proper refuse area must be designated in the construction camp. NO containers or refuse storage areas will be permitted on other areas of the construction site. Refuse is not to be buried or burnt on site. Chemical storage: All chemical storage i.e. paint, solvents, fuel etc. is to be stored in a lockable area, on a concrete slab with a 500mm bund wall. The structure is to have a roof. Where applicable the appropriate authorisations from DTEC are to be obtained. Spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer. The resulting contaminated soil / absorbtion material is to be diposed of in the appropriate manner. Vehicle & plant maintenance: No vehicle or plant maintainace is to take place on site. All vehciles and equipment that have oil leaks are to be reported to the environmental officer on site and repaired as a matter of urgency. If the project requires such repairs on site, a designated area is to be established and managed accordingly. Drip trays must be placed under each contruction vehcile when it is not in operation at all times.	  	Absence of waste stockpiling on site. Storage of chemical is undertaken in the appropriate manner. Authorisation has been granted by DTEC. Record of spillages and the remediation is kept. No repairs to vehicles and plant is evident on site or only taking place in designated areas. Soil contamination does not occur from unavoidable repairs on site.	Contractor Contractor Contractor Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		8 Soil Contamination (Operations)	Could result from negligence or operational problems, at the following: Waste water treatment site (DCb-8) Basic sanitation provision (Dcc-8) Storage dumps/ landfill sites (DEb-8)		Chemical storage: All chemical storage i.e. paint, solvents, fuel etc. is to be stored in a lockable area, on a concrete slab with a 500mm bund wall. The structure is to have a roof. Where applicable the appropriate authorisations from DTEC are to be obtained. Spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer. The resulting contaminated soil / absorbtion material is to be diposed of in the appropriate manner.		Storage of chemical is undertaken in the appropriate manner. Authrisation has been obtained from DTEC. Record of spillages and the remediation is kept.	Contractor Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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					Vehicle and plant maintenance: No vehicle or plant maintenance is to take place on site. All vehicles and equipment that have oil leaks are to be reported to the environmental officer on site and repaired as a matter of urgency. If the project requires such repairs on site, a designated area is to be established and managed accordingly. Drip trays are to be placed under all vehicles and plant when not in operation.		No repairs to vehicles and plant is evident on site or only taking place in designated areas. Soil contamination does not occur from unavoidable repairs on site.	Contractor		
		8 Soil Contamination (Maintenance)	Could result from the following activities: Mowing (MA-8) Alien vegetation clearing (MD-8) Sediment removal (MG-8) Road resurfacing (MJ-8) Trenching (MK-8) Sewage spill clean-up (ML-8)		Refueling of vehicles and plant: Where the refueling of the vehicles and plant is to take place on site, the appropriate measures are to be taken to reduce soil contamination. Fuel tanks and refueling areas are to be on a concrete slab, with a 500mm bund wall or cut-off drain which prevents spillage from contaminating the surrounding soil. Chemical storage: All chemical storage i.e. paint, solvents, fuel etc. is to be stored in a lockable area, on a concrete slab with a 500mm bund wall. The structure is to have a roof. Where applicable the appropriate authorisations from DTEC are to be obtained. Spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer. The resulting contaminated soil / absorbtion material is to be disposed of in the appropriate manner. Vehicle and plant maintenance: No vehicle or plant maintenance is to take place on site. All vehicles and equipment that have oil leaks are to be reported to the environmental officer on site and repaired as a matter of urgency. If the project requires such repairs on site, a designated area is to be established and managed accordingly. Drip trays must be placed under each construction vehicle when it is not in operation.		Refueling on site is being addressed in the appropriate manner. Storage of chemical is undertaken in the appropriate manner. Authorisation has been obtained from DTEC. Record of spillages and the remediation is kept. No repairs to vehicles and plant is evident on site or only taking place in designated areas.	Contractor Contractor Contractor Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		8 Soil Contamination (Design)	Landfill sites (DEb-8)		Ensure that the appropriate structures are accommodated on site to mitigate the contamination of soil by chemicals. Ensure that the requirements for the prevention of soil contamination are included in the tender documents. Ensure that the landfill sites have the correct classification and that the appropriate liners, as required by DWAf are in place.		Soil pollution is addressed in the design and planning stage of the project.	Engineers	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		9 Slope Collapse (Construction)	Insufficient support of excavations (CCb-9) This aspect may lead to significant sedimentation, refer to relevant section.		Ensure that excavations are sufficiently supported at all times.		No soil collapse on the construction site.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		9 Slope Collapse (Operations)								
		9 Slope Collapse (Maintenance)	Maintenance of retaining structures (MI-9)		Ensure that the integrity of the retaining structures is not undermined by erosion. This includes: * ensuring positive, controlled drainage behind retaining walls * ensuring that fill behind the retaining walls remains in place.		Retaining structures do not fail.		Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		9 Slope Collapse (Design)	Cut and fill slopes along roads (DAa-9) Storm water inlets (DBa-9) Storm water outlets (DBb-9) Detention structures (DBc-9) Retention Structures (DBd-9) Channels (DBh-9) Storage dumps/ landfill sites (DEb-9)		Ensure that the retaining structures that are designed are appropriate for the function that is to be fulfilled. Where embankments alongside roads have to be steep, measures are to be undertaken to prevent collapse of the embankments, such as constructing a retaining wall. These structures are to be designed by an engineer and planted where possible.		Approved building plans. No collapse of embankments along steep sections of road,	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM. Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	



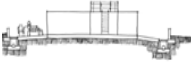
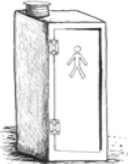
PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES
MUNICIPAL CIVIL INFRASTRUCTURE: SURFACE WATER IMPACTS - EMP MASTER



Date: 2007-12-14	Project No: A1289	Consultant: African EPA	Client: PKSMD
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		10 Surface Water Physical Pollution (Construction)	Cleaning, sanitation & worker activity (CAb-10) Storage or dumping of building rubble (CBc-10) Storage of general refuse (CBd-10) Refuse/ rubble removal from site (Cdb-10)		All litter and building rubble is to be collected, stored in a central place within the construction camp and disposed of in the appropriate manner. Waste collection is to be undertaken on a regular basis, all weigh bills are to be filed. Litter and refuse are not to be dumped in or stored near any watercourses or water bodies and preventative measures are to be taken to ensure that refuse does not wash out of designated storage areas during heavy rains.	 	Litter and rubble free site. Weigh bills of the waste disposed should be available on request.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	
		10 Surface Water Physical Pollution (Operations)			All sites that are operational should ensure that no litter is present on site. Any litter is to be collected, stored and disposed of in the appropriate manner.		Litter free site.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	
		10 Surface Water Physical Pollution (Maintenance)	Following activities may result in pollution: Mowing (MA-10) Pruning (MB-10) Weeding (MC-10) Sediment removal (MG-10) Refuse removal (MH-10)		Litter and waste removal: All litter and building rubble is to be collected, stored in a central place and disposed of in the appropriate manner. Waste collection is to be undertaken on a regular basis, all weigh bills are to be filed. Sediment removal: The material that is to be removed is to be removed and transported in such a manner that it does not pollute the surrounding surface water. The detailed EMP for this activity is to be adhered to. Organic waste removal: All plant cuttings and remains are to be taken to a registered garden refuse drop off point and compost made from the material.		Litter and rubble free site. Weigh bills of the waste disposed should be available on request. No pollution of surface water resources in the vicinity of the sediment removal activities. Compost for use by PKSMD.	Maintenance personnel Contractor Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD. Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD. Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	

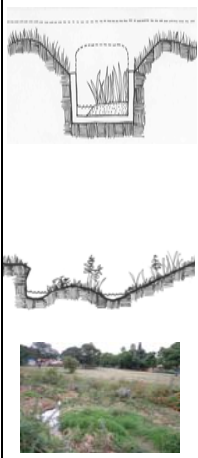
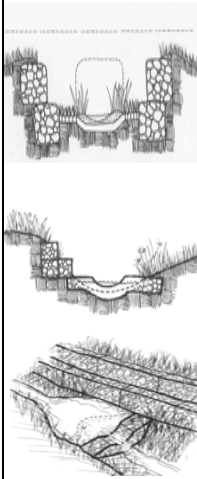
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		10 Surface Water Physical Pollution (Design)	Following infrastructure requires physical pollution control: Roadside edges (DAc-10) Inlets (DBa-10) Outlets (DBb-10) Detention & retention structures (DBc- 10, DBd-10) Channels (DBh-10) Landfill sites (DEb-10)		Where required & appropriate litter traps are to be incorporated in the design of certain stormwater management infrastructure. Mitigation measures relating to surface water pollution are to be incorporated in the tender documents.		Reduced litter in surface water resources.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		11 Surface Water Sewage Pollution (Construction)	Sanitation and worker activity at the construction camp (CAB-11)		Shower or washing facilities, when provided, must be linked to the existing sewer system or the runoff must be drained to a soak-away system as approved by the ECO or project manager.		Positive drainage of all amenities.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		11 Surface Water Sewage Pollution (Operations)	Sewage treatment works (DCb-11) Basic sanitation provision (DCc-11)		Any spillages that may occur in the sewage treatment works are to be cleaned up in the appropriate manner. The site supervisor is to be notified as soon as a problem has arisen. All monitoring as stated in the EMP and DWAF water use license are to be adhered to.		Incident & accident reporting of the event as well as the action taken. Monitoring results are to be made available on request.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		11 Surface Water Sewage Pollution (Maintenance)								
		11 Surface Water Sewage Pollution (Design)	Sewage treatment works (DCb-11) Basic sanitation provision (DCc-11)		Ensure that the operation of the facility is taken into account in the design process and the precautionary principle taken for the design of sewage treatment works. Ensure that the facility has sufficient capacity and does not operate beyond its capacity.		Design that addresses environmental impacts holistically.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

