Report on the floristic and ecological assessment of the proposed expansion of the Cillie graveyard, Northern Cape Province.

October 2012

Prepared by:
Darius van Rensburg

H2ON Environmental Specialists
21 Dromedaris Street • Dan Pienaar • Bloemfontein
Suite 158 • Private Bag X01 • Brandhof • 9324
darius@h2on.co.za
Tel: 051 4444 700 • Fax: 086 6976 132

Prepared for:
MDA Environmental Consultants
9 Barnes Street
Westdene
9301

Table of contents

Vegetation and ecological assessment.

Vegetation and ecological assessment.

1. Introduction

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.

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 Gariep 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.

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

The proposed expansion of the Cillie graveyard is situated approximately 300m west of the periphery of the Cillie settlement. The graveyard may be reached by taking Magrietjie Street and following the dirt road for approximately 260m outside the settlement (Map 1)

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

2. Scope and limitations

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

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

Some of the bulbous species may have been overlooked. Many species have a spring/summer flowering period.
Some species may have been overlooked due to an annual cycle.
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, Coates-Palgrave 2002, Court 2010, Hartmann 2001, Le Roux 2005, Roberts & Fourie 1975, Van Oudtshoorn 2004, Van Rooyen 2001, Manning 2009, Van Wyk & Van Wyk 1997).

Terrestrial fauna:
Field guides for species identification (Smithers 1986).

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 & Ruterford 2006)

The vegetation in the area consists of Bushmanland Arid Grassland (NKb 3). The vegetation type is characterised by the dominance of white grasses (*Stipagrostis spp.*) and may contain a large degree of annual herbs after periods of high rainfall.

The topography is relatively flat and sloping slightly towards the south. The site is situated within an extensive streamwash (Map 1). This area forms part of a floodplain of an ephemeral stream. The streamwash has a width of approximately 300m in this area. The ephemeral stream is situated approximately 150m west of the proposed site (Map 1). Due to the arid climate this stream only flows during years of exceptional rains. Furthermore the streamwash does receive moisture but should only be inundated by large floods during a 1 in 100 year flood. These ephemeral systems function in a manner where flash floods occur within a short period but infrequently. During such a large scale flood water also flows perpendicular to the main channel flow and resides in an extensive streamwash. These waters then reside in the streamwash for a short period where after it infiltrates to the groundwater.

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 site may be subjected to water erosion. This must be kept in mind throughout the design of the graveyard. The implementation of erosion measures is recommended.

It can be deduced from the above discussion that the graveyard may become shallowly inundated for a short period. However, this will only occur during times of high rainfall and is anticipated to occur during a 1 in 100 year flood. The risk of the graveyard being eroded during such an event is relatively low since the floodplain morphology does not lend itself to fast flowing flood water. However, it is still recommended that erosion measures be implemented to prevent any sheet or gulley erosion of the graveyard.

The vegetation on the site consists of a well developed grass layer, dominated by annual grasses, and a well developed tree layer. The dominant grasses on the site include *Schmidtia kalihariensis, Stipagrostis uniplumis, S. obtusa* and *S. ciliata*. These are the characteristic "white grasses" of this vegetation type. The dwarf shrub, *Monechma genistifolium* subsp. *genistifolium*, is interspersed between grasses on the site. The common trees on the site include *Parkinsonia africana* and *Acacia mellifera* subsp. *detinens*. These species are common and widespread and not a concern to the development. The mistletoe parasite, *Tapinanthus oleifolius*, is common on these trees.

Two protected tree species were noted on the site. One small juvenile specimen of the Shepherds Tree (*Boscia albitrunca*) occurs on the site. This species is widespread but protected and the specimen should either be kept intact on the site or a permit must be acquired to remove it. A large specimen of the Camel Thorn Tree (*Acacia erioloba*) occurs on the site. This species is widespread but protected. It is recommended that this specimen be kept intact on the site. If this is not possible a permit must be acquired to remove it.

The area around the existing graveyard has already been degraded. The vegetation on the site is not high in diversity and no rare or endangered species occur on the site. The graveyard is located within the streamwash of an ephemeral stream but it is not considered that the development would have a high impact on this floodplain.

