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Report on the floristic and ecological assessment of the proposed establishment of the Lennertsville Graveyard, Northern Cape Province.

July 2014

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Vegetation and ecological assessment.

1. Introduction

1.1 Background

Natural vegetation is an important component of ecosystems. Some of the vegetation units in a region can be more sensitive than others, usually as a result of a variety of environmental factors and species composition. These units are often associated with water bodies, water transferring bodies or moisture sinks. These systems are always connected to each other through a complex pattern. Degradation of a link in this larger system, e.g. tributary, pan, wetland, usually leads to the degradation of the larger system. Therefore, degradation of such a water related system should be prevented.

South Africa has a large amount of endemic species and in terms of biological diversity ranks third in the world. This has the result that many of the species are rare, highly localised and consequently endangered. It is our duty to protect our diverse natural resources.

South Africa contains 19 known centres of endemism. These areas contain a high number of species endemic to this specific area. Due to the limited range of most of these species many are rare, protected or endangered. The proposed graveyard is situated on the eastern border of the Gariiep Centre of Endemism. Many species occurring within this centre is unique and localised to this area. Development in such centres of endemism should be done with careful investigation of the biodiversity and species composition of the area. Areas with rare, endangered or endemic species and areas with a high biodiversity should be avoided when planning a development.

Though vegetation may seem to be uniform and low in diversity it may still contain species that are rare and endangered. The occurrence of such a species may render the development unviable. Should such a species be encountered the development should be moved to another location or cease altogether.

Development around cities and towns are necessary to accommodate an ever growing population. Areas along the boundaries of cities and towns are usually in a degraded state due to the impact of the large population these areas house. Though this may be the case in most situations there may still be areas that consist of sensitive habitats such as water courses, wetlands or rare vegetation types that need to be conserved. These areas may also contain endangered fauna and flora.

An ever increasing population is accompanied by an ever increasing fatality-rate. This necessitates the expansion or establishment of graveyards. These graveyards should be located in areas of low slope to prevent the erosion of graves and should also not occur near water courses where graves may be exposed by floods.

The proposed graveyard will be situated approximately 300 meters south of the settlement of Lennertsville near the town of Keimoes (Map 1).

A site visit was conducted on 20 June 2014 and the entire footprint of the graveyard was surveyed.

For the above reasons it is necessary to conduct a vegetation and ecological assessment of an area proposed for development.

The report together with its recommendations and mitigation measures should be used to minimise the impact of the proposed development.

1.2 The value of biodiversity

The diversity of life forms and their interaction with each other and the environment has made Earth a uniquely habitable place for humans. Biodiversity sustains human livelihoods and life itself. Although our dependence on biodiversity has become less tangible and apparent, it remains critically important.

The balancing of atmospheric gases through photosynthesis and carbon sequestration is reliant on biodiversity, while an estimated 40% of the global economy is based on biological products and processes.

Biodiversity is the basis of innumerable environmental services that keep us and the natural environment alive. These services range from the provision of clean water and watershed services to the recycling of nutrients and pollution. These ecosystem services include:

- Soil formation and maintenance of soil fertility.
- Primary production through photosynthesis as the supportive foundation for all life.
- Provision of food, fuel and fibre.
- Provision of shelter and building materials.
- Regulation of water flows and the maintenance of water quality.
- Regulation and purification of atmospheric gases.
- Moderation of climate and weather.
- Detoxification and decomposition of wastes.
- Pollination of plants, including many crops.
- Control of pests and diseases.
- Maintenance of genetic resources.

2. Scope and limitations

- To evaluate the present state of the vegetation and ecological functioning of the area proposed for the graveyard development.
- To identify possible negative impacts that could be caused by the proposed construction of a graveyard.

2.1 Vegetation

Aspects of the vegetation that will be assessed include:

- The vegetation types of the region with their relevance to the proposed site.
- The overall status of the vegetation on site.
- Species composition with the emphasis on dominant-, rare- and endangered species.

The amount of disturbance present on the site assessed according to:

- The amount of grazing impacts.
- Disturbance caused by human impacts.
- Other disturbances.

2.2 Fauna

Aspects of the fauna that will be assessed include:

- A basic survey of the fauna occurring in the region using visual observations of species as well as evidence of their occurrence in the region (burrows, excavations, animal tracks, etc.).
- The overall condition of the habitat.
- A list of species that may occur in the region (desktop study).

2.3 Limitations

Several bulbous and herbaceous species may have finished flowering or is dormant and may have been overlooked or not identifiable.

Due to time constraints the entire pipeline route could not be surveyed and only likely sensitive areas were surveyed. It is therefore possible that sensitive species may have been overlooked. Some animal species may not have been observed as a result of their nocturnal and/or shy habits.

3. Methodology

3.1 Several literature works were used for additional information.

Vegetation:

Red Data List (Raymondo *et al.* 2009)

Vegetation types (Mucina & Rutherford 2006)

Field guides used for species identification (Adams 1976, Bromilow 1995, 2010, Coates-Palgrave 2002, Court 2010, Le Roux 2005, Mannheimer *et al* 2008, Manning 2009, Van Oudtshoorn 2004, Roberts & Fourie 1975, Shearing & Van Heerden 2008, Van Rooyen 2001, Van Wyk & Van Wyk 1997).

Terrestrial fauna:

Field guides for species identification (Smithers 1986a).

3.2 Survey

The site was assessed by means of transects and sample plots.

Noted species include rare and dominant species.

The broad vegetation types present on the site were determined.

The state of the environment was assessed in terms of condition, grazing impacts, disturbance by humans, erosion and presence of invader and exotic species.

Animal species were also noted as well as the probability of other species occurring on or near the site according to their distribution areas and habitat requirements. The state of the habitat was also assessed.

3.3 Criteria used to assess sites

Several criteria were used to assess the site and determine the overall status of the environment.

Vegetation characteristics

Characteristics of the vegetation in its current state. The diversity of species, sensitivity of habitats and importance of the ecology as a whole.

Habitat diversity and species richness: normally a function of locality, habitat diversity and climatic conditions.

Scoring: Wide variety of species occupying a variety of niches – 1, Variety of species occupying a single nich – 2, Single species dominance over a large area containing a low diversity of species – 3.

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role on the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species can potentially be a fatal flaw.

Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely – 3.

Ecological function: All plant communities play a role in the ecosystem. The ecological importance of all areas though, can vary significantly e.g. wetlands, drainage lines, ecotones, etc.

Scoring: Ecological function critical for greater system – 1, Ecological function of medium importance – 2, No special ecological function (system will not fail if absent) – 3.

Degree of rarity/conservation value:

Scoring: Very rare and/or in pristine condition – 1, Fair to good condition and/or relatively rare – 2, Not rare, degraded and/or poorly conserved – 3.

Vegetation condition

The sites are compared to a benchmark site in a good to excellent condition. Vegetation management practises (e.g. grazing regime, fire, management, etc.) can have a marked impact on the condition of the vegetation.

Percentage ground cover: Ground cover is under normal and natural conditions a function of climate and biophysical characteristics. Under poor grazing management, ground cover is one of the first signs of vegetation degradation.

Scoring: Good to excellent – 1, Fair – 2, Poor – 3.

Vegetation structure: This is the ratio between tree, shrub, sub-shrubs and grass layers. The ratio could be affected by grazing and browsing by animals.

Scoring: All layers still intact and showing specimens of all age classes – 1, Sub-shrubs and/or grass layers highly grazed while tree layer still fairly intact (bush partly opened up) – 2, Mono-

layered structure often dominated by a few unpalatable species (presence of barren patches notable) – 3.

Infestation with exotic weeds and invader plants or encroachers:

Scoring: No or very slight infestation levels by weeds and invaders – 1, Medium infestation by one or more species – 2, Several weed and invader species present and high occurrence of one or more species – 3.

Degree of grazing/browsing impact:

Scoring: No or very slight notable signs of browsing and/or grazing – 1, Some browse lines evident, shrubs shows signs of browsing, grass layer grazed though still intact – 2, Clear browse line on trees, shrubs heavily pruned and grass layer almost absent – 3.

Signs of erosion: The formation of erosion scars can often give an indication of the severity and/or duration of vegetation degradation.

Scoring: No or very little signs of soil erosion – 1, Small erosion gullies present and/or evidence of slight sheet erosion – 2, Gully erosion well developed (medium to large dongas) and/or sheet erosion removed the topsoil over large areas – 3.

Faunal characteristics

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role on the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species or very unique and sensitive habitats can potentially be a fatal flaw.

Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely.