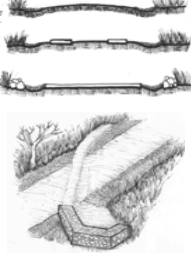
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					Provision should be made in the design of additional infrastructure or new treatment plants, for the mitigation of potential spills. This could include a concrete slab around aeration dams with a cut off drain, or emergency overflow. These systems should release excess sewage into the dry beds. However said measures should only be for emergency use, until the capacity of the treatment works has been sufficiently increased.			Engineer		
		12 Surface Water Biological Pollution (Construction)	Cleaning, sanitation and general worker activity at the construction camp (CAb-12)		Ensure that no raw sewage enters any water resources. VIP latrines should be provided in the construction camp. Pit latrines and soakaways should only be used if the geo-hydrological assessment indicates that it is acceptable to do so. Said structures should be located outside any flood lines or as indicated by a specialist. Only ablution facilities provided in the construction camp may be used for this purpose. Non-compliance or using the rest of the site as latrine must be fined.	 	Monitoring the water quality data. No pollution of water due to worker activities. No human waste or unauthorised ablation on site.	Contractor Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		12 Surface Water Biological Pollution (Operations)	Sewage Treatment works (CCb-12)		Ensure that no raw sewage enters any water resources.		Monitoring the water quality data.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		12 Surface Water Biological Pollution (Maintenance)								
		12 Surface Water Biological Pollution (Design)	Sewage Treatment works (CCb-12)		Ensure that the operation of the facility is taken into account in the design process and the precautionary principle taken for the design of sewage treatment works. Ensure that the facility has sufficient capacity and does not operate beyond its capacity.		Design that addresses environmental impacts holistically.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

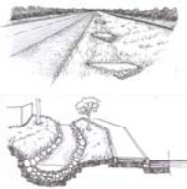
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		13 Surface Water Chemical Pollution (Construction)	Fuel storage (CBb-13) Mixing of materials (CDa-13)		Mixing of materials: Run-off produced by aggregate washing, concrete mixing and curing should be regulated by erosion control measures. All mixing of materials should take place at a suitable distance from the any water resources. Concrete mixing shall only take place within the designated areas on site. Refueling: Where the refueling of the vehicles and plant is to take place on site, the appropriate measures are to be taken to reduce the potential of surface water contamination. Fuel tanks and refueling areas are to be on a concrete slab, with a 500mm bund wall or cut-off drain which prevents spillage from contaminating the surrounding soil. Chemical storage: All chemical storage i.e. paint, solvents, fuel etc. is to be stored in a lockable area, on a concrete slab with a 500mm bund wall. The structure is to have a roof. Where applicable the appropriate authorisations from DTEC are to be obtained.	  	No evidence of run-off into the surrounding water courses. Mixing takes place at a reasonable distance from water courses. Designated areas for concrete mixing. Refueling on site is being addressed in the appropriate manner. Storage of chemical is undertaken in the appropriate manner. Authorisation has been obtained from DTEC.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					Chemical spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer.		Record of spillages and the remediation is kept.			
		13 Surface Water Chemical Pollution (Operations)	Waste water treatment works (DCb-13) Chemical & Fuel storage		Refueling: Where the refueling of the vehicles and plant is to take place on site, the appropriate measures are to be taken to reduce the potential of surface water contamination. Chemical storage: All chemical storage i.e. paint, solvents, fuel etc. is to be stored in a lockable area, on a concrete slab with a 500mm bund wall. The structure is to have a roof. Where applicable the appropriate authorisations from DTEC are to be obtained. Chemical spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer.		Refueling on site is being addressed in the appropriate manner. Storage of chemical is undertaken in the appropriate manner. Authorisation has been obtained from DTEC. Record of spillages and the remediation is kept.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		13 Surface Water Chemical Pollution (Maintenance)	Treating of weeds with pesticides (MC-13) Chemical treatment of alien invader plant species (MD-13) Careless litter and refuse removal (MH-13) Road resurfacing (MJ-13)		Refueling: Where the refueling of the vehicles and plant is to take place on site, the appropriate measures are to be taken to reduce the potential of surface water contamination. In areas where refuse is removed, the operator is to ensure that all the refuse is collected. Where spillage of refuse has occurred, it is to be collected and disposed of accordingly. Chemical spillages: Spillages are to be reported to the environmental officer on site or to the foreman, the appropriate clean up is to take place and be approved by the environmental officer.		Refueling on site is being addressed in the appropriate manner. No sign of spillage or litter pollution. Record of spillages and the remediation is kept.	Maintenance personnel Maintenance personnel Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM. Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					Ensure that the requirements for the prevention of soil contamination are included in the tender documents. Ensure that the landfill sites have the correct classification and that the appropriate liners, as required by DWAF are in place.		Soil pollution is addressed in the design and planning stage of the project.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					Access roads: Ensure that the roads are slightly above the natural ground level to ensure positive drainage. Along temporary roads, water drainage channels are to be constructed in the appropriate manner to prevent erosion. Backfilling: All excavated areas are to be backfilled in layers of 150mm and compacted prior to the placement of the next layer. Positive drainage on site: All levels on the site are to be in accordance with the design drawings. Ponding is to be prevented by ensuring positive drainage in all areas of the site.		Access roads above natural ground level. Appropriate drainage channels along temporary roads. No sagging / settling of compacted areas occurs. No ponding is evident on site.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		14 Drainage Problems (Operations)			Positive drainage on site: All levels on the site are to be such that positive drainage can take place. Ponding is to be prevented by ensuring positive drainage in all areas of the site. Stormwater management: All inlets, outlets, detention and retention structures are to be maintained in such a manner that the flow of water is not obstructed in any manner to ensure effective functioning of the structure. The material that is removed from these structures is to be disposed of in the appropriate manner.		No ponding is evident on site. No indications of stormwater ponding or causing flooding of any areas. Free-flowing inlets outlets and pipes.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		14 Drainage Problems (Maintenance)	Poor irrigation practice which leads to ponding (MF-14) Trenching/ pipe repairs (MK-14)		Irrigation points/ sprinklers should be so positioned that they do not cause runoff to accumulate in low-lying areas; and positive site leveling should be ensured to prevent ponding from occurring. Irrigation programs and timing should be based on the requirements of the landscape planting design and unnecessary irrigation is to be avoided.		No ponding due to excessive or inappropriate irrigation practices evident on site.	Contractor/ Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					Stormwater management: All inlets, outlets, detention and retention structures are to be maintained in such a manner that the flow of water is not obstructed in any manner to ensure effective functioning of the structure. The material that is removed from these structures is to be disposed of in the appropriate manner.		No indications of stormwater ponding or causing flooding of any areas.			
		14 Drainage Problems (Design)	Stormwater considerations relating to the design of the following: Roadside edges (DAC-14) Inlets (DBa-14) Outlets (DBb-14) Detention structures (DBc-14) Retention structures (DBd-14) Artificial wetlands (DBf-14) Pipes (DBg-14) Channels (DBh-14)		Positive drainage on site: All levels on the site are to be such that positive drainage can take place. Ponding is to be prevented by ensuring positive drainage in all areas of the site. General: Ensure that the aspects of drainage are adequately addressed in the tender document as well as how drainage problems are to be resolved.		Resolved levels prior to construction commencing.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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					Stormwater management: All inlets, outlets, detention and retention structures are to be maintained in such a manner that the flow of water is not obstructed in any manner to ensure effective functioning of the structure. The design is to accommodate easy access and cleaning of these structures and not cause excessive sedimentation or collection of debris.		Effectively functioning stormwater structures.			
		15 Anaerobic Conditions (Construction)								
		15 Anaerobic Conditions (Operations)	Waste water treatment works (DCb-15)		Should anaerobic conditions arise, a specialist is to be consulted.		Specialist consulted and condition resolved.		Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		15 Anaerobic Conditions (Maintenance)	Detention & retention structures - 14 sediment removal (MG-15)		Should anaerobic conditions arise, a specialist is to be consulted.		Specialist consulted and condition resolved.		Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		15 Anaerobic Conditions (Design)	Detention & retention structures, artificial wetlands (DBc-15; DBd-15; DBf-15)		Designs should ensure that anaerobic conditions will not operate in the plants unless so intended.		Specialist consulted and condition resolved.		Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		16 Increased Runoff Rate (Construction)	Access roads with steep slopes which increases the speed of run-off (CAa-16; CBf-16; CCf-26; CDc-16) Levels on site which do not adequately direct storm water runoff or are to steep (CDd-16)		Where increased run-off is evident on the site, measures are to be taken to reduce the speed of run-off. This can be accomplished by placing gravel or establishing cut-off mounds that drain the water to a designated area where the speed of flow is retarded as the water flows over the grassed areas. Sheetflow from the site is to be directed into the stormwater structures that are to be established on site.		No erosion, as a result of increased run-off rate visible on site.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		16 Increased Runoff Rate (Operations)	All sites		Where increased run-off is evident on the site, measures are to be taken to reduce the speed of run-off. This can be accomplished by placing gravel or establishing cut-off mounds that drain the water to a designated area where the speed of flow is retarded as the water flows over the grassed areas.		No erosion, as a result of increased run-off rate visible on site.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		16 Increased Runoff Rate (Maintenance)	Steep slopes increase the speed of run-off Compacted Areas arising from road resurfacing (MJ-16) and any other maintenance requiring heavy vehicles		Where increased run-off is evident on the site, measures are to be taken to reduce the speed of run-off. This can be accomplished by placing gravel or establishing cut-off mounds that drain the water to a designated area where the speed of flow is retarded as the water flows over the grassed areas.		No erosion, as a result of increased run-off rate visible on site.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		16 Increased Runoff Rate (Design)	Design aspects relating to: Roadside edges (DAc-16) Channels (DBh-16)	 	Slopes along roads, and channel embankments are not to exceed a 1:3 gradient. Where this is not feasible such embankments shall be stabilised with plantable concrete blocks, gabions or retention walls, as appropriate.		No erosion taking place on site due to the establishment of structures that assist in the reduction of stormwater flow.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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					Where feasible, vegetated swales are to be used to channel stormwater run-off alongside roads. Alternatively packed stone is to be used, where runoff rates will allow it. Retention and detention structures can be designed into the stormwater management plan of the site.					



PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES
MUNICIPAL CIVIL INFRASTRUCTURE: GROUND WATER IMPACTS - EMP MASTER

Date: 2007-12-14	Project No: A1289	Consultant: African EPA	Client: PKSMD
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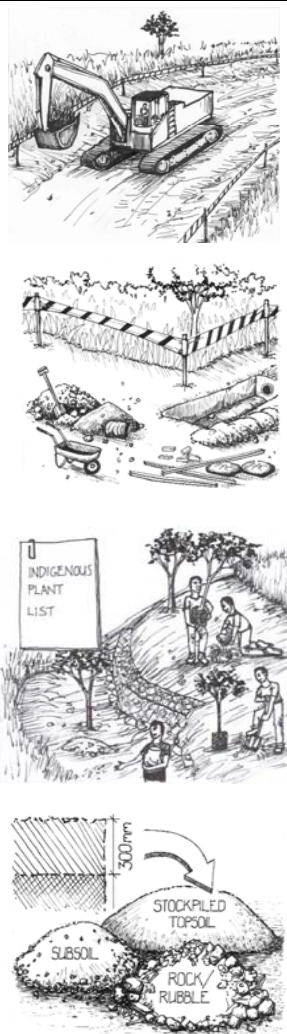
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		17 Ground Water Biological Pollution (Construction)								
		17 Ground Water Biological Pollution (Operations)	Waste water collection (DCa-17) Waste water treatment (DCb-17) Basic sanitation provision (DCC-17) Landfill sites (DEb-17)		Should such a condition arise, a specialist is to be consulted.		Specialist consulted and condition resolved.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	
		17 Ground Water Biological Pollution (Maintenance)	Negligent or insufficient sewage spill cleanup (ML-17)		Should such a condition arise, a specialist is to be consulted.		Specialist consulted and condition resolved.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	
		17 Ground Water Biological Pollution (Design)	Waste water collection (DCa-17) Waste water treatment (DCb-17) Basic sanitation provision (DCC-17) Landfill sites (DEb-17)		Designs should ensure that biological pollution of the ground water is prevented.		Specialist appointed to verify designs.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	
		18 Ground Water Chemical Pollution (Construction)	On site storage of chemicals and fuels (CBb-18)		Should such a condition arise, a specialist is to be consulted.		Incident report which states cause of the spill as well as how the situation was remediated.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	
		18 Ground Water Chemical Pollution (Operations)	Waste water treatment works (DCb- 18) Negligent or inappropriate operational procedures at landfill sites and storage dumps (DEb-18)		Should such a condition arise, a specialist is to be consulted.		Specialist consulted and condition resolved.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSMD.	

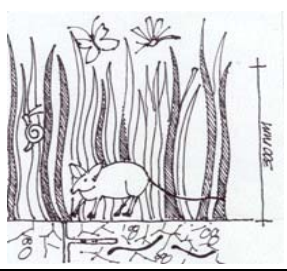
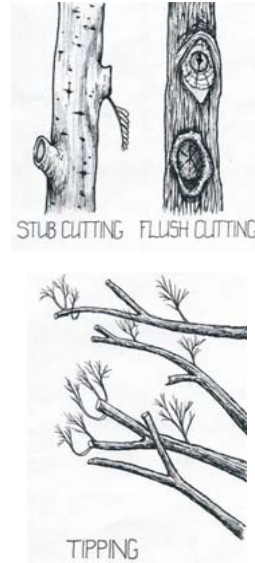
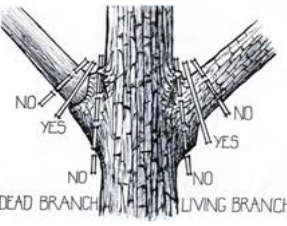
		18 Ground Water Chemical Pollution (Maintenance)	Treating of weeds with pesticides (MC-18) Chemical treatment of alien invader plant species (MD-18) Careless litter and refuse removal (MH-18) Road resurfacing (MJ-18)		Should such a condition arise, a specialist is to be consulted.		Specialist consulted and condition resolved.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		18 Ground Water Chemical Pollution (Design)	Waste water treatment works (DCb-18) Insufficient landfill sites and storage dumps design (DEb-18)		Designs should ensure thatchemical pollution of the ground water is prevented.		Specialist appointed to verify designs.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	



PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES	
MUNICIPAL CIVIL INFRASTRUCTURE: FAUNA AND FLORA IMPACTS - EMP MASTER	

Date: 2007-12-14	Project No: A1289	Consultant: African EPA	Client: PKSDM
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RELEVANT LEGISLATION/ STANDARDS	REFERENCE DRAWING/ SHEET NO.	SPECIFIC IMPACTS	POSSIBLE CAUSE	IMPACT PHOTO/ DRAWING EXAMPLE	MITIGATION MEASURE	MITIGATION PHOTO/ DRAWING EXAMPLE	PERFORMANCE INDICATOR/ VERIFICATION	RESPONSIBILITY	NOTES/ GENERAL	SIGN. + DATE
		19 Habitat & vegetation loss (Construction)	Cooking areas and fires (CAa-19) Cleaning, sanitation worker activities on site (CAb-19) Temporary and permanent buildings on site (CAC-19) Access Roads (CAAd-19; CBf-19; CCf-19; CDc-19)		Access & construction roads must be established in areas that are already disturbed, e.g. where alien vegetation has been removed, tracks exist etc. Loss of habitat and vegetation as a result of the construction activities is to be minimised as far as possible. Trees that have been identified by a suitably qualified person are to be retained as best possible during the construction phase. Areas where vegetation loss has occurred as a result of construction activities are to be rehabilitated as per the site specific EMP. Topsoil is to be stripped in such a manner that the seed bank is contained therein (first 300mm of soil). This topsoil is to be stockpiled separately and utilized specifically for rehabilitation purposes. The site specific EMP is to be adhered to.		Access roads and other infrastructure located in disturbed areas. Few areas of habitat and vegetation loss. Marked trees on site that are protected e.g. fenced). Areas being rehabilitated successfully. Topsoil (first 300mm) separately stockpiled. Site specific EMP being adhered to.	Contractor Contractor Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		19 Habitat & vegetation loss (Operations)			Rehabilitated areas are to be maintained and where rehabilitation is not successful are to be reinstated. The site specific EMP is to be adhered to.			Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		19 Habitat & vegetation loss (Maintenance)	Careless or inappropriate mowing (MA-19) Careless or inappropriate pruning (MB-19) Alien vegetation clearance (MD-19)		No vegetation is to be removed arbitrarily unless it is interfering with the operation of the facility. Weeds and alien invader vegetation should be removed in all instances. The blades of the mowers are to be set at the appropriate height to ensure that the grass is not cut too short.		Retained habitats on site.	Operator/ Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
					When pruning trees and larger shrubs, care should be taken to avoid stub-and flush cutting, or merely "tipping" (removing the ends of branches) as these practices may lead to distressed or diseased vegetation, which may eventually die.		No damage to plants from pruning activities	Operator/ Maintenance personnel		
		19 Habitat & vegetation Loss (Design)	Positioning and specific design of the following facilities and infrastructure could lead to habitat and vegetation loss: Cut and fill slopes along roads (DAa-19) Stormwater inlets and outlets (DBa-19; DBb-19) Waste water treatment facilities (DCb-19) Water purification works (DDe-19) Reservoir sites (DDg-19) Landfill and dumping sites (DEb-19) Powerlines servitudes (DFb-19)		No vegetation is to be removed arbitrarily unless it is interfering with the operation of the facility. Weeds and alien invader vegetation should be removed in all instances and these areas rehabilitated with indigenous vegetation. Where possible buildings, facilities and structures should be located to avoid the loss of areas of indigenous vegetation.		Retained habitats on site.	Maintenance Personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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			Loss of potential habitat areas arising from the extensive use of exotic, water-consuming plant species (DAb-19)		Where possible roadside planting should be indigenous species that require limited irrigation.		Roadside planting offers habitat and is a source of food to bird species.	Contractor		
		20 Habitat Fragmentation (Construction)	Positioning of acces roads on site (CAAd-20; CBf-21; CCf-20; CDc-20)		Construction activities are to avoid breaking up clumps of vegetation for access purposes. Construction vehicles are to move around these clumps.		No fragmentation of habitats unless unavoidable.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		20 Habitat Fragmentation (Operations)	Operational actions at the following facilities and structures: Waste water treatment facilities (DCb-20) Water purification works (DDe-20) Reservoir sites (DDg-20) Landfill and dumping sites (DEb-20) Powerlines servitudes (DFb-20)		The activities associated with the operation of the plant should avoid breaking up clumps of vegetation for access purposes. Alternative routes are to be used. Only the minimum amount of vegetation around facilities must be removed to maintain safety and operational requirements and allow maintenance personnel access to facilities.		No fragmentation of habitats unless unavoidable.	operator/ maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		20 Habitat Fragmentation (Maintenance)								
		20 Habitat Fragmentation (Design)	Design and positioning of the following facilities and structures: Waste water treatment facilities (DCb-20) Water purification works (DDe-20) Reservoir sites (DDg-20) Landfill and dumping sites (DEb-20) Powerlines servitudes (DFb-20)		Layout of the proposed development is to take cognizance of habitats. The recommendations stated in the ecological report, undertaken as part of the EIA are to be incorporated in the design process.		Ecologically sensitive design.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

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		21 Habitat Degradation/ Disturbance (Construction)	Inappropriate location of access roads could lead to environmental degradation or disturbance - including weed growth and alien invader plant species proliferation (CAAd-20; CBf-21; CCf-21; CDc-21)		Access & construction roads must be established in areas that are already disturbed, e.g. where alien vegetation has been removed, tracks exist etc. The site specific EMP is to be adhered to in this regard.		No sign of disturbed areas on site. Compliance with EMP	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		21 Habitat Degradation/ Disturbance (Operations)	Operational actions at the following facilities and structures: Waste water treatment facilities (DCb-21) Bulk water lines (DDc-21) Water purification works (DDe-21) Reservoir sites (DDg-21) Landfill and dumping sites (DEb-21) Powerlines servitudes (DFb-21)		Cognizance is to be taken of ecologically important areas. Where possible operational movement around plant and facilities is to be limited, to avoid disturbance of remaining habitat areas. The site specific EMP is to be adhered to in this regard.		No sign of disturbed areas on site. Compliance with EMP	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		21 Habitat Degradation/ Disturbance (Maintenance)	Carelessness during weeding/ alien plant clearance activities (MC-21; MC-22) Inadequate re-planting of embankments, slopes or rehabilitated areas (ME-21) Sediment removal (MG-21) Embankment structural maintenance (MI-21) Road resurfacing (MJ-21) Trenching/ pipe repairs (MK-21)		Cognizance is to be taken of ecologically important areas. Weeds and alien invader plant species removed from any area should be disposed off at a garden refuse site or as specified in the EMP. Care must be taken to prevent propagative material from getting into watercourses or ecologically sensitive areas during weeding/ alien vegetation clearance. Adequate measures should be taken during site rehabilitation activities, to prevent the spread of weeds or possible alien invader plant species. Stored topsoil should be used for this purpose and continued weeding must be done during the initial establishment of the planted vegetation, as required. The site specific EMP is to be adhered to in this regard.		No sign of disturbed areas on site. Compliance with EMP	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