4.2 Overview of terrestrial mammals (actual & possible)

No rare or endangered mammals could be identified on the site.

As a result of the activities around the existing graveyard the area is disturbed. Although natural vegetation occurs at the site no mammals or signs of any mammals on the site could be identified. It is deemed highly unlikely that any species of concern would occur on or near the site.

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

Aardwolf	*Proteles cristatus*
Bat-Eared Fox	*Otocyon megalotis*
Striped Weasel	*Poecilogale albinucha*
Small Spotted Cat	*Felis negripes*
Antbear	*Orycteropus afer*

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

5. Site specific results

Habitat diversity and species richness:
Habitat diversity on the site is relatively low. The habitat consists of a well developed grass and tee layer. Localised disturbance has occurred adjacent to the existing graveyard. Species diversity on the site is relatively low. This vegetation type is not known to contain a high diversity of species.

Presence of rare and endangered species:
No species of concern could be identified on the site. The area has experienced localised disturbance. This vegetation type is not known to contain a high amount of rare or endangered species. Two species of protected trees were noted on the site. These are one large specimen of Camel Thorn Tree (*Acacia erioloba*) and one juvenile specimen of Shepherds Tree (*Boscia albitrunca*).

Ecological function:
The ecological function of the site remains relatively intact but has been degraded by the existing graveyard. The site functions as part of an ephemeral streamwash/floodplain. The ecological function is relatively important to the integrity of the system. However, due to the size of the proposed development it is not anticipated to have a large impact on this streamwash/floodplain.

Degree of rarity/conservation value:
The vegetation type that is present on the site is regarded as being of Least Concern and it is not rare. The site does not have a high degree of diversity and does not contain any rare or endangered species. The conservation value of the ephemeral streamwash is relatively high.

Percentage ground cover:
Due to the aridity of the environment the percentage ground cover is relatively low. It is anticipated that the percentage ground cover would dramatically increase after high rainfall as a result of the high germination rate of annuals.

Vegetation structure:
The vegetation structure consists of a grass and tree layer. The vegetation structure is regarded as natural and relatively untransformed. However, some degradation on the site is evident as a result of the existing graveyard.

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.

Degree of grazing/browsing impact:
Grazing by domestic stock is regarded as moderate.

Signs of erosion:
Erosion on the site and surroundings are considered moderate. Limited sheet erosion is present around the existing graveyard and some gulley forming occurs on the site. This is caused by the site being located within the streamwash and resulting surface water flow causes such drainage lines.

Terrestrial animals:
No mammals could be identified on the site. Due to the existing graveyard and localised disturbance of the site it is considered highly unlikely that any mammals of concern would occur on the site.

Table 2: Biodiversity Sensitivity Rating for the proposed graveyard expansion.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness	3		
Presence of rare and endangered species		2	
Ecological function		2	
Uniqueness/conservation value		2	
Vegetation condition			
Percentage ground cover	3		
Vegetation structure		2	
Infestation with exotic weeds and invader plants or encroachers			1
Degree of grazing/browsing impact		2	
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 3: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
Cillie graveyard expansion	22	Acceptable	3

7. Discussion and conclusions

The site has been rated as being Acceptable for the proposed development.

The vegetation on the site is notably degraded due to the activities associated with the existing graveyard. The vegetation type of the area is regarded as being of Least Concern and is not rare or under severe anthropological pressures. The species diversity on the site is relatively low and no rare or endangered species occur on the site.

The site forms part of an extensive streamwash (Map 1). An ephemeral stream is located approximately 150 meters to the west of the site and this streamwash forms part of the floodplain of this stream (Map 1). Due to the arid climate of the area it is anticipated that shallow flooding of the site may occur during a 1 in 100 year flood. The erosion of the site during such an event should be minimal. This is due to the morphology of the streamwash in this area. The area acts as a sediment sink and due to the low slope alluvium is deposited in the area during large floods. The streamwash is considered to perform an important ecological function and any large scale transformation of this area should not be allowed. However, the existing graveyard does not seem to have a large impact on the area and it is not anticipated that the proposed expansion would detrimentally affect the area. Due to the size of the proposed development no large scale impacts would occur with regard to the streamwash.

Two species of protected trees were noted on the site. These are one large specimen of Camel Thorn Tree (*Acacia erioloba*) and one juvenile specimen of Shepherds Tree (*Boscia albitrunca*). Although these species are widespread they remain protected. The two trees occurring on the site should be left intact if possible. Should this not be possible a permit must be obtained to remove them.

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. 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 a peaceful 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 *Acacia erioloba* (Camel Thorn)*, A. melifera* (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 disturbance is kept localised and measures are implemented to prevent erosion. The following recommended mitigation measures should be adhered to.

8. Recommendations

- The implementation of erosion measures is recommended.
- The area should be monitored for signs of erosion. Should any erosion occur prevention measures should be put in place.
- The specimens of protected trees on the site, Shepherds Tree (*Boscia albitrunca*) and Camel Thorn Tree (*Acacia erioloba*), should be kept intact. If this is not possible permits should be acquired to remove them.
- The use of the Mesquite Tree (*Prosopis glandulosa*) as a shade tree should not be permitted.
- The use of indigenous shade trees should be investigated. This will also aid in stabilisation of the soil.
- No animals may be captured, hunted or harmed in any way during construction or operation of the facility.

9. References

Adams, J. 1976. Wild Flowers of the Northern Cape. The Department of Nature and Environmental Conservation of the Provincial Administration of the Cape of Good Hope, Cape Town.

Coates-Palgrave, M. 2002. Keith Coates-Palgrave Trees of Southern Africa, edn 3, imp. 4 Random House Struik (Pty.)Ltd, Cape Town.

Court, D. 2010. Succulent Flora of Southern Africa. Struik Publishers, Cape Town.

Germishuizen, G. & Meyer, N.L. (eds) 2003. Plants of Southern Africa: an annotated checklist. *Strelitzia* 14. National Botanical Institute, Pretoria.

Government of South Africa. 2008. National Protected Area Expansion Strategy for South Africa 2008: Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Government of South Africa, Pretoria.

Hartmann, H.E.K. 2001. Illustrated Handbook of Succulent Plants: Aizoaceae F-Z. Springer-Verlag, Berlin.

Le Roux, A. 2005. Namankwaland: Wild Flower Guide of South Africa Nr. 1. Botanical Society of South Africa, Cape Town.

Manning, J. 2009. Field Guide to Wild Flowers. Struik Nature, Cape Town.

Mucina, L. & Rutherford, M.C. (eds.) 2006. The Vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19.South African National Biodiversity Institute, Pretoria.

Raymondo, D. Van Staden, L. Foden, W. Victor, J.E. Helme, N.A. Turner, R.C. Kamundi, D.A. Manyama, P.A. (eds.) 2009. Red List of South African Plants. *Strelitzia* 25. South African National Biodiversity Institute, Pretoria.

Roberts, B.R. & Fourie, J.H. 1975. Common grasses of the Northern Cape. Northern Cape Livestock co-Operative Limited, Vryburg.

Smithers, R.H.N. 1986. Land Mammals of Southern Africa. Macmillan, Johannesburg.

Van Oudtshoorn, F. 2004. Gids tot Grasse van Suider-Afrika. Briza Publications, Pretoria.

Van Rooyen, N. 2001. Flowering plants of the Kalahari dunes. Ekotrust CC, Lynnwood.

Van Wyk, B. & Van Wyk, P. 1997. Field guide to trees of Southern Africa. Struik Publishers, Cape Town.

Annexure A: Maps and Site photos

Locality of the proposed expansion of the Cillie graveyard.

Preparred for:
MDA Consultants
9 Barnes Street
Bloemfontein
9301

Legend:

- Dirt access roads
- Proposed graveyard
- Ephemeral streams
- Streamwash

Map Information

Spheroid: WGS 84
Topo Cadastre Sheet: T2820DA

0 120 240 360
Scale (m)

Environmental Consultant
H2ON Environmental Specialists
Contact Darius van Rensburg at:
darius@h2on.co.za
Suite 158, P/Bag X01, Brandhof, 9324
Tel: 051 4444 700
Fax: 086 6976 132

Map 1: The location of the proposed expansion of the Cillie graveyard. The dirt roads providing access to the site is indicated. The ephemeral stream is indicated as well as the resulting extensive streamwash. The streamwash is associated with sediment deposition.

Layout of the proposed expansion of the Cillie graveyard.

Preparred for:
MDA Consultants
9 Barnes Street
Bloemfontein
9301

Legend:
- Access road
- Protected tree
- Existing graveyard
- Proposed graveyard
- Ephemeral streams

Map Information

Spheroid: WGS 84
Topo Cadastre Sheet: T2820DA

0 29 58 87
Scale (m)

Environmental Consultant
H2ON Environmental Specialists
Contact Darius van Rensburg at:
darius@h2on.co.za
Suite 158, P/Bag X01, Brandhof, 9324
Tel: 051 4444 700
Fax: 086 6976 132

Map 2: The approximate layout of the proposed expansion of the Cillie graveyard. The access road as well the large specimen of protectedCamel Thorn Tree (*Acacia erioloba*) is indicated. The ephemeral streams in the area is indicated in red.

Figure 1: Panorama of the western portion of the site. Note the low percentage vegetation cover, small trees disturbance cause by dirt roads.

Figure 2: Panorama of the northern portion of the site. Note the existing graveyard (red figure) as well as the disturbance caused by the dirt road.

Figure 3: Panorama of the southern portion of the site. Note the disturbance by the dirt road. The protected Camel Thorn Tree (*Acacia erioloba*) occurring on the site is also indicated.

Figure 4: The large specimen of the protected Camel Thorn Tree (*Acacia erioloba*) occurring on the site. This specimen must be kept intact on the site or a permit must be acquired to remove it.

Figure 5: The juvenile of the protected Shepherds Tree (*Boscia albitrunca*) occurring on the site. This specimen must be kept intact on the site or a permit must be acquired to remove it.

Figure 6: Other trees occurring on the site. On the left is *Acacia melifera* subsp. *detinens* and on the right is *Parkinsonia africana*. These species are widespread and not of a concern to the development.

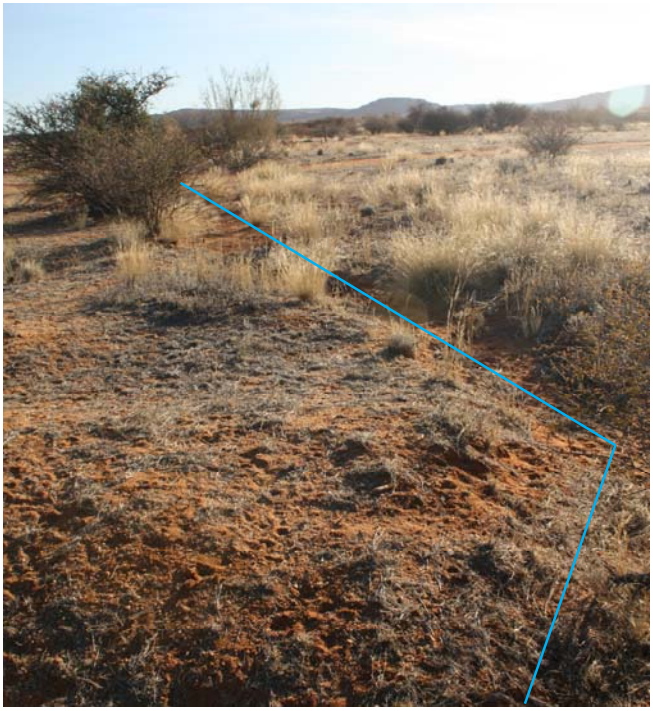

Figure 7: A small drainage canal on the site (blue line). This is due to the site being located within the streamwash. It is also an example of the erosion that occurs on the site. Erosion measures must be implemented to contain such erosion.