3.4 Biodiversity sensitivity rating (BSR)

The total scores for the criteria above were used to determine the biodiversity sensitivity ranking for the sites. On a scale of 0 – 30, six different classes are described to assess the suitability of the sites to be developed. The different classes are described in the table below:

Table 1: Biodiversity sensitivity ranking

BSR	BSR general floral description	Floral score equating to BSR class
Ideal (5)	Vegetation is totally transformed or in a highly degraded state, generally has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area has lost its inherent ecological function. The area has no conservation value and potential for successful rehabilitation is very low. The site is ideal for the proposed development.	29 – 30
Preferred (4)	Vegetation is in an advanced state of degradation, has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area's ecological function is seriously hampered, has a very low conservation value and the potential for successful rehabilitation is low. The area is preferred for the proposed development.	26 – 28
Acceptable (3)	Vegetation is notably degraded, has a medium level of species diversity although no species of concern are present. Invasive plants are present but are still controllable. The area's ecological function is still intact but may be hampered by the current levels of degradation. Successful rehabilitation of the area is possible. The conservation value is regarded as low. The area is acceptable for the proposed development.	21 – 25
Not preferred (2)	The area is in a good condition although signs of disturbance are present. Species diversity is high and species of concern may be present. The ecological function is intact and very little rehabilitation is needed. The area is of medium conservation importance. The area is not preferred for the proposed development.	11 – 20
Sensitive (1)	The vegetation is in a pristine or near pristine condition. Very little signs of disturbance other than those needed for successful management are present. The species diversity is very high with several species of concern known to be present. Ecological functioning is intact and the conservation importance is high. The area is regarded as sensitive and not suitable for the proposed development.	0 - 10

4. Ecological overview of the site

4.1 Overview of ecology and vegetation types (Mucina & Rutherford 2006)

According to Mucina & Rutherford (2006) the area consists of Bushmanland Arid Grassland (NKb 3). This vegetation is not currently listed as being a Threatened Ecosystem (National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)) (Map 2). The area is largely natural and is not currently subjected to any pronounced development pressures.

The topography of the site is relatively flat with a gradual slope toward the north. The site is located approximately 300 meters south of the settlement of Lennertsville (Map 1). The site is situated in a predominately natural area but is bordered on the north by an old borrow pit and to the west by commercial buildings and infrastructure (Map 1). The footprint of the site is approximately 3.7 hectares. A portion of the site was previously cultivated, presumably for vineyards or orchards but is currently fallow. The majority of the site consists of natural vegetation.

The area contains sandy soils covered by recent alluvium, calcrete and superficial deposits of the Kalahari Group. Bedrock is shallow in many areas of the site and areas where gneisses outcrop occur on the site. This creates a free draining area which may become susceptible to erosion.

An ephemeral drainage line crosses the site (Map 1). The drainage line enters the at the south of the site and flows north where it exits the site. The drainage line is degraded downstream of the site by the borrow pit and extensive vineyards. Although in a degraded condition the drainage line remains a vital water transporting body and therefore is regarded as sensitive. It should be excluded from the graveyard and a buffer zone of 10 meters should be afforded to the drainage line.

The region is very arid with a very low Mean Annual Precipitation (MAP) of 124mm. Rain occurs mainly in the form of summer thunderstorms and these may periodically cause flash floods. The soils of the area are loose, freely draining soils that are easily mobilised by surface water flow. As a result the areas on the site adjacent to the drainage lines would be subjected to water erosion. This must be kept in mind throughout the design of the graveyard. The implementation of erosion measures should be investigated.

The vegetation structure consists predominately of a grass layer with dwarf shrubs and scattered shrubs. The drainage line on the site contains a prominent small tree and shrub layer. The site also contains a prominent annual herb component which is activated by sufficient rains.

Dominant grasses include *Stipagrostis obtusa*, *S. ciliata* and *Schmidtia kalahariensis*. Dwarf shrubs consist of *Zygophyllum decumbens* subsp. *decumbens* and *Monechma genistifolium*. The annual herb component consist among others of *Arctotis leiocarpa*, *Dimorphotheca sinuata*, *Foveolina dichotoma*, *Osteospermum sp.*, *Gisekia pharnacioides*, *Leysera tenella* and *Tribulus zeyheri*. Other perennial herbs that are common on the site include *Barleria lichtensteiniana*, *Blepharis mitrata* and *Dicoma capensis*. Scattered shrubs include *Phaeoptilum spinosum*, *Rhigozum trichotomum* and *Lycium cinereum*.

The ephemeral drainage line is dominated by the small tree, *Senegalia mellifera* subsp. *detinens*. The small tree, *Parkinsonia africana*, also occurs along the drainage line as well as the grass, *Cenchrus ciliaris*.

Several protected succulents occur on the site and are associated with areas of exposed rock (appendix B). These species are *Aloe claviflora*, *Euphorbia braunsii* and *E. gariiepina* subsp. *gariiepina*. These are widespread and not considered to be rare. However, permits must be obtained and the species transplanted to an area where they will not be affected by the proposed graveyard.

According to the species list sourced from Plants of South Africa (POSA) on 18 June 2014 (www.posa.sanbi.org) only one species of conservational concern occurs in the region. This species is *Dinteranthus wilmotianus* which is Red Listed as Near Threatened. The site was surveyed for this species but was not found to occur on the site. The site also does not contain the required habitat for this species.

The vegetation on the site cannot be considered to be sensitive or unique and does not contain rare or endangered species. The site is somewhat degraded by surrounding activities. The drainage line occurring on the site is deemed as sensitive and must be excluded from the graveyard.

4.2 Overview of terrestrial mammals (actual & possible)

No mammal species could be identified on the site and no signs of burrows or foraging could be identified. Due to surrounding activities including the residential area, tarred road and commercial buildings it is considered unlikely that species of concern would occur on the site. However there still remains a possibility that mammal species could occur on the site. This must be kept in mind during construction and no mammals may be hunted, captured or trapped.

List of some Red Data terrestrial mammals that could occur in the region:

Pangolin	<i>Manis temminckii</i>
Aardwolf	<i>Proteles cristatus</i>
African Wild Cat	<i>Felis lybica</i>
Small-Spotted Cat	<i>Felis nigripes</i>
Bat-Eared Fox	<i>Otocyon megalotis</i>
Striped Weasel	<i>Poecilogale albinucha</i>

The likelihood that one or several of these endangered species may occur in this area is unlikely.

5. Site specific results

Habitat diversity and species richness:

Habitat diversity on the site is considered as moderate. The site contains deep sands, exposed rock, superficial pebble deposits and a drainage line all of which contribute to habitat diversity. As a result of the different micro habitats the species diversity on the site is considered to be moderate.

Presence of rare and endangered species:

No rare or endangered species could be identified on the site. It is considered highly unlikely that such species would occur on the site since the entire footprint was surveyed. The required habitat for these species in the area are also not present on the site. However, the site does contain several protected species consisting of *Aloe claviflora*, *Euphorbia braunsii* and *E. gariiepina* subsp. *gariiepina* (Appendix B). These are widespread and not considered to be rare. However, permits must be obtained and the species transplanted to an area where they will not be affected by the proposed graveyard.

Ecological function:

The ecological function of the site has been degraded to some extent. Previous ploughing of a portion of the site has altered the ecological function to some extent (Map 1). Ecological function of the drainage line on the site is relatively intact but has been degraded downstream of the site (Map 1). This is due to the borrow pit in the flow of the drainage line as well as the residential area and extensive vineyards. Despite the degraded condition of the drainage line it still provides an important ecological function as water transporting body.

Degree of rarity/conservation value:

The vegetation type on the site is not considered rare or endangered (Map 2). A portion of the site has also been previously ploughed (Map 1). The conservation value of the site cannot be regarded as significant.

The drainage line on the site, although degraded, still has a significant conservation value and must be excluded from the graveyard (Map 1).

The protected species occurring on the site is widespread but still has some conservation value (Appendix B). Permits must be obtained to transplant these species to an area where they will not be affected by the development.

Percentage ground cover:

Due to the aridity of the environment the percentage ground cover is relatively low. This is considered natural to the area.

Vegetation structure:

The vegetation structure consists predominately of a grass layer with dwarf shrubs and scattered shrubs. The drainage line on the site contains a prominent small tree and shrub layer. The site also contains a prominent annual herb component which is activated by sufficient rains. This is natural to the area except where previous ploughing has taken place and the vegetation structure in this area is altered (Map 1).

Infestation with exotic weeds and invader plants:

No exotic species could be identified on the site. Due to the aridity of this area it is not susceptible to infestation by exotics. Care should be taken not to introduce the exotic Mesquite Tree (*Prosopis glandulosa*) as a shade tree in the graveyard as this species readily forms infestations in this region (Appendix C).

Degree of grazing/browsing impact:

The majority of the area is being utilised as grazing for domestic stock. As a result the amount of overgrazing is relatively high.

Signs of erosion:

Erosion on the site is moderate. The soils are exceedingly sandy and susceptible to erosion. Erosion is evident along surface runoff routes.

Terrestrial animals:

No mammal species could be identified on the site and no signs of burrows or foraging could be identified. Due to surrounding activities including the residential area, tarred road and commercial buildings it is considered unlikely that species of concern would occur on the site. However there still remains a possibility that mammal species could occur on the site. This must be kept in mind during construction and no mammals may be hunted, captured or trapped.

Table 3: Biodiversity Sensitivity Rating for the proposed graveyard.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness		2	
Presence of rare and endangered species	3		
Ecological function		2	
Uniqueness/conservation value		2	
Vegetation condition			
Percentage ground cover		2	
Vegetation structure		2	
Infestation with exotic weeds and invader plants or encroachers			1
Degree of grazing/browsing impact	3		
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species	3		
Sub total	9	12	1
Total		22	

6. Biodiversity sensitivity rating (BSR) interpretation

Table 4: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
Lennertsville Graveyard	22	Acceptable	3

7. Discussion and conclusions

The site proposed for the Lennertsville Graveyard has been rated as being acceptable for the development.

According to Mucina & Rutherford (2006) the area consists of Bushmanland Arid Grassland (NKb 3). This vegetation is not currently listed as being a Threatened Ecosystem (National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)) (Map 2).

The site is located approximately 300 meters south of the settlement of Lennertsville (Map 1). The site is situated in a predominately natural area but is bordered on the north by an old borrow pit and to the west by commercial buildings and infrastructure (Map 1). A portion of the site was previously cultivated, presumably for vineyards or orchards but is currently fallow. The majority of the site consists of natural vegetation.

An ephemeral drainage line crosses the site (Map 1). The drainage line enters the site at the south of the site and flows north where it exits the site. The drainage line is degraded downstream of the site by the borrow pit and extensive vineyards. Although in a degraded condition the drainage line remains a vital water transporting body and therefore is regarded as sensitive. It should be excluded from the graveyard and a buffer zone of 10 meters should be afforded to the drainage line.

The region is very arid with a very low Mean Annual Precipitation (MAP) of 124mm. Rain occurs mainly in the form of summer thunderstorms and these may periodically cause flash floods. The soils of the area are loose, freely draining soils that are easily mobilised by surface water flow. As a result the areas on the site adjacent to the drainage lines would be subjected to water erosion. This must be kept in mind throughout the design of the graveyard. The implementation of erosion measures should be investigated.

No rare or endangered species could be identified on the site. It is considered highly unlikely that such species would occur on the site since the entire footprint was surveyed. The required habitat for these species in the area are also not present on the site. However, the site does contain several protected species consisting of *Aloe claviflora*, *Euphorbia braunsii* and *E. gariiepina* subsp. *gariiepina* (Appendix B). These are widespread and not considered to be rare. However, permits must be obtained and the species transplanted to an area where they will not be affected by the proposed graveyard.

The area contains no visible exotic species. The region has a low susceptibility to exotic infestation due to the arid climate. However, the Mesquite Tree (*Prosopis glandulosa*) is adapted to this environment and causes infestation problems in many areas (Appendix C). This tree should not be used as a shade tree in the graveyard.

Several trees indigenous to the region may be considered as shade trees within the graveyard. This will contribute to the sense of place and will provide shade to visitors. These trees will also aid in stabilisation of the soil. Trees that should be considered include *Vachellia erioloba* (Camel Thorn), *Senegalia mellifera* (Black Thorn), *Searsia lancea* (Karree) and *Parkinsonia africana* (Greenhair Tree).

The expansion of the proposed graveyard on this site would have a relatively low impact on the environment as long as the drainage lines on the site are excluded from the development and disturbance kept localised. Protected species on the site should be transplanted. The following recommended mitigation measures should be adhered to.

8. Recommendations

- The drainage line on the site should be excluded from the layout (Map 1).
- A buffer of 10 meters should be respected from this drainage line.
- The area should be monitored for erosion. Should any erosion occur prevention measures should be put in place.
- The implementation of erosion measures along the drainage line should be investigated.
- Permits must be obtained and the protected species occurring on the site, *Aloe claviflora*, *Euphorbia braunsii* and *E. gariiepina* subsp. *gariiepina*, transplanted to an adjacent area where they will not be affected (Appendix B).
- The use of the Mesquite Tree (*Prosopis glandulosa*) as a shade tree should not be permitted (Appendix C).
- The use of indigenous shade trees should be investigated. This will also aid in stabilisation of the soil.
- No animals may be hunted, captured or trapped in any way during construction or operation of the graveyard.

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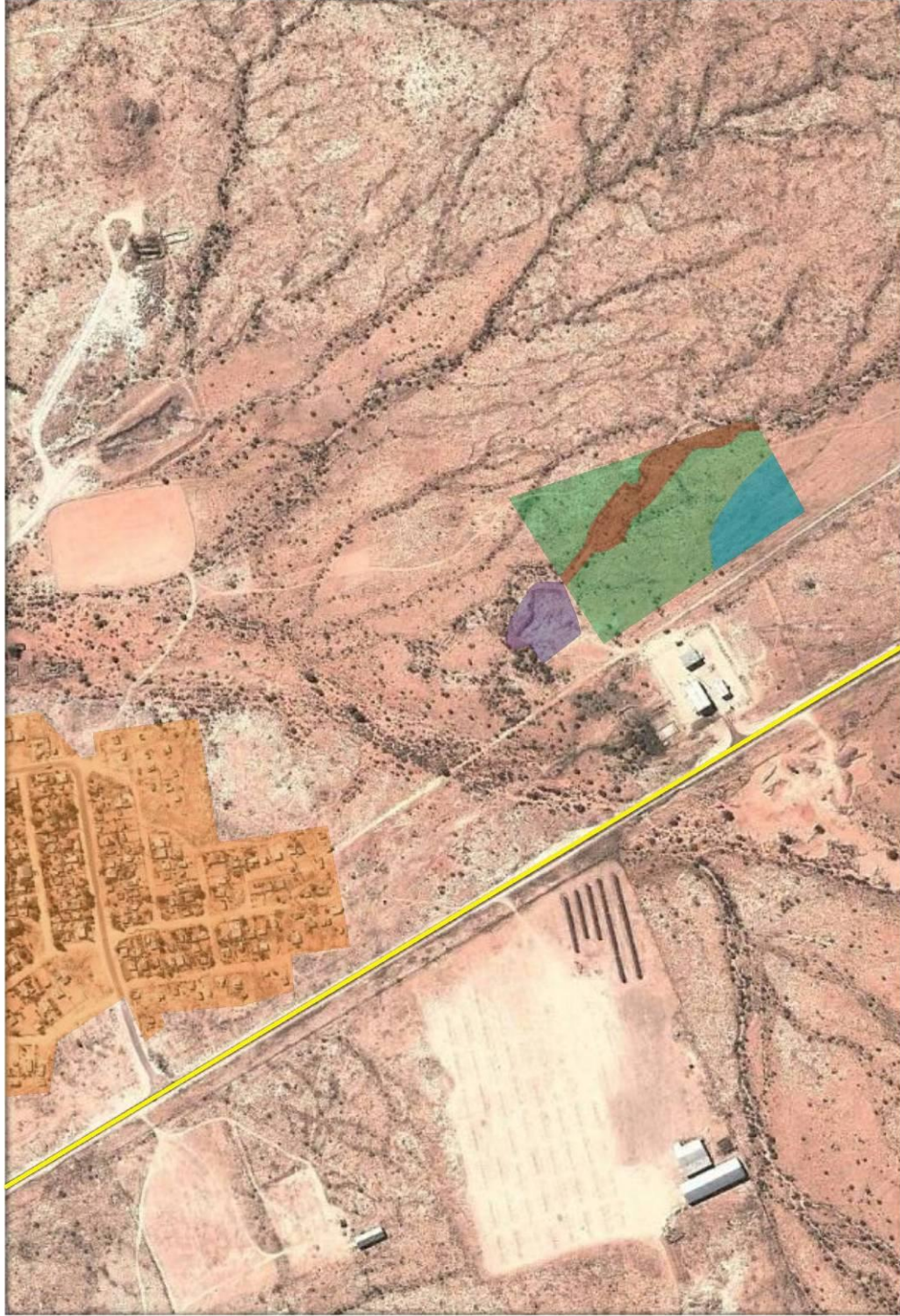
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Annexure A: Maps and Site photos

Layout map for the proposed establishment of the Lennertsville Graveyard, Northern Cape Province.



Map 1: Layout for the proposed establishment of the Lennertsville Graveyard, Northern Cape Province. The drainage line is indicated as well as the area that has previously been ploughed. The old borrow pit and Lennirtsville settlement is also indicated. Note buildings to the west of the site as well as surrounding areas cleared for cultivation.



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Legend:

- R27 Tarrred Road
- Graveyard footprint
- Drainage line
- Ploughed area
- Borrow pit
- Lennirtsville Settlement

Map Information

Spheroid: WGS 84



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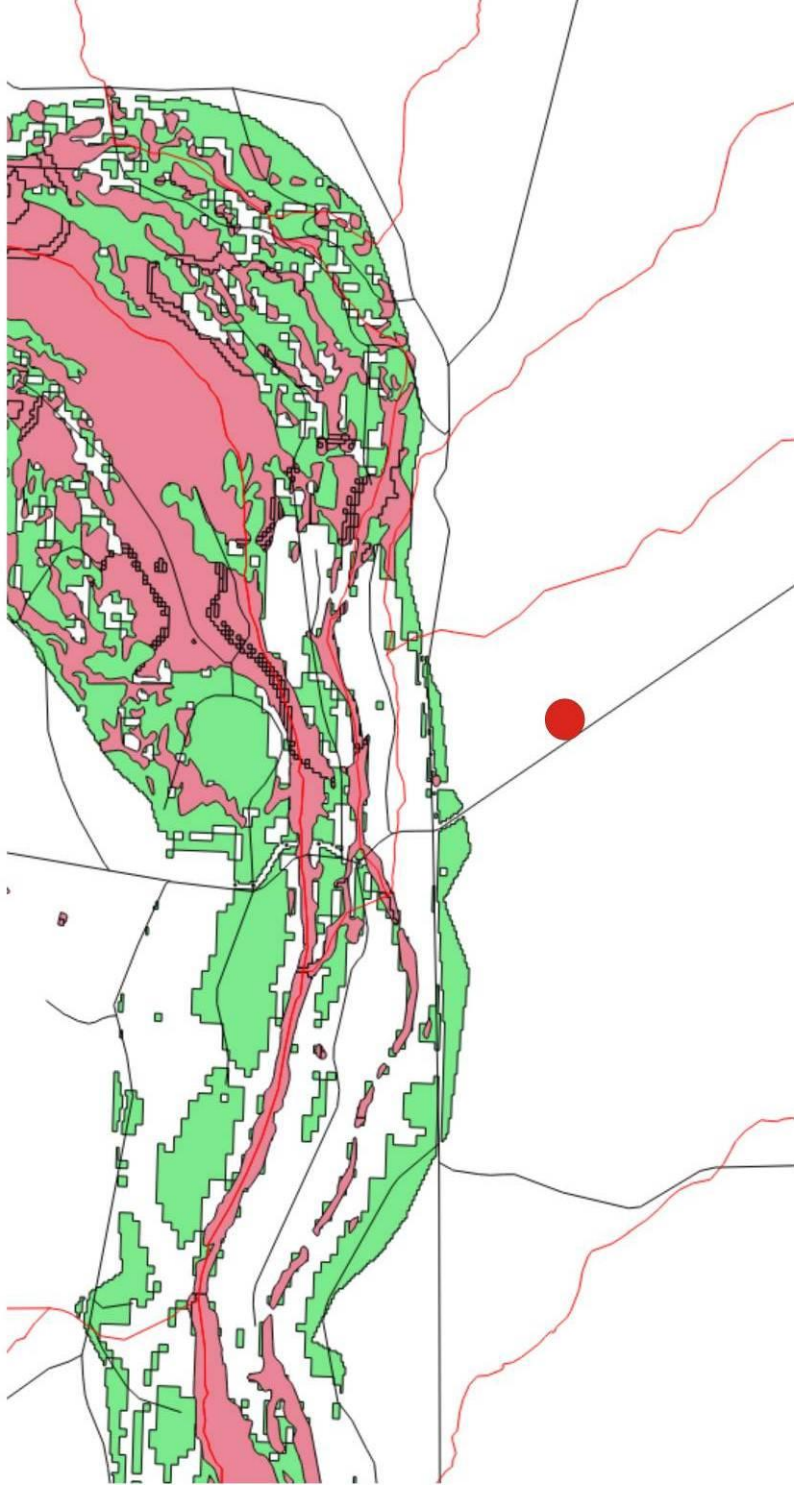
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Sensitivity map for the proposed establishment of the Lennertsville Graveyard, Northern Cape Province.



Map 2: Sensitivity map of the proposed establishment of the Lennertsville Graveyard, Northern Cape Province. Areas consisting of Threatened Ecosystems, National Freshwater Ecosystems Priority Areas (NFEPA) rivers and wetlands are indicated. Note that the site does not fall within any of these areas. The region also does not contain any Strategic Water Source Areas (SWSA), National Protected Areas Expansion Strategy (NPAES) Focus Areas or Important Bird Areas (IBA).



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Legend:

- Road Network
- NFEPA Watercourses
- NFEPA Wetlands
- Threatened Ecosystems
- Graveyard Site

Map Information

Spheroid: WGS 84
Scale: 1:50 000
Quantum GIS

Environmental Consultant

EKO Environmental
Contact Darius van Rensburg at:
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Figure 1: Panorama of the site. The percentage ground cover is relatively low due to the aridity of the area. Note scattered small trees and shrubs. The vegetation is dominated by white grasses including *Stipagrostis spp.*



Figure 2: Panorama of the site. The percentage ground cover is relatively low due to the aridity of the area. Note scattered small trees and shrubs.



Figure 3: Panorama of the site. The percentage ground cover is relatively low due to the aridity of the area. Note scattered small trees and shrubs.



Figure 4: Panorama of the site. The percentage ground cover is relatively low due to the aridity of the area. Note scattered small trees and shrubs. Note adjacent buildings (red).



Figure 5: View of the drainage line on the site (blue).



Figure 6: View of the drainage line on the site (blue). This illustrates the main channel of the drainage line.

Appendix B: Protected species on the site

Protected species on the site may not be limited to these species but these species have identified on and around the site. Additional sources should be consulted to confirm the presence of protected species.



Aloe claviflora
Canon Aloe/Kraal Aalwyn

Protected in the Northern Cape Province

National Red List Status: **Least Concern**

Method: **The species occurs on exposed rock and near the drainage line. Those specimens that will be affected by the development must be transplanted to an area where they will not be affected by the development. Permits must be obtained to transplant specimens.**



Euphorbia gariepina* subsp. *gariepina
Melkbos

Protected in the Northern Cape Province

National Red List Status: **Least Concern**

Method: **The species occurs on exposed rock and near the drainage line. Those specimens that will be affected by the development must be transplanted to an area where they will not be affected by the development. Permits must be obtained to transplant specimens.**



Euphorbia braunsii
Vingerpol

Protected in the Northern Cape Province

National Red List Status: **Least Concern**

Method: The species occurs on exposed rock and near the drainage line. Those specimens that will be affected by the development must be transplanted to an area where they will not be affected by the development. Permits must be obtained to transplant specimens.

Appendix C: Likely invader weed species

Invader weed species on the site may not be limited to these species but these are considered to be the most likely and significant invaders to occur. Additional sources should be consulted to confirm invader weed species as well as the best method to eradicate them.

According to the Conservation of Agricultural Resources Act, No. 43 of 1983 any Category 1 declared plants must be controlled by the land user on whose land such plants are growing.



***Opuntia* spp.**
Prickly Pear/Turksvy

Type: Weed
Category: 1

Mechanical control is effective for single specimens. All parts of the plant must be removed and burned.

Chemical control is the most effective method. Monosodium methanearsonate (MSMA) and glyphosate must be injected into the stem as concentrated solutions.



Prosopis glandulosa
Mesquite/Muskietboom/Prosopis

Type: Invader
Category: 2

The species is highly problematic in the Northern Cape and is not easily eradicated.

Trees should be cut and the stumps immediately treated with a ticlopyr or ticloram herbicide.

Afterwards the area must be monitored for the germination of any seedlings which must be pulled out and disposed of. The area must also be monitored for the coppicing of any of the stumps which must be cut and treated with a herbicide.



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