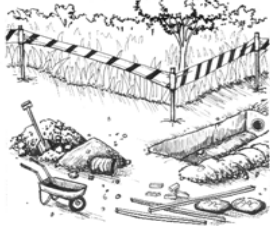
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		21 Habitat Degradation/ Disturbance (Design)	Accumulated sediment, litter and alien plant seeds in storm water management structures (DBa-21; DBb- 21; DBc-21; DBd-21; DBe-21; DBf-21; DBh-21)		Layout of the proposed development is to take cognizance of habitats. Designs of all storm water systems are to facilitate the easy and effective removal of weed growth, accumulated materials, sediment and pollution. The recommendations stated in the ecological report, undertaken as part of the EIA are to be incorporated in the design process.		No sign of disturbed areas on site. No disturbance to watercourse vegetation or adjacent habitat caused by storm water structures. Compliance with EMP	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		22 Poaching (Construction)	Worker activity on site (CAb-22)		No poaching is allowed on or in the vicinity of the site. No collection of firewood, from vegetated areas on or near the site is allowed. Employees found to be undertaking such activities will be fired. Inform employees accordingly.		No evidence of snares, skins etc. No damaged trees or other planting.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		22 Poaching (Operations)	All plant or facilities situated in remote locations or near natural habitat areas.		No poaching is allowed on or in the vicinity of the site. No collection of firewood, from vegetated areas on or near the site is allowed. Employees found to be undertaking such activities will be fired. Inform employees accordingly.		No evidence of snares, skins etc. No damaged trees or other planting.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		22 Poaching (Maintenance)	Alien vegetation removal or other maintenance activities in remote locations or near natural habitat areas.		No poaching is allowed on or in the vicinity of the site. No collection of firewood, from vegetated areas on or near the site is allowed. Employees found to be undertaking such activities will be fired. Inform employees accordingly.		No evidence of snares, skins etc. No damaged trees or other planting.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		22 Poaching (Design)								

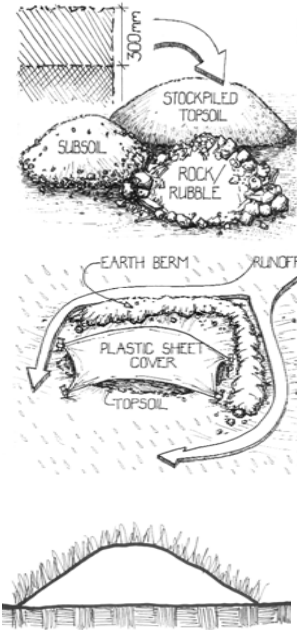


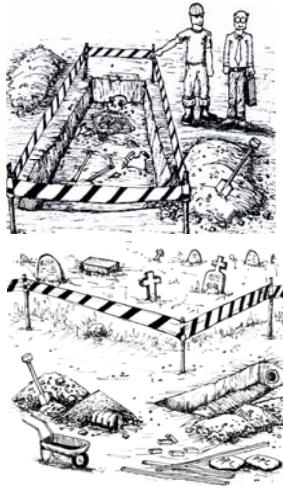
PIXLEY KA SEME DISTRICT MUNICIPALITY - MUNICIPAL INFRASTRUCTURE GUIDELINES
MUNICIPAL CIVIL INFRASTRUCTURE: OTHER IMPACTS - EMP MASTER

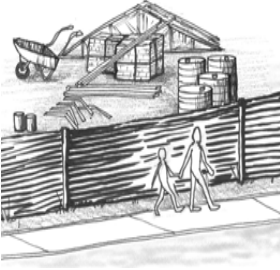


Date: 2007-12-14	Project No: A1289	Consultant: African EPA	Client: PKSDM
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		23 Other impacts - Sensitive areas (construction)			Sensitive areas are to be fenced and include an appropriate buffer zone. Ensure that no building activity takes place in the demarcated sensitive areas. Measures stated in the site specific EMP are adhered to.		Fenced sensitive areas. No building activities in sensitive areas. Compliance with site specific EMP	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Sensitive areas (operation)			Ensure that no activities associated with the operation of the facility are taking place in the sensitive areas. Measures stated in the site specific EMP are to be adhered to.		No sign of operation activities taking place in sensitive areas. Compliance with site specific EMP	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Sensitive areas (maintenance)			Ensure that no activities associated with the maintenance of the facility are taking place in the sensitive areas. Measures stated in the site specific EMP are to be adhered to.		No sign of inappropriate maintenance activities taking place in sensitive areas. Compliance with site specific EMP	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Sensitive areas (design)			Ensure that all building footprints are outside any sensitive areas e.g. ridges, flood plains etc. Ensure that mitigation measures are proposed in the EMP for the environmental management of these areas.		No buildings in sensitive areas. Management of sensitive areas included in EMP.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

RELEVANT LEGISLATION/ STANDARDS	REFERENCE DRAWING/ SHEET NO.	SPECIFIC IMPACTS	POSSIBLE CAUSE	IMPACT PHOTO/ DRAWING EXAMPLE	MITIGATION MEASURE	MITIGATION PHOTO/ DRAWING EXAMPLE	PERFORMANCE INDICATOR/ VERIFICATION	RESPONSIBILITY	NOTES/ GENERAL	SIGN. + DATE
		23 Other impacts - Topsoil management (construction)			The contractor is to strip topsoil from the relevant areas as identified and stockpile the material prior to the commencement of the construction activities. Topsoil should be stored separately from other excavated material and building rubble. Topsoil stockpiles are not to exceed 1.5m in height, and placed in locations that will not interfere with building activities. Topsoil is only to be handled twice - once to strip and stockpile and secondly to replace where required. Topsoil should be stockpiled in the appropriate manner to prevent erosion and compaction of the stockpiled soil. If the stockpile is remain on site for more than one season it is to be vegetated.		Stockpile of topsoil in the agreed position. Stockpiles are not higher than 1.5m. Stockpiles have hay bales on the perimeter and are not situated in drainage channels. Vegetated stockpile (if required).	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Topsoil management (operation)			Conditions stipulated in the site specific EMP are to be adhered to. Stockpile should be vegetated, and vegetation maintained.		Compliance with site specific EMP. No erosion of stockpile evident.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Topsoil management (maintenance)			Conditions stipulated in the site specific EMP are to be adhered to. Stockpile should be vegetated, and vegetation maintained.		Compliance with site specific EMP. No erosion of stockpile evident.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Topsoil management (design)			Areas that are to be stripped of topsoil for the building and infrastructure is to be limited. Ensure that the aspect of topsoil management is addressed in the EMP.		Limited areas requiring topsoil stripping. Inclusion of topsoil management in EMP.	Engineers	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Alien vegetation (Construction)			Eradication of alien invasives is to be supervised by persons that have a fundamental knowledge of such activities. In the event of alien invasives being eradicated using chemicals, the manufacturers application specifications area to be adhered to. Clearing of alien vegetation is to be undertaken by using best practice principles or as stated in the site specific EMP.			Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

RELEVANT LEGISLATION/ STANDARDS	REFERENCE DRAWING/ SHEET NO.	SPECIFIC IMPACTS	POSSIBLE CAUSE	IMPACT PHOTO/ DRAWING EXAMPLE	MITIGATION MEASURE	MITIGATION PHOTO/ DRAWING EXAMPLE	PERFORMANCE INDICATOR/ VERIFICATION	RESPONSIBILITY	NOTES/ GENERAL	SIGN. + DATE
		23 Other impacts - Alien vegetation (operation)			Undertake follow up treatment of the areas that were cleared during the construction phase as required. Adhere to the measures stated in the site specific EMP.		Alien vegetation free site. Compliance with EMP.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Alien vegetation (maintenance)			Undertake follow up treatment of the areas that were cleared during the construction phase as required. Adhere to the measures stated in the site specific EMP.		Alien vegetation free site. Compliance with EMP.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Alien vegetation (design)			When designing new facilities or infrastructure, ensure that a programme is developed for the removal of alien vegetation. Try to locate building or infrastructure footprints in these disturbed areas.		Management of alien vegetation from the outset of project. Building and infrastructure footprints in disturbed areas.	Engineer, project manager	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Protection of cultural & historical features (construction)			Cultural and Historic features are to be fenced. An appropriate buffer is to be established within the fence line. If any other archaeological findings are made during the excavation process e.g. graves, artefacts etc. the project leader and SAHRA is to be notified immediately. All measures stated in the site specific EMP are to be adhered to.		Fenced historical and cultural features. Notification to and from SAHRA if artefacts etc. are found. Compliance with EMP.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Protection of cultural & historical features (operation)			Follow the measures stipulated in the EMP.		Adherence to the EMP.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Protection of cultural & historical features (maintenance)			Follow the measures stipulated in the EMP.		Adherence to the EMP.	Maintenance personnel	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Protection of cultural & historical features (design)			Identify all cultural and historical features. Determine the importance of these features by consulting SAHRA. Undertake the necessary action to include these features in the design of the new facility or infrastructure.		Plan indicating the position (where possible) of historical / cultural features Correspondence from SAHRA. Design that takes cognizance of the features.	Engineer	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

RELEVANT LEGISLATION/ STANDARDS	REFERENCE DRAWING/ SHEET NO.	SPECIFIC IMPACTS	POSSIBLE CAUSE	IMPACT PHOTO/ DRAWING EXAMPLE	MITIGATION MEASURE	MITIGATION PHOTO/ DRAWING EXAMPLE	PERFORMANCE INDICATOR/ VERIFICATION	RESPONSIBILITY	NOTES/ GENERAL	SIGN. + DATE
		23 Other impacts - Visual Impact of proposed development (construction)			All materials are to be stored in such a manner and location that it does not cause a visual impact. Construction rubble is to be removed from site on a regular basis. Areas that are disturbed are to be rehabilitated in the appropriate manner.		Neat site. No stockpiling of rubble. Successful rehabilitation of disturbed areas.	Contractor	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Visual Impact of proposed development (operation)			Should an operation be expanded, the structures are to be constructed with materials that are similar in nature to the existing infrastructure.		No unsightly additions.	Operator	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Visual Impact of proposed development (maintenance)			All maintenance activities are to take cognizance of the original aesthetic of the structure and use the same material where possible.		No unsightly maintenance.	Maintenance personnel.	Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Visual Impact of proposed development (design)			Height restrictions and no-building zones may have been identified in the EIA process, these are to be adhered to.				Precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Development on Dolomitic Areas (construction)			Trenches and excavation works should be opened and closed as rapidly as possible. All trenches and excavation works must be properly backfilled and compacted. Once services/cables are installed and backfilling is completed, it must be ensured that ground surface is graded to match the slope of the surrounding area. No rocks should be placed in the top layer. Berms should be constructed on the up-slope side of trenches to prevent the inflow of water during storms. The fall of trenches shall be away from buildings. No ponding of surface water is to be permitted over, in or in the vicinity of trenches and excavations. Preparation of the site must ensure adequate sloping to facilitate drainage of storm water. The slope must be according to the recommendations of the engineer. Water leakage detection must be done after the installation of services. All wet services pipes must be water tight and pressure tested for leakages.		No ponding of surface runoff water occurs in trenches. Final levels after construction is complete match the surrounding natural ground levels. Inflow of storm water into trenches during storms is averted. No ponding occurs where such ponding may be detrimental due to the presence of trenches. Positive drainage away from undesired locations occurs. Regular leak detection is done, which prevents the occurrence of leaks.		General compliance with NHBRC Standard is required. Furthermore precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

RELEVANT LEGISLATION/ STANDARDS	REFERENCE DRAWING/ SHEET NO.	SPECIFIC IMPACTS	POSSIBLE CAUSE	IMPACT PHOTO/ DRAWING EXAMPLE	MITIGATION MEASURE	MITIGATION PHOTO/ DRAWING EXAMPLE	PERFORMANCE INDICATOR/ VERIFICATION	RESPONSIBILITY	NOTES/ GENERAL	SIGN. + DATE
		23 Other impacts - Development on Dolomitic Areas (operation)			Water leakage detection must be done after the installation of services. Furthremore water leakage testing should be conducted at least every two years. No ponding of surface water is to be permitted over, in or in the vicinity of wet service servitudes or pipes. Owners or operation personnel should be informed where services traverse so that accidental puncturing of pipes does not occur.		Regular leak detection is done, which prevents the occurence of leaks. No ponding occurs where such ponding may be detrimental due to the presence of trenches. Accidental damage to pipes does not occur.		General compliance with NHBRC Standard is required. Furthermore precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Development on Dolomitic Areas (maintenance)			Water leakage detection must be done after the installation of services. Furthremore water leakage testing should be conducted at least every two years. No ponding of surface water is to be permitted over, in or in the vicinity of wet service servitudes or pipes. Owners or operation personnel should be informed where services traverse so that accidental puncturing of pipes does not occur.		Regular leak detection is done, which prevents the occurence of leaks. No ponding occurs where such ponding may be detrimental due to the presence of trenches. Accidental damage to pipes does not occur.		General compliance with NHBRC Standard is required. Furthermore precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	
		23 Other impacts - Development on Dolomitic Areas (design)			Brick and precast concrete walls must be so designed as to provide drainage ports at ground level permitting passage of maximum probable volumes of water. The free flow of surface water should be ensured where the layout of the design may cause runoff to be trapped in low-lying areas. A lined canal should permit passage of water into a drain or onto a lawn some distance away from structures. Piping materials selected should be appropriate to local subsurface conditions. Clay pipes are not recommended. Some soils may have low pH values which will render the use of ferrous material for underground services unsuitable. In such instances High impact PVC or other flexible pipes as required shall be used. Pipes should be flexible where possible, while joints sould be minimised. Differential movement must also be accommodated without causing the pipes to break.		The maximum volumes of surface runoff is allowed to pass concrete precast and brick walls. Adequate positive drainage occurs on the entire site. Clay pipes are not used unless specifically required. Deterioration or corrosion of pipes does not occur due to inappropriate material or pipe selection. Pipes do not break, crack or leak due to insufficient differential movement.		General compliance with NHBRC Standard is required. Furthermore precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM. Chapter II in "A Technical Guide to Good House Construction" NBRI of the CSIR (July 1984) should be consulted in areas where soils with low pH values are encountered. General compliance with NHBRC Standard is required. Furthermore precautions are to be undertaken to the satisfaction of the PM and the Environmental Management Division of the PKSDM.	

RELEVANT LEGISLATION/ STANDARDS	REFERENCE DRAWING/ SHEET NO.	SPECIFIC IMPACTS	POSSIBLE CAUSE	IMPACT PHOTO/ DRAWING EXAMPLE	MITIGATION MEASURE	MITIGATION PHOTO/ DRAWING EXAMPLE	PERFORMANCE INDICATOR/ VERIFICATION	RESPONSIBILITY	NOTES/ GENERAL	SIGN. + DATE
					Water reticulation to buildings should be kept at a minimum depth of 500mm up to the structure. As many services as possible should also be accommodated in the same trench. Encasement of pipes in concrete or soilcrete should be avoided. Preferably place pipes in sleeves. If this cannot be achieved, care must be taken to ensure that differential movement can still be accommodated without the pipe breaking. Placement of wet services below the footprint of structures must be avoided. No plumbing and drainage pipes should be placed under floor slabs. Wherever practical, service trenches shall not be excavated along the length of structures or buildings within the first 3m beyond the perimeter of such units. Rodding eyes or similar access to the sewer connection should be provided in addition to the inspection eye/s. The roots of trees planted in close proximity to the line of water-bearing services often cause leaks in or malfunctioning of the services. Care should therefore be taken to avoid the unfortunate positioning of trees and other plants. No trees should be planted within 1.5 times their mature height from the line of storm water services. No accumulation of surface water is to be permitted and the entire development must be properly drained. Surface run-off must not be allowed to pond on the up-slope side of the development. A minimum gradient of 1:150 should be maintained along storm water systems. All ponds and water courses should be rendered impervious. The storm water drainage shall incorporate measures to ensure water tightness of conduits. Whenever possible, storm water should be channeled in lined, surface canals. Where relevant all street levels are to be sufficiently lower than the stand or facilities to ensure easy drainage to storm water management systems.		The amount of trenches for service provision is minimised. Where possible pipes are not placed in concrete or soilcrete and in all instances adequate differential movement is accommodated. Wet services are not placed below building footprints and disturbance or damage for servicing and repair purposes is kept to a minimum. Sufficient access for inspection and maintenance of sewerage and wet systems is provided. Tree roots do not cause damage to services or trenches. Tree roots do not cause damage to services or trenches. Effective drainage of the site is achieved. No erosion or infiltration along watercourses or ponds occurs. Effective drainage from the site to the street and storm water management system occurs.			

- 8 -

STAKEHOLDER PARTICIPATION REPORT

PIXLEY KA SEME DISTRICT MUNICIPALITY

STAKEHOLDER ENGAGEMENT REPORT

DECEMBER 2007

Project no: A1289

Compiled by:
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PIXLEY KA SEME INTEGRATED ENVIRONMENTAL MANAGEMENT PLAN (PKS IEMP)

STAKEHOLDER ENGAGEMENT REPORT

1. INTRODUCTION

African EPA has been appointed by Pixley ka Seme District Municipality to draw up an Integrated Environmental Management Plan (IEMP) for the district. The stakeholder and public consultation process forms a key component of the review process. This project is primarily focused on the environmental process, but consultation and inputs from the stakeholder focus groups in finalizing the proposed new framework will be of value to this process.

Whilst the final framework cannot represent a consensus view, proper involvement from the stakeholders is important. Their inputs, ideas, concerns and visions for the environmental management will assist in finding a workable policy for conservation/development and associated management in the province.

This approach gives a direction on the activities planned by the professional team to date, and the process to be followed from here in the stakeholder consultation process.

2. APPROACH & ACTIONS

The aim of this stakeholder consultation process is to get as many as possible stakeholders actively involved in this process. By involving them in the process the outcome of the new policy will carry so much more weight. The wider the base of consultation, the better input and output can be expected, which will result in better general acceptance and implementation of the new legislation.

Phase 1: Identification of stakeholders

The first phase in the consultation process was to identify, list and register all relevant stakeholders. Once all stakeholders and all interest groups have been identified, the consultation process could commence. PKSDM assisted mainly with this process. Main stakeholders were all local municipalities within the district as well as the relevant state departments.

Phase 2: Consultation process

- Hold two one day workshop with official representative structures: First workshop with local municipalities with main purpose to explain the process and understand the key environmental issues of that municipality.
- Send out letters via fax & email to various identified state departments to get information and comments.
- Conduct focus group meetings where possible.
- Second workshop with state departments and local municipalities to get comments on the Draft State of the Environment Report made available to them, confirming the key environmental issues in each local municipality.

Phase 3: Opportunity to comment on Reports & Deliverables

- Draft Status Quo Report was made available for comment to all local municipalities – no response was received.
- When the Draft Deliverable has been prepared, time (a week) will be allowed for all stakeholders to read and comment on the policy in writing.

3. SUMMARY OF INPUTS & COMMENTS

After conducting specific meetings, good information was received from the following departments:

- DWAF
- DTEC
- SANPARKS

The following stakeholders attended workshops:

- Thembelihle Local Municipality
- Umsobomvu Local Municipality
- Emthanjeni Local Municipalities
- DWAF
- DTEC

The most valuable input was gained from the second and final workshop, as summarized in the notes of this workshop as attached under **Annexure C**

4. CONCLUSION

Proper opportunity has been give to all relevant stakeholders to become involved in the process. In general the attendance of workshops and response to letters have been less than desirable, taking into account all stakeholders invited.

Prepared by : Johan Goosen
Date : December 2007

**ANNEXURE A – INVITATION &
ATTENDANCE TO
FIRST WORKSHOP**

INVITATION TO ATTEND A 1-DAY WORKSOP

Background:

African EPA (Pty) Ltd was recently contracted as a Service Provider by the **Pixley ka Seme District Municipality** to compile an **Integrated Environmental Management Plan (IEMP)** for the entire Pixley ka Seme area of jurisdiction. Your organisation is hereby kindly requested to attend a **1-day**

Workshop where we would like to:

- Explain the IEMP process and the inputs required from the various roleplayers
- Confirm the planned projects that your municipality would like to implement in the near future
- Gain understanding about the environmental challenges your municipality faces

Please prepare a list of the last two items applicable in your municipality to make the session more meaningful.

Who Should Attend?

It is essential that appropriate representatives from your organisation attend the workshop. Technical and/or LED/IDP Managers are requested to attend the workshop.

Details of the Workshop:

We are aware that most municipalities of Pixley ka Seme District Municipalities will attend a District Water and Sanitation Workshop scheduled for Thursday, 16 August 2007, organised by Mr Hennie Greef from Pixley ka Seme District Municipality. It was therefore decided to hold this workshop 1 day prior to this workshop where all municipalities will in any event visit De Aar. Your participation and attendance of this workshop will be greatly appreciated.

Workshop Topic: Integrated Environmental Management Plan (IEMP) for Pixley ka Seme DM

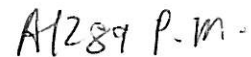
Date: Wednesday, 15 August 2007

Venue: Boardroom of Pixley ka Seme DM

Time: 10:00 to 15:00

Enquiries can be directed to either:

Sam Diokpala (PIMS Manager – Pixley ka Seme DM) at (053) 631 0891, or 083 256 9930, or
Onno Fortuin (African EPA (Pty) Ltd in Kimberley) at (053) 831 1675, or 083 455 9499



P O Box 13776
Hatfield 0028

Ditsela Place
1204 Park St
Cnr Duncan & Park St
Hatfield, Pretoria

ATTENDANCE REGISTER

CLIENT : PIXLEY KA SEME DISTRICT MUNICIPALITY	CONTRACT NO. : A1289
PROJECT : PIXLEY KA SEME	REFERENCE NO. :

VENUE : PIXLEY KA SEME DISTRICT MUNICIPALITY	DATE : 15 AUGUST 2007
SUBJECT : I&AP WORKSHOP	TIME : 10H00

[illegible]

[illegible]

**ANNEXURE B – INFORMATION SENT
OUT AFTER FIRST WORKSHOP**

Environmental Issues / Development Opportunities for: _____ Local Municipality

By: _____

Categories of Development and Sub-categories that require at minimum a Scoping report under ECA or NEMA	Some Specific Municipal Issues
Informal Residential Low density urban, Informal, high density urban, Informal, low density rural, Informal, high density rural	Housing Backlog Lack of availability of land for settlements (most land privately owned). Informal settlements in open areas (public open spaces)
Formal Residential Low density (plot sizes > 1500m ²), Formal, normal density (plot sizes 500m ² - 1500m ²), Formal, medium density (shared plots, single & double storey), High density (multi storey units in complex)	1. No land available at this stage
Commercial Free Trade Zones. Trade Zones. Shopping Centres. CBD Commercial	Ancillary benefication from agricultural activities

Categories of Development and Sub-categories that require at minimum a Scoping report under ECA or NEMA	Some Specific Municipal Issues
Grain Silos	
Leisure & Tourism Hotel - large (more than 100 rooms), medium (30 - 100 rooms), small (less than 30 rooms), Guest house, Resort - detached units in a rural or natural setting outside urban areas, Caravan Park / Site, Casino, Golf Course	Rolfontein Outdoor School Wildebeestkuil Rock Art Boesmansgat Resort Douglas Holiday Resort Die Bos- Prieska Rhenosterfontein Doornkloof San Rock Art
Game & Hunting Lodges 1. Game & hunting lodges, 2. Eco-lodge (low impact facilities in a natural environment)	1. Only 1,2% of land cover utilized for game farming. 2. New developments to be done in consultation with IEMP
Trails 1. 4x4Trail, 2. Motorbike Trail, 3. Equestrian Trail, 4. Hiking Trail	Not present in this area. Potential for hiking trails.

Categories of Development and Sub-categories that require at minimum a Scoping report under ECA or NEMA	Some Specific Municipal Issues
Animal Husbandry Cattle farming, Cattle, large (more than 1000ha), Cattle, medium (250ha - 1000ha), Cattle, small (less than 250ha), Cattle, high density feeding lots, Dairy Farming, Poultry farming, Ostrich farm, Sheep farming, Sheep large (more than 1000ha), Sheep medium (250ha - 1000ha) Sheep small (less than 250ha) Pig farm, Crocodile farm, All goats farming Mixed grazing	1. Low carrying capacity 2. Low resilience 3. Informal settlements. Keeping of livestock in urban areas. Possibility of outbreak of pests or diseases.
Crop Farming Agriculture 1. Irrigated agriculture (all farm sizes), 2. Mono-culture agriculture, large (more than 1000ha), 3. Mono-culture agriculture, medium (250ha - 1000ha), 4. Mono-culture agriculture,	1. Seasonal migrant workers working on farms. 2. High water table on farms. 3. Volatility of crop farming. (sudden climatic changes can destroy the whole industry)

Categories of Development and Sub-categories that require at minimum a Scoping report under ECA or NEMA	Some Specific Municipal Issues
small (less than 250ha), 5. Mono-culture agriculture, subsistence. 6. Rain-fed crops. 7. Nurseries	
Aquaculture	Opportunity
Game Farming Game farming, large (more than 4000ha), Game, medium (600ha - 1000ha), Game, small (less than 600ha)	Game farming on small scale.
Mixed Agriculture Mixed agriculture (livestock & crops), large (more than 1000ha), medium (250ha - 1000ha), small (less than 250ha), subsistence, Communal Grazing system	Expansion of urban area could have impact on agricultural land bordering urban areas. See under informal and formal settlements. Farming Opportunities
Forestry Large scale forestry, Small scale commercial forestry	Although areas are electrified households still use wood fires for cooking and heating which leads to air pollution – subsistence forestry

Categories of Development and Sub-categories that require at minimum a Scoping report under ECA or NEMA	Some Specific Municipal Issues
(less than 10ha), Subsistence forestry (firewood etc.)	
Industrial Heavy industrial - metal smelting, chemical processing, assembly plants, other, Medium industrial- chemical processing, other, Light industrial, Workshop, Agricultural processing plants on agricultural land	Current Olive factory and Peanut factory. Expansion of these industries are possible. No data available yet. Local communities partnerships lacking.
Mining 1. Open cast mine, 2. Open cast mine with drag line, 3. Underground mine, 4. Sand works, 5. Clay quarry associated with brickworks, 6. Other clay quarries, 7. Gravel quarry for road fill, 8. Rock quarry for construction aggregate, 9. Rock quarry for blocks or slabs of rock, 10. Salt works	No mining in this area (opportunities)

Categories of Development and Sub-categories that require at minimum a Scoping report under ECA or NEMA	Some Specific Municipal Issues
Airports International airports. Regional airports, Small airports. Public and private landing strips	Air field at ammunition depot. Not utilized infrastructure. Air field only used for private light aircraft.
Power Stations Alternative Power Electricity generation facilities, Coal powered stations, Hydro electricity generators, Wind electricity generators (commercial only), Bio-electricity generators (commercial only)	
Parking, Related Structures & Facilities Parking lot, Taxi rank, Bus or heavy vehicle depot, Filling station, Vehicle service facility, Traffic control centre, Dirt road with high traffic loads, Dirt road with low traffic loads.	Taxi ranks along the main roads.

Categories of Development and Sub-categories that require at minimum a Scoping report under ECA or NEMA	Some Specific Municipal Issues
Roads 1. Roads 2. Double carriageway highway, 3. Tarred road with 120km/h speed limit, 4. Tarred road with 80km/h speed limit, 5. Tarred roads with speed limits below 80km/h	1. Road upgrade at other towns such as 2. Construction of roads necessitates gravel borrow pits. 3. Road construction leads to deforestation. 4. New roads lead to higher volume of stormwater run off.
Railways, Related Structures & Facilities 1. Railway structures, 2. Railway lines, 3. Stations, 4. Shunt yards & workshops, 5. Railway bridges	Main railway line through Municipal area. Mainly used to transport cargo
Pipelines, Cable Networks Pipeline for the transportation of hazardous substances including petroleum products, Water bulk supply pipelines, Cable networks, Telephone lines and associated structures, Industrial cable way and associated structures,	1. Electrification of informal settlements/residential areas deforested for high voltage cables and servitudes 2. Water pipes for bulk water old. 3. Storage reservoirs needs attention, old and leaking.

Categories of Development and Sub-categories that require at minimum a Scoping report under ECA or NEMA	Some Specific Municipal Issues
Tourism cable way and associated	
Water storage 1. Water storage and supply structures as well as structures affecting the flow of water in rivers, 2. Bulk water supply/storage dam, 3. Farm dam, 4. Inter catchments water transfer scheme, Reservoirs for public water supply, 5. Levees, 6. Weirs	1. Upgrade bulk water at Hartswater, Jan Kempdorp and Pampierstad 2. Canal leaking and very old 3. All reservoirs are old and capacity not sufficient.
Towers and masts, Conveyors 1. Microwave towers (telecommunications), 2. Radio transmission towers and masts, 3. Cellular phone network masts, 4. Wireless loop telecommunication masts, 5. Radar masts, 6. Reception dishes and structures, Industrial	Visual impact of cellular base stations are often negative. By-laws and regulations required regarding positioning of base stations especially in rural areas.

Categories of Development and Sub-categories that require at minimum a Scoping report under ECA or NEMA	Some Specific Municipal Issues
conveyor - long distance (>1km), Industrial conveyor	
Conservation 1. All conservation area, 2. National park, 3. Provincial nature reserve, 4. Regulated natural area, 5. Natural heritage site, 6. National monument, 7. Marine reserve, 8. Local authority conservation area, 9. Private nature reserve, 10. Urban open space area	No areas conserved. Game farming only 1,2% which can be seen as conservation of land.
Waste sites, Sewage treatment Household waste landfill, Class 2 waste landfill, Class 1 waste landfill, Waste indicator, Radioactive waste site, Sewage disposal structures, Sewage treatment plants, Off- shore disposal pipelines, Sewage pipelines (MAIN)	Waste management plan

Categories of Development and Sub-categories that require at minimum a Scoping report under ECA or NEMA	Some Specific Municipal Issues
Hazardous Materials Handling, and manufacturing Hazardous materials transportation route, Hazardous materials handling facility, Hazardous materials processing facility, Hazardous materials storage facility, Hazardous materials manufacturing facility	1. Waste management plan 1. Refer to final documentation
Advertisement All advertisement. Posters and other general signs. Signs on buildings, structures and premises. Signs for the tourist and traveller. Mobile signs, Billboards and other high impact free standing structures	Not currently addressed in IDP or other policy statements
Fuel Stations 1. Petrol/Diesel Filling Stations, 2. Fuel Storage Facilities, 3. Fuel Refineries,	1. Full EIA assessment for new filling stations. 2. Location of new filling stations/ fuel storage facilities/refineries to be addressed in Spatial Development Frameworks in conjunction with IEMP.
Heritage Structures National Monuments	Develop the museum of Historical sites Archaeological sites

Categories of Development and Sub-categories that require at minimum a Scoping report under ECA or NEMA	Some Specific Municipal Issues
Artifacts Rock Paintings Battlefields Museums Mission Stations	Cultural sites Scientific and ecological sites

**ANNEXURE C – SECOND WORKSHOP
INVITATION, ATTENDANCE & NOTES**

INVITATION TO ATTEND THE FINAL ONE DAY WORKSHOP – PIXLEY KA SEME INTERGRATED ENVIRONMENTAL MANAGEMENT PLAN (IEMP)

Background:

African EPA (Pty) Ltd was recently contracted as a Service Provider by the **Pixley ka Seme District Municipality** to compile an **Integrated Environmental Management Plan (IEMP)** for the entire Pixley ka Seme area of jurisdiction.

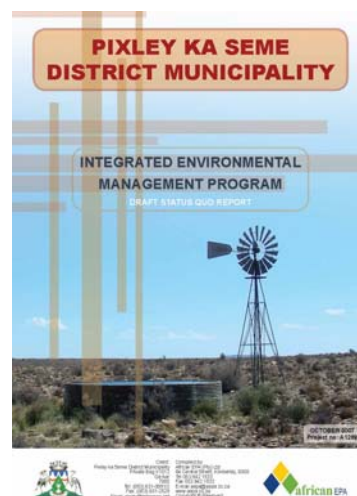
A **first workshop** was held on 16 August 2007 where we inter alia

- Explained the IEMP process and received inputs from the various roleplayers
- Confirmed the planned projects that each municipality would like to implement
- Gained understanding about the environmental challenges each municipality faces

A **checklist with environmental challenges** was subsequently sent out to all local municipalities. Relevant information was also requested from various state departments.

A **second and final workshop** is now planned for the following purpose:

- Present the findings of the **Draft Status Quo Report** and gain comments thereon (this report is available per email – liase with Zelda van Wyk at zvzw@aepa.co.za)
- Present the Environmental Priority Issues for each municipality and gain comments thereon
- Present the Objectives for the addressing of the Environmental Priority Issues
- Present the Key Performance Indicators for each Environmental Priority Issues
- Identify implementable projects for each municipality



Who Should Attend?

It is essential that appropriate representatives from your organisation attend the workshop. Technical and/or LED/IDP Managers are requested to attend the workshop.

Details of the Workshop:

Date: Tuesday, 04 December 2007 / Venue: Boardroom of Pixley ka Seme DM in De Aar / Time: 10:00 to 15:00

Enquiries can be directed to either:

Sam Diokpala (PIMS Manager – Pixley ka Seme DM) at (053) 631 0891, or 083 256 9930, or Onno Fortuin (African EPA (Pty) Ltd in Kimberley) at (053) 831 1675, or 083 455 9499

RSVP to Zelda van Wyk: zvzw@aepa.co.za or 012 366 0100 by 27 November 2007

Attendance Register

FLG

Integrated Environmental Management Plan Workshop (IEMP)

Pitso ka Seme District Municipality - Boardroom

4 December 2007

04/12/07

Name	Dept/ Mun/ Org	Designation	Address	Contact Numbers	Signature
Sam Dikobak	PKS D/m.	Senior Manager	P/Bag X1012 De Aar 7000	Office: 053 631 0891 Fax: 053 631 1664 Mobile: 083 256 9930 e-mail: Sam.Dikobak@lgnet.org.za	B.
JACQUES SAMIMAN	DWAF	ADD	P/B x 6101 KIMBELET 8300	Office: 053 - 831 8800 Fax: Mobile: 078 457 2275 e-mail: samiman@dwaf.gov.za	
B.D. Rassouw	Unisa	Business Development	P/B x 6 Coastal 9795	Office: 051 758 0777/8/9 Fax: 051 753 0574 Mobile: 082 806 1876 e-mail: b.d.rassouw@unisa.ac.za	
Lushca Summies	Pitso ka Seme DM	Environmental Health Practitioner	Wilvet Road De Aar 7000	Office: (053) 631 0891 Fax: (053) 631 2529 Mobile: 082 474 0331 e-mail: Lushca.Summies@lgnet.org.za	Lushca Summies
Dewald Wilhouse	Pitso ka Seme DM	E.H.P.	Culvest Road De Aar 7000	Office: (053) 631 0891 Fax: (053) 631 2529 Mobile: 084 389 6191 e-mail: Dewald.Wilhouse@lgnet.org.za	

Name	Dept/ Mun/ Org	Designation	Address	Contact Numbers	Signature
PJ KANSIMAN	Pixley ka Sekele DM	Technician	Pixley Sekele University De PAC	Office: 053 631 1117 Fax: Mobile: 082 773 4723 e-mail:	
V. JONES	Pixley ka Sekele DM	INFRASTRUCTURE	" "	Office: 053 631 1117 Fax: 053 631 4048 Mobile: 082 774 9920 e-mail: pmu@pixley@telkomsa.net	
T. MASHALE	Pixley ka Sekele DM	PROJECT MANAGER	" "	Office: 053 631 1117 Fax: 053 631 4048 Mobile: 082 773 4339 e-mail: pmu@pixley@telkomsa.net	
H.P. Greeff	Pixley ka Sekele DM Infrastructure & Technical Services	Head of Dept	" "	Office: 053 631 1117 Fax: 053 631 4048 Mobile: 082 440 8800 e-mail: hpgreeff@mtelkomsa.co.za	
L. SEBUSENG	DfEC	ENVIRONMENTAL OFFICER	P.O. Box 1347 Kimberley 8300	Office: (053) 807 4800 Fax: (053) 831 3530 Mobile: e-mail: lsebusing@dfec-ncpe.gov.za	
O. Fortuin	African EPA	Director	28 ORANGE TON Salem Kimberley	Office: (053) 831 1625 Fax: (053) 832 2502 Mobile: 083 455 9499 e-mail: o.fortuin@africa-epa.co.za	

Name	Dept/ Mun/ Org	Designation	Address	Contact Numbers	Signature
J. Gossan	African EPA	Div. Head	Dikela Place, Hartfield Pretoria 0018.	Office: (012) 566 0100 Fax: (012) 346 0111 Mobile: 012 325 0228 e-mail: jg@epa.co.za	
Name	Dept/ Mun/ Org	Designation	Address	Contact Numbers	Signature
				Office: Fax: Mobile: e-mail:	
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Name	Dept/ Mun/ Org	Designation	Address	Contact Numbers	Signature
				Office: Fax: Mobile: e-mail:	

NOTES ON PIXLEY KA SEMA DISTRICT MUNICIPALITY IEMP – SECOND WORKSHOP

(4/12/2007 @ 10:00 AT PIXLEY KA SEME OFFICES IN DE AAR)

INTRODUCTION

- Spatial Development Framework – almost completed
- IWMP developed by KV3
- Attendance (12 in total)
 - DTEC – Lerato
 - PKS
 - DWAF – Jacques Saaiman (ADD)
 - Umzobomvu

PROCESS & FIRST FINDINGS

- 16 Aug – First round meeting
 - o Env. Challenges
 - o IDP's → put objective to
 - o PKS → general issues identified
- Crucial issues to be confirmed (Env. challenges)
 - 1. Status Quo – was completed
 - 2. Red data deficiency ID – need inputs
- Eco tourism (NB)
 - Gateway design & signage
- Water balance is NB!!
- Heritage potential must be developed
 - Question 1: Water quality – Orange River Polluted
 - Source of pollution to be ID
- Conservations – inputs on
- Hazardous waste & medical waste is NB!!

GENERAL ISSUES

National & Provincial frameworks must be adhered to

MIG funding – reporting & allocation management is NB!!

- report on problems
- DPLG report on MIG funding

MDG – Millennium Development Grants

Waste dump sites – proximity to informal settlements

Burning of wood in proximity of towns

- trees used for fuel
- level of poverty

Over grazing i.t.o. carrying capacity

Invader plants in riverstreams & consume water

Air Pollution - Environmental Education is NB

Replacement of bucket system – technology not viable & appropriate

Influx of people with towns – NB Apollo fees & public toilets

SPECIFIC MUNICIPAL ISSUES

- **Umzobomvu (M Rossouw)**
 - a) Hazardous substance – driving through town
 - accidents and spillages
 - safety issue for towns
 - trucks stay over – proper overnight facility
 - summer very hot – emergency issues
 - Prov.
 - b) Informal housing and all related to this – not planned well ahead
 - c) 2x rural informal settlements in rural veld ± 30 km away from town
 - stay in road reserve (Naaupoort: Steynb – Colesb)
 - Henrie to locate sites
 - d) Sanitation in Colesberg – sewer overflowing
 - funding is lacking
 - new housing funding
 - 40m in phases to be spent
 - bulk water taken over by DWAF
 - Gariep tourism initiative – NB
 - Tourism along river @ Norvalpoint
 - e) How to involve local community issues
 - Unit costs very high for services
 - Awareness campaign
 - Public participation
 - 2002 (UN) – initiative (must adhere to)
 - promote grants
 - formalizing of towns
- **Thembelihle Municipality (Hopetown)**

Hopetown:
Upgrading of oxidation ponds (funding problems)
Solid waste site – relocated (next year)
Gariep abattoir – no project, just problem: spilling into retention dams & dumping (effluent spillages) – blood on environment
Stormwater @ Hopetown & Streydenburg
Resort Development potential
- **Emthanjeni Municipality (De Aar)**

Treatment of borehole water – hardness
Sewerage effluent for urban greening – De Aar
 - License with Dwaf
 - Pollution of PaardevleiDust pollution is NB
Brickmaking – licenses / closed down
 - De Aar, Hanover, Britstown
- **Kareeberg**

SKA project – Tracey to get involved – 5x EIA projects currently ongoing
Vosburg – landfill site, overflowing of sewerage tanks
Carnarvon – overflowing of sewerage tanks / education is NB – new pipeline

Land Audit Plan – ownership (private state mun – to assist housing development)
Carnarvon – brickmaking & air pollution

- **Renosterberg (Petrusvill/Vanderhof/Philipstown)**
Relocate solid waste site in Petrusville
Historical sites to be ID and status quo condition to be confirmed – ID development projects to conserve
Spatial Development Framework – get this info
Development along Orange River – emerging projects for irrigation
- **Siyancuma (Douglas, Griekwastad, Campbell)**
Mohala SANPARKS
Vaal/Orange confluence – not well development
→ Bucklands – huge tourism potential
Alluvial diamond mining along rivers
→ dust / water
→ illegal mining
→ borrow pits – not registered
- **Siyathemba**
Asbestos rehabilitation (±45 mines) – asbestose sickness in Prieska
Incinerator not working
Marydale land-fill site
Van Wyksvlei – bulk water project
Copperton pipeline to Prieska
“Die Bosch” development – lack of public facilities
Niekerkshoop – Tiger-eye mining illegal
- **Ubuntu (Victoria West, Richmond, Loxton)**
Problem with roads – borrow-pit and quarry
Exploration for Uranium ongoing
Mining Resources – GIS info – get map from Geological Surveyor
Mining beneficiation opportunities
Agric industries – limited initiatives

ANNEXURE D – CORRESPONDENCE SUMMARY

DISTRIBUTION OF INVITATION TO ATTEND FIRST WORKSHOP

ORGANISATION	CONTACT PERSON	DISTRIBUTED
Emthanjeni Municipality	Mr C Appies	E-mailed 2007-08-08
Kareeberg Municipality	Mr Viljoen	E-mailed 2007-08-08
Renosterberg Municipality	Mr L Pula	Faxed 2007-08-08
Siyancoma Municipality	Mr Groenewald	E-mailed 2007-08-08
Siyathemba Municipality	Mr Basson	E-mailed 2007-08-08
Thembelihle Municipality	Mr P Demas	E-mailed 2007-08-08
Ubuntu Municipality	Mr H Jacobs	Faxed 2007-08-08
Umsobomvu Municipality	Mr G Khapha	E-mailed 2007-08-08

DISTRIBUTION OF FIRST WORKSHOP CORRESPONDENCE

ORGANISATION	CONTACT PERSON	DISTRIBUTED
Emthanjeni Municipality	Mr C Appies	E-mailed 2007-08-17
Kareeberg Municipality	Mr Viljoen	E-mailed 2007-08-17
Renosterberg Municipality	Mr L Pula	Faxed 2007-08-23
Siyancoma Municipality	Mr Groenewald	E-mailed 2007-08-17
Siyathemba Municipality	Mr Basson	E-mailed 2007-08-17
Thembelihle Municipality	Mr P Demas	E-mailed 2007-08-17
Ubuntu Municipality	Mr H Jacobs	Faxed 2007-08-17
Umsobomvu Municipality	Mr G Khapha	E-mailed 2007-08-17

PIXLEY KA SEME DISTRIBUTION OF REQUESTS FOR INFORMATION

ORGANISATION	CONTACT PERSON	DISTRIBUTED
Dept of Transport	Mr V Modise	Faxed 2007-09-12
Doornkloof Nature Reserve	Mr Cronje	Faxed 2007-09-12
Eskom	Mr T van der Walt	Faxed 2007-09-12
National Roads Agency	Ms A Groenewald	Faxed 2007-09-12
Pixley ka Seme District Municipality	Mr S Diokpala	Faxed 2007-09-12
Rolfontein Nature Reserve	Mr W Nkuna	Faxed 2007-09-12
Transnet	Mr J Mouton	Faxed 2007-09-12

DISTRIBUTION OF SECOND WORKSHOP CORRESPONDENCE

ORGANISATION	CONTACT PERSON	DISTRIBUTED
Emthanjeni Municipality	Mr C Appies	E-mailed 2007-11-20
Kareeberg Municipality	Mr Viljoen	E-mailed 2007-11-20
Renosterberg Municipality	Mr L Pula	Faxed 2007-11-20
Siyancoma Municipality	Mr Groenewald	E-mailed 2007-11-20
Thembelihle Municipality	Mr P Demas	E-mailed 2007-11-20
Ubuntu Municipality	Mr H Jacobs	Faxed 2007-11-20
Umsobomvu Municipality	Mr G Khapha	E-mailed 2007-11-20
Thembelihle Municipality	Mr P Demas	E-mailed 2007-11-20
Ubuntu Municipality	Mr H Jacobs	Faxed 2007-11-20
Umsobomvu Municipality	Mr G Khapha	E-mailed 2007-11-20
Thembelihle Municipality	Mr P Demas	E-mailed 2007-11-20
Ubuntu Municipality	Mr H Jacobs	Faxed 2007-11-20
Umsobomvu Municipality	Mr G Khapha	E-mailed 2007-11-20
Thembelihle Municipality	Mr P Demas	E-mailed 2007-11-20

SECOND WORKSHOP FOLLOW UP

Municipality	Comments
Emthanjeni	Spoke to Mr Appies, they will send a delegate.
Kareeberg	Fax invitation again, follow up, nobody to attend.
Petrusville	Fax invitation again, follow up, Mr Pula out of office.
Siyancoma	Mr Groenewald on leave, will not attend.
Siyathemba	Mr Bessies to phone back, Mr Viljoen not available.
Thembelihle	All diaries fully booked, nobody to attend.
Ubuntu	Left message
Umsobomvu	Resend email, address changed. Follow up, no answer.
Pixley ka Seme	2 delegates to attend.
Dept of Housing	Mr Jack to attend.
Dept Transport	No answer
DHLG	All diaries fully booked nobody to attend.
Dept Agriculture	No answer
Dept Public Works	Nr do not work
Dept Economic	Mr Mostert refer the invite to Mrs Basani Mcombo, another colleague will attend.
Dept Mineral & Energy	Ms F Mazabane on leave.
DWAF	Mr Streuders spoke to Onno, will not be able to attend.

Eskom	Mr T van der Walt on leave
Transnet	J Mouton phoned, he is not the right person to attend.
SANRAL	Send email, they will not attend but would like feedback on the workshop.
Doornkloof Nature Reserve	Left message
Rolfontein Nature Reserve	Mr W Nkuna request the that invitation be send again.

- 9 -

REFERENCE TABLE OF DOCUMENTS

Document Name	Organisation	Completed by	Date
GENERAL DOCUMENTATION			
PKS DM Integrated Waste Management Plans	PKS DM	Kwezi V3 Engineers Kimberley	2007
Galeshewe Open Space and Landscape Plan, Volume 1	Sol Plaatjes Municipality	African EPA	September 2004
Pixley Ka Seme, District Growth and Development Strategy	Pixley Ka Seme Municipality		2007/08 to 2012/13
Karoo Travel Guide	Northern Cape Tourism Authority	Cape Africa Media and Publishing (Dougie Oakes)	
Northern Cape State of The Environment Report Overview	The Department of Tourism, Environment and Conservation	CSIR Department of Water, Environment & Forestry Technology	2004
VEGMAP Vegetation Classification for South Africa	SANBI	SANBI	2006
Riverine Habitat Rehabilitation Project – Strategic Plan	Endangered Wildlife Trust	Endangered Wildlife Trust	2007
Pixley Ka Seme District Municipality (PKSDM), Feasibility Study For Bulk Water Supply	DWAF		October 2007
INTEGRATED DEVELOPMENT PLANS			
Umsobomvu Integrated	Umsobomvu Municipality		2003-2005

Document Name	Organisation	Completed by	Date
Development Plan (IDP)			
Ubuntu IDP	Ubuntu Municipality		March 2005
Siyancuma IDP	Siyancuma Municipality		2006/2007
Kareeberg IDP, Revision 5	Kareeberg Municipality	Ebersohn & Associates	May 2005
Renosterberg IDP	Renosterberg Municipality		2007
Profile of Pixley Ka Seme District Municipality	The Department and Local Government, Republic of South Africa		2006
Emthamjeni IDP	Emthamjeni Municipality		Reviewed 2007
Siyathemba IDP	Siyathemba Municipality		April 2007
Thembelihle IDP	Thembelihle Municipality		March 2007
WATER SERVICES DEVELOPMENT PLANS			
Renosterberg Water Services Development Plans	Renosterberg Municipality	DWAF	
Emthanjeni Water Services Development Plans	Emthanjeni Municipality	DWAF	
Siyathemba Water Services Development Plans	Siyathemba Municipality	DWAF	
Kareeberg Water Services Development Plans	Kareeberg Municipality	Kwezi V3	
Siyancuma Water Services Development Plans	Siyancuma Municipality	DWAF	
Umsobomvu Water Services Development Plans	Umsobomvu Municipality	DWAF	