

# DPR

**Ecologists & Environmental Services**

## **Report on the ecological assessment of a proposed development on the Remainder of the Farm Outspan 1960 in the Bainsvlei Small Holdings, Bloemfontein, Free State Province.**

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Prepared by:

### **Darius van Rensburg**

Pr.Sci.Nat. 400284/13

T 083 410 0770

darius@dprecologists.co.za

P.O. Box 12726 | 61 Topsy Smith Street  
Brandhof | Langenhovenpark  
9324 | 9300

Prepared for:

Turn 180 Environmental Consultants


Suite 221, Private Bag X01

Brandhof

9324

## DECLARATION OF INDEPENDENCE

DPR Ecologists and Environmental Services is an independent company and has no financial, personal or other interest in the proposed project, apart from fair remuneration for work performed in the delivery of ecological services. There are no circumstances that compromise the objectivity of the study.

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<b>Author</b>	<b>DP van Rensburg (Pr.Sci.Nat)</b>		<b>Apr'19</b>

## Executive Summary

According to Mucina & Rutherford (2006) the area consists of Bloemfontein Dry Grassland (Gh 5). This vegetation type is currently listed as being Vulnerable (VU) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Map 2). It is currently subjected to severe pressure mostly as a result of agricultural crop cultivation. However, the vegetation on the site is considered to be largely transformed from the natural condition. Although, according to the List of Threatened terrestrial ecosystems (remaining extent) (SANBI 2011) a small portion of the site still consist of this vegetation type. The on-site survey has indicated that remnants of the vegetation type is indeed still present on the site, but is degraded and is not representative of this vegetation type. This is largely affirmed by the Free State Province Biodiversity Management Plan (2015) which regards the site to fall within the Degraded and Other categories and indicates that it is no longer considered to be of high conservation value (Map 3).

From the survey of the site it is clear that it is devoid of watercourses or wetlands. However, a longitudinal, poorly defined channel is present which may be construed as a drainage line (Map 1 & 2). It is however considered most likely an artificial modification brought about by road building or storm water ditches. The vegetation along this channel does contain a few riparian species but is for the most part, dominated by terrestrial species. It does also not form part of a continuous watercourse and is therefore an isolated channel without any significant function. At the south eastern border of the site at the Kenilworth Road a culvert occurs which feeds into the storm water channels adjacent to the R64 road and any storm water contained within the channel on the site is most likely to feed into this storm water system. The channel identified on the site is therefore considered as artificial, does not form part of any surrounding watercourse or wetland and therefore does not have any significant function. It can therefore be incorporated into the development without having any significant impact on surrounding systems. However, the channel may still have some function in terms of storm water management and the development should design and incorporate an adequate storm water management system which feeds into the surrounding system.

The site still contains a moderate species diversity with numerous geophytic species and two protected species still remain on the site namely, *Aloe jeppeae* and *Raphionacme hirsuta*. Both are uncommon with the former considered rare. They therefore still have a significant conservation value and their loss would entail a moderate-high impact. Adequate mitigation will therefore have to be implemented to decrease the impact. Since neither of these would be beneficial in the landscaping of the development, the entire footprint of the site will be developed and the surrounding area is already mostly transformed it will not be possible to retain these on the site or transplant them to an adjacent area. Instead it is recommended that the necessary permits be obtained and these species removed from the site. A record of both species must be preserved in a local accredited herbarium and the remaining specimens donated to a conservation area such as the local botanical gardens. Should this mitigation be implemented the impact should be decreased to moderate.

As was observed the site contains numerous exotic weeds with a few being considered problematic weeds and invasives (Appendix B). Monitoring of weed establishment and eradication should form a prominent part of management of the development. Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.

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## **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.

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.

South Africa has a large amount of endemic species and in terms of plant 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.

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.

The proposed site will entail development of an agricultural associated sales and storage facility and will be situated on the Remainder of the Farm Outspan 1960 which is situated in the Bainsvlei Small Holdings along the western outskirts of Bloemfontein (Map 1). The site is bordered to the south by the R64 tarred road and to the north by small holdings. The approximate extent of the site is 15 hectares. Due to the location and surroundings the site consists of natural vegetation but which is significantly modified from the pristine condition. The site is also isolated from surrounding natural areas and its ecological functioning impaired to a significant degree.

A site visit was conducted on 13 March 2019. The entire footprint of the site was surveyed. The site survey was conducted during summer after sufficient rains and the plant identification on the site was considered optimal.

For the above reasons it is necessary to conduct an 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 development.
- To identify possible negative impacts that could be caused by the proposed development.

### **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 geophytic or succulent species may have been overlooked due to a specific flowering time or cryptic nature.

Although a comprehensive survey of the site was done it is still likely that several species were 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 (Bromilow 1995, 2010, Coates-Palgrave 2002, Fish *et al* 2015, Gibbs-Russell *et al* 1990, Manning 2009, Retief & Meyer 2017, Van Oudtshoorn 2004, Van Wyk & Malan 1998, Van Wyk & Van Wyk 1997, Venter & Joubert 1985).

Terrestrial fauna:

Field guides for species identification (Smithers 1986a, Child *et al* 2016).

#### **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 niche – 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

Refer to the list of species encountered on the site in Appendix B.

According to Mucina & Rutherford (2006) the area consists of Bloemfontein Dry Grassland (Gh 5). This vegetation type is currently listed as being Vulnerable (VU) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Map 2). It is currently subjected to severe pressure mostly as a result of agricultural crop cultivation. However, the vegetation on the site is considered to be largely transformed from the natural condition. Although, according to the List of Threatened terrestrial ecosystems (remaining extent) (SANBI 2011) a small portion of the site still consist of this vegetation type. The on-site survey has indicated that remnants of the vegetation type is indeed still present on the site, but is degraded and is not representative of this vegetation type. This is largely affirmed by the Free State Province Biodiversity Management Plan (2015) which regards the site to fall within the Degraded and Other categories and indicates that it is no longer considered to be of high conservation value (Map 3).

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The majority of the site still consists of indigenous vegetation but only remnants of the natural vegetation type remains (Map 1). This is most probably due to the small size of the site, its isolation from surrounding natural areas and previous land use of the site. The site does not contain any buildings or structures. However, it has a slim longitudinal shape and is bordered to the south by the R64 tarred road and to the north by the Van Vuuren gravel road. Both of these have a significant impact on the site as a result of the edge-effect which includes storm water ditches, rubbish dumping, spread of exotic weeds and invaders which coupled with the slim shape of the site contributes to significant degradation of the site. The site also contains a longitudinal disturbance from north west to south east and resembles a channel or watercourse (Map 1 & 2). It is however most likely associated with an old road or historical storm water ditches but the likelihood that it is a remnant of a natural drainage line cannot be discounted.

The topography of the site consists of a relatively flat area without any discernible slope. The topography is relatively uniform except for the longitudinal channel acting as storm water conduit (Map 1 & 2). The topography on the site is still mostly intact but due to the slim shape of the site and longitudinal channel some modification of the topography is considered likely.

From the survey of the site it is clear that it is devoid of watercourses or wetlands. However, a longitudinal, poorly defined channel is present which may be construed as a drainage line (Map 1 & 2). It is however considered most likely an artificial modification brought about by road building or storm water ditches. The vegetation along this channel does contain a few riparian species but is for the most part, dominated by terrestrial species. It also does not form part of a

continuous watercourse and is therefore an isolated channel without any significant function. At the south eastern border of the site at the Kenilworth Road a culvert occurs which feeds into the storm water channels adjacent to the R64 road and any storm water contained within the channel on the site is most likely to feed into this storm water system. The channel identified on the site is therefore considered as artificial, does not form part of any surrounding watercourse or wetland and therefore does not have any significant function. It can therefore be incorporated into the development without having any significant impact on surrounding systems. However, the channel may still have some function in terms of storm water management and the development should design and incorporate an adequate storm water management system which feeds into the surrounding system.

Vegetation along the artificial channel is dominated by trees and shrubs which include *Searsia lancea*, *Asparagus larcinus*, *Vachellia karroo*, *Buddleja saligna*, *Ziziphus mucronata* and *Ehretia rigida*. Although several of these are often associated with watercourses, in this region, they are not considered to be exclusively riparian species. The dense tree layer also causes the establishment of shade loving herbs and grasses along the channel and these include *Atriplex semibaccata* and *Setaria verticillata*. Due to the artificial nature and general disturbance along the channel, exotic weeds and invasive species are common and include *Schinus molle*, *Opuntia ficus-indica* and *Alternanthera pungens*. Although the channel is dominated by terrestrial species and is not indicative of waterflow, a few areas where water does collect is indicated by the riparian grass, *Panicum coloratum* and the herb, *Alternanthera sessilis*. The vegetation along the artificial channel is therefore also not indicative of any prominent riparian conditions or waterflow but a few areas with scant riparian vegetation does indicate at least temporary elevated moisture levels.

Geology in this area consists of sedimentary mudstones and layers of sandstone of the Beaufort Group but does not outcrop and is covered by deeper sands overlaying clay. This is also indicative of the natural grassland vegetation type occurring in this area.

The area has a mean average temperature of 16.2°C, with a maximum of 30.9°C in January and temperatures below zero common in winter (-1.6°C in July). Summer rainfall occurs mostly as thunderstorms with an average annual rainfall of 548 mm.

The vegetation on the site consists of a few grassland patches which are considered remnants of the natural vegetation type with a species composition also comparable to the natural vegetation type. Disturbance and modification of the site has however caused encroachment of trees and shrubs which dominate along the artificial channel as well as along the boundaries of the site. The general degradation of the site also causes the establishment of numerous exotic weeds and invasive species. The patches of remnant grassland is dominated by grasses which include *Eragrostis superba*, *Aristida congesta*, *Tragus koelerioides*, *Themeda triandra*, *Eragrostis curvula*, *Cynodon dactylon*, *Eragrostis lehmanniana*, *Chloris virgata*, *Digitaria eriantha* and *Urochloa panicoides*. This consists of an assemblage of pioneer and climax species which clearly represents a patch of remnant grassland from the original vegetation type but which has been significantly degraded and isolated from surrounding natural areas. Within the grass layer a herb and dwarf shrub component is also prominent and includes species such as *Selago densiflora*, *Massonia angustifolia*, *Lycium horridum*, *Commelina africana*, *Hibiscus pusillus*, *Ruschia hamata*, *Menodora africana*, *Hermannia comosa*, *Dimorphotheca zeyheri*, *Nolletia ciliaris*, *Ipomoea oblongata* and *Rosenia humilis*. These are mostly natural to the vegetation type but some herbaceous species such as *Nidorella resedifolia* which is abundant on the site does indicate some disturbance of the grass layer. Another prominent component is

the abundance of geophytic species. This is also a natural component of the sandy soils of this vegetation type and does indicate that remnant patches are still present. These species include *Hypoxis hemerocallidae*, *Bulbine narcissifolia*, *Aloe jeppeae*, *Dipcadi viride*, *Trachyandra saltii*, *Dipcadi ciliare*, *Ledebouria luteola*, *Eriospermum porphyrium*, *Albuca cooperi* and *Raphionacme hirsuta*. Most of these are widespread and not of conservation significant. However, *A. jeppeae* and *R. hirsuta* are both protected species not common with the foremost considered a rare species. Since neither of these would be beneficial in the landscaping of the development, the entire footprint of the site will be developed and the surrounding area is already mostly transformed it will not be possible to retain these on the site or transplant them to an adjacent area. Instead it is recommended that the necessary permits be obtained and these species removed from the site. A record of both species must be preserved in a local accredited herbarium and the remaining specimens donated to a conservation area such as the local botanical gardens. As already discussed, the site is significantly degraded and as a result numerous exotic weeds and invasive species occur on the site and these include *Echinopsis schickendantzii*, *Opuntia ficus-indica*, *Cestrum laevigatum*, *Verbena tenuisecta*, *Sphaeralcea bonariensis* and *Portulaca oleracea*. Several of these are also known to be problematic weeds and invasives. Encroaching thicket is dominated by trees and shrubs and include *Vachellia karroo*, *Asparagus larcinus*, *Searsia lancea*, *Ehretia rigida* and *Buddleja saligna*.

From the description of the vegetation on the site it is clear that patches of remnant grassland remain but are degraded from the natural condition and that it is largely isolated from any surrounding natural areas. There are no elements of exceptional conservation value although two protected geophytic species do retain some conservation value.

In conclusion, the natural vegetation type, Bloemfontein Dry Grassland, occurring in this area is currently listed as being Vulnerable (VU) which gives a high conservation value to any remaining portions of this vegetation type still in a natural condition (Map 2). However, on-site survey has indicated that only remnant patches of the vegetation type still remain and are also degraded to a significant extent (Map 1). This is also affirmed by the Free State Biodiversity Management Plan which lists the site as being within the Degraded and Other categories and indicates that it is no longer considered to be of high conservation value (Map 3). Furthermore, the site is isolated from any surrounding natural areas and consequently it would not have any significant value should the vegetation on the site be conserved. The site does not contain any unique habitats or high species diversity but does still contain two protected geophytic species namely, *Aloe jeppeae* and *Raphionacme hirsuta*. Since neither of these would be beneficial in the landscaping of the development, the entire footprint of the site will be developed and the surrounding area is already mostly transformed it will not be possible to retain these on the site or transplant them to an adjacent area. Instead it is recommended that the necessary permits be obtained and these species removed from the site. A record of both species must be preserved in a local accredited herbarium and the remaining specimens donated to a conservation area such as the local botanical gardens. The longitudinal, indistinct channel occurring on the site (Map 1 & 2) is considered most likely artificial and a consequence of road building or storm water ditches. In the unlikely event that it is a remnant of a natural drainage line it does not form part of any watercourse or wetland system and therefore does not perform any significant function. It can therefore be incorporated into the development without having any significant impact on surrounding systems. However, the channel may still have some function in terms of storm water management and the development should design and incorporate an adequate storm water management system which feeds into the surrounding system.

## 4.2 Overview of terrestrial fauna (actual & possible)

The survey of the site clearly indicated that mammal activity is evidently quite low. This is most likely due to the isolation of the site from surrounding natural areas, the location of the site within small holdings which dissuades many mammals from inhabiting the area, the surrounding large roads and the degraded condition of the site. For these reasons it is also highly unlikely that any species of concern will occur on the site. It is also still likely that some mammal species may have been overlooked during the survey.

Excavated soil mounds of the Common Moleate (*Cryptomys hottentotus*) is common on the site. The species is well adapted to urban areas and the proposed development is not anticipated to impact significantly on this species.

Foraging excavations by Porcupine (*Hystrix africaeaustralis*) is rare on the site. The species is widespread and still common in peri-urban areas and is consequently not of significant conservation value. The proposed development is not anticipated to impact significantly on this species.

The impact that the proposed development will have is mainly concerned with the loss of habitat which will decrease the available habitat for faunal species. The faunal population will vacate the site into adjacent natural areas which will put a strain on surrounding populations. The current population is however already much diminished and an assemblage of generalist species adapted to peri-urban environments and the impact is anticipated to remain low.

It is considered likely that the site will also contain several other mammal species but these were not observed on the site and it is considered unlikely that a rare or endangered species would occur on the site.

In order to ensure no direct impact on the mammals on the site the hunting, capturing or trapping of mammals on the site should be strictly prohibited during the construction phase.

List of some Red Data terrestrial mammals that could occur in the region (Child *et al* 2016):

South African Hedgehog	<i>Atelerix frontalis</i>
Striped Weasel	<i>Poecilogale albinucha</i>
Small-Spotted Cat	<i>Felis nigripes</i>

It is considered unlikely that these species would occur on the site due to the degraded condition of the site and proximity of dwellings. However, the South African Hedgehog is known to occur in per-urban areas and is still likely to occur in this area.

## 5. ANTICIPATED IMPACTS

Anticipated impacts that the development will have is primarily concerned with the loss of habitat and species diversity.

The natural vegetation type, Bloemfontein Dry Grassland, occurring in this area is currently listed as being Vulnerable (VU) which gives a high conservation value to any remaining portions of this vegetation type still in a natural condition (Map 2). However, on-site survey has indicated that only remnant patches of the vegetation type still remain and are also degraded to a significant extent (Map 1). This is also affirmed by the Free State Biodiversity Management Plan which lists the site as being within the Degraded and Other categories and indicates that it is no longer considered to be of high conservation value (Map 3). Furthermore, the site is isolated from any surrounding natural areas and consequently it would not have any significant value should the vegetation on the site be conserved. As a result of the above, the loss of the vegetation and species diversity is only considered as moderate.

The site still contains a moderate species diversity with numerous geophytic species and two protected species still remain on the site namely, *Aloe jeppeae* and *Raphionacme hirsuta*. Both are uncommon with the former considered rare. They therefore still have a significant conservation value and their loss would entail a moderate-high impact. Adequate mitigation will therefore have to be implemented to decrease the impact. Since neither of these would be beneficial in the landscaping of the development, the entire footprint of the site will be developed and the surrounding area is already mostly transformed it will not be possible to retain these on the site or transplant them to an adjacent area. Instead it is recommended that the necessary permits be obtained and these species removed from the site. A record of both species must be preserved in a local accredited herbarium and the remaining specimens donated to a conservation area such as the local botanical gardens. Should this mitigation be implemented the impact should be decreased to moderate.

The site is devoid of watercourses or wetlands. However, a longitudinal, poorly defined channel is present which may be construed as a drainage line (Map 1 & 2). It is however considered most likely an artificial modification brought about by road building or storm water ditches. The vegetation along this channel does contain a few riparian species but is for the most part, dominated by terrestrial species indicating the absence of any significant waterflow. It does also not form part of a continuous watercourse and is therefore an isolated channel without any significant function. It can therefore be incorporated into the development without having any significant impact on surrounding systems. However, the channel may still have some function in terms of storm water management and the development should design and incorporate an adequate storm water management system which feeds into the surrounding system.

As was observed the site contains numerous exotic weeds with a few being considered problematic weeds and invasives (Appendix B). The proposed development may also increase disturbance and therefore increase the susceptibility for the establishment of weeds. Monitoring of weed establishment and eradication should form a prominent part of management of the development. Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.

The impact that the proposed development will have is mainly concerned with the loss of habitat which will decrease the available habitat for faunal species. The faunal population will

vacate the site into adjacent natural areas which will put a strain on surrounding populations. The current population is however already much diminished and an assemblage of generalist species adapted to peri-urban environments and the impact is anticipated to remain low. In order to ensure no direct impact on the mammals on the site the hunting, capturing or trapping of mammals on the site should be strictly prohibited during the construction phase.

The impact significance has been determined and it is clear that the impacts before mitigation will be moderate to low but the loss of protected species is considered moderate-high and a significant impact. With adequate mitigation all impacts can be reduced to low to moderate.

Please refer to Appendix C for the impact methodology.

**Significance of the impact:**

Impact	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
<b>Before Mitigation</b>								
Loss of vegetation type and clearing of vegetation	3	5	2	3.3	4	4	4	13.2
Loss of protected species	5	5	2	4	5	4	4.5	18
Impact on watercourses	1	2	2	1.6	2	2	2	3.2
Infestation with weeds and invaders	2	4	2	2.6	4	3	3.5	9.1
Impact on Terrestrial fauna	2	5	2	3	3	3	3	9
<b>After Mitigation</b>								
Loss of vegetation type and clearing of vegetation	3	5	2	3.3	4	4	4	13.2
Loss of protected species	3	5	2	3.3	4	3	3.5	11.5
Impact on watercourses	1	2	2	1.6	2	2	2	3.2
Infestation with weeds and invaders	2	2	1	1.6	3	2	2.5	4
Impact on Terrestrial fauna	2	5	2	3	3	3	3	9



## 6. SITE SPECIFIC RESULTS

### **Habitat diversity and species richness:**

Habitat diversity on the site consists mostly of remnant grassland patches and is consequently considered as relatively low. The artificial channel and thicket encroachment is considered modified and therefore not considered to increase the natural habitat diversity (Map 1). Despite the relatively low habitat diversity the species diversity is still considered moderate though somewhat lower than the natural condition.

### **Presence of rare and endangered species:**

The site does not contain any unique habitats or high species diversity but does still contain two protected geophytic species namely, *Aloe jeppeae* and *Raphionacme hirsuta*. Both are uncommon with the former considered rare. Since neither of these would be beneficial in the landscaping of the development, the entire footprint of the site will be developed and the surrounding area is already mostly transformed it will not be possible to retain these on the site or transplant them to an adjacent area. Instead it is recommended that the necessary permits be obtained and these species removed from the site. A record of both species must be preserved in a local accredited herbarium and the remaining specimens donated to a conservation area such as the local botanical gardens.

### **Ecological function:**

The ecological function of the site has been modified to a large degree. The site functions as habitat for fauna, sustains a specific vegetation type, i.e. Bloemfontein Dry Grassland and also forms part of the catchment of surrounding watercourses and wetlands (Map 1 & 2). The natural vegetation and vegetation type on the site has been modified to a significant degree and only remnant grassland patches remain. Consequently, the function as habitat is also degraded to some extent and the faunal population it sustains therefore also modified. Furthermore, the function of the site is not paramount to the continued functioning of the surrounding natural areas since it is largely isolated from any such areas. The site does not contain any natural watercourses or wetlands but still functions as part of the catchment of such surrounding systems. However, the surrounding roads and storm water ditches has largely modified the runoff patterns of the site. From the above it is clear that the ecological functioning has been altered significantly and is consequently considered as low.

### **Degree of rarity/conservation value:**

According to Mucina & Rutherford (2006) the area consists of Bloemfontein Dry Grassland (Gh 5). This vegetation type is currently listed as being Vulnerable (VU) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Map 2). It is currently subjected to severe pressure mostly as a result of agricultural crop cultivation. However, the vegetation on the site is considered to be largely transformed from the natural condition. Although, according to the List of Threatened terrestrial ecosystems (remaining extent) (SANBI 2011) a small portion of the site still consist of this vegetation type. The on-site survey has indicated that remnants of the vegetation type is indeed still present on the site, but is degraded and is not representative of this vegetation type. This is largely affirmed by the Free State Province Biodiversity Management Plan (2015) which regards the site to fall within the Degraded and Other categories and indicates that it is no longer considered to be of high conservation value (Map 3).

**Percentage ground cover:**

The percentage vegetation cover is moderate. Disturbance and a decrease in the grass cover is evident in many areas of the site.

**Vegetation structure:**

The vegetation structure has been modified to a significant degree. Naturally the site should consist exclusively of a grass layer without any significant shrubs or trees. However, currently the site only contains patches of grassland with tree/shrub thickets encroaching in large parts along the artificial channel and fringes of the site. Furthermore, the abundance of exotic weeds and trees also contribute to the vegetation structure modification.

**Infestation with exotic weeds and invader plants:**

Numerous exotic weeds and invasives are present and may form dense stands in some areas. Some of these are also considered as problematic invaders.

**Degree of grazing/browsing impact:**

The site is not currently being utilised for grazing by domestic stock. Although pioneer species indicative of overgrazing are abundant, i.e. pioneer grasses and herbaceous *Nidorella resedifolia*, they cannot conclusively be attributed to overgrazing.

**Signs of erosion:**

Signs of erosion are present as small gullies as well as some sheet erosion but has not yet become extensive.

**Terrestrial animals:**

The survey of the site clearly indicated that mammal activity is evidently quite low. This is most likely due to the isolation of the site from surrounding natural areas, the location of the site within small holdings which dissuades many mammals from inhabiting the area, the surrounding large roads and the degraded condition of the site. For these reasons it is also highly unlikely that any species of concern will occur on the site. It is considered likely that the site will also contain several other mammal species but these were not observed on the site and it is considered unlikely that a rare or endangered species would occur on the site.

Table 2: Biodiversity Sensitivity Rating for the proposed agricultural facility development.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness		2	
Presence of rare and endangered species		2	
Ecological function	3		
Uniqueness/conservation value	3		
Vegetation condition			
Percentage ground cover		2	
Vegetation structure	3		
Infestation with exotic weeds and invader plants or encroachers	3		
Degree of grazing/browsing impact			1
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species	3		
Sub total	15	8	1
Total		24	

## 7. BIODIVERSITY SENSITIVITY RATING (BSR) INTERPRETATION

Table 3: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
Outspan agricultural facility	24	Acceptable	3

## 8. DISCUSSION AND CONCLUSION

The proposed development has been rated as being acceptable for the development but is subject to adequate mitigation of protected species occurring on the site.

The proposed site will entail development of an agricultural associated sales and storage facility and will be situated on the Remainder of the Farm Outspan 1960 which is situated in the Bainsvlei Small Holdings along the western outskirts of Bloemfontein (Map 1). The site is bordered to the south by the R64 tarred road and to the north by small holdings. The approximate extent of the site is 15 hectares. Due to the location and surroundings the site consists of natural vegetation but which is significantly modified from the pristine condition. The site is also isolated from surrounding natural areas and its ecological functioning impaired to a significant degree.

According to Mucina & Rutherford (2006) the area consists of Bloemfontein Dry Grassland (Gh 5). This vegetation type is currently listed as being Vulnerable (VU) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Map 2). It is currently subjected to severe pressure mostly as a result of agricultural crop cultivation. However, the vegetation on the site is considered to be largely transformed from the natural condition. Although, according to the List of Threatened terrestrial ecosystems (remaining extent) (SANBI 2011) a small portion of the site still consist of this vegetation type. The on-site survey has indicated that remnants of the vegetation type is indeed still present on the site, but is degraded and is not representative of this vegetation type. This is largely affirmed by the Free State Province Biodiversity Management Plan (2015) which regards the site to fall within the Degraded and Other categories and indicates that it is no longer considered to be of high conservation value (Map 3).

The majority of the site still consists of indigenous vegetation but only remnants of the natural vegetation type remains (Map 1). This is most probably due to the small size of the site, its isolation from surrounding natural areas and previous land use of the site. The site does not contain any buildings or structures. However, it has a slim longitudinal shape and is bordered to the south by the R64 tarred road and to the north by the Van Vuuren gravel road. Both of these have a significant impact on the site as a result of the edge-effect which includes storm water ditches, rubbish dumping, spread of exotic weeds and invaders which, coupled with the slim shape of the site, contributes to significant degradation of the site. The site also contains a longitudinal disturbance from north west to south east and resembles a channel or watercourse (Map 1 & 2). It is however most likely associated with an old road or historical storm water ditches but the likelihood that it is a remnant of a natural drainage line cannot be discounted.

From the survey of the site it is clear that it is devoid of watercourses or wetlands. However, a longitudinal, poorly defined channel is present which may be construed as a drainage line (Map 1 & 2). It is however considered most likely an artificial modification brought about by road building or storm water ditches. The vegetation along this channel does contain a few riparian species but is for the most part, dominated by terrestrial species. It does also not form part of a continuous watercourse and is therefore an isolated channel without any significant function. At the south eastern border of the site at the Kenilworth Road a culvert occurs which feeds into the storm water channels adjacent to the R64 road and any storm water contained within the channel on the site is most likely to feed into this storm water system. The channel identified on the site is therefore considered as artificial, does not form part of any surrounding watercourse or wetland and therefore does not have any significant function. It can therefore be

incorporated into the development without having any significant impact on surrounding systems. However, the channel may still have some function in terms of storm water management and the development should design and incorporate an adequate storm water management system which feeds into the surrounding system.

The site still contains a moderate species diversity with numerous geophytic species and two protected species still remain on the site namely, *Aloe jeppeae* and *Raphionacme hirsuta*. Both are uncommon with the former considered rare. They therefore still have a significant conservation value and their loss would entail a moderate-high impact. Adequate mitigation will therefore have to be implemented to decrease the impact. Since neither of these would be beneficial in the landscaping of the development, the entire footprint of the site will be developed and the surrounding area is already mostly transformed it will not be possible to retain these on the site or transplant them to an adjacent area. Instead it is recommended that the necessary permits be obtained and these species removed from the site. A record of both species must be preserved in a local accredited herbarium and the remaining specimens donated to a conservation area such as the local botanical gardens. Should this mitigation be implemented the impact should be decreased to moderate.

As was observed the site contains numerous exotic weeds with a few being considered problematic weeds and invasives (Appendix B). The proposed development may also increase disturbance and therefore increase the susceptibility for the establishment of weeds. Monitoring of weed establishment and eradication should form a prominent part of management of the development. Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.

In conclusion, the natural vegetation type, Bloemfontein Dry Grassland, occurring in this area is currently listed as being Vulnerable (VU) which gives a high conservation value to any remaining portions of this vegetation type still in a natural condition (Map 2). However, on-site survey has indicated that only remnant patches of the vegetation type still remain and are also degraded to a significant extent (Map 1). This is also affirmed by the Free State Biodiversity Management Plan which lists the site as being within the Degraded and Other categories and indicates that it is no longer considered to be of high conservation value (Map 3). Furthermore, the site is isolated from any surrounding natural areas and consequently it would not have any significant value should the vegetation on the site be conserved. The site does not contain any unique habitats or high species diversity but does still contain two protected geophytic species namely, *Aloe jeppeae* and *Raphionacme hirsuta*. Since neither of these would be beneficial in the landscaping of the development, the entire footprint of the site will be developed and the surrounding area is already mostly transformed it will not be possible to retain these on the site or transplant them to an adjacent area. Instead it is recommended that the necessary permits be obtained and these species removed from the site. A record of both species must be preserved in a local accredited herbarium and the remaining specimens donated to a conservation area such as the local botanical gardens. The longitudinal, indistinct channel occurring on the site (Map 1 & 2) is considered most likely artificial and a consequence of road building or storm water ditches. In the unlikely event that it is a remnant of a natural drainage line it does not form part of any watercourse or wetland system and therefore does not perform any significant function. It can therefore be incorporated into the development without having any significant impact on surrounding systems. However, the channel may still have some function in terms of storm water management and the development should design and incorporate an adequate storm water system which feeds into the surrounding system.

## 9. RECOMMENDATIONS

- Two protected plant species occur on the site namely, *Aloe jeppeae* and *Raphionacme hirsuta* (Appendix B):
  - It is recommended that the necessary permits be obtained and these species removed from the site.
  - A record of both species must be preserved in a local accredited herbarium and the remaining specimens donated to a conservation area such as the local botanical gardens.
  - A walkthrough survey of the site should be conducted prior to construction. This should include identification and marking of all protected plants on the site and should be performed by an ecologist or botanist.
- The artificial channel on the site (Map 1 & 2) may still have some function in terms of storm water management and the development should design and incorporate an adequate storm water management system which feeds into the surrounding system.
- The hunting, capturing or trapping of fauna, including mammals, reptiles, birds and amphibians, on the site should be strictly prohibited during construction.
- Adequate monitoring of weed establishment and their continued eradication must be maintained (Appendix B). Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.
- After construction has ceased all construction waste should be removed from the area.
- Monitoring of construction including weed establishment and erosion should take place.

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## **Annexure A: Maps and Site photos**

# Layout map of a proposed development on the Remainder of the Farm Outspan 1960 in the Bainsvlei Small Holdings, Bloemfontein, Free State Province.



Map 1: Layout map of the proposed development on the Farm Outspan 1960 in the Bainsvlei Small Holdings. The grassland vegetation on the site is clearly being encroached by a shrub/tree thicket. Note also transformation of the surrounding areas by small holdings and historical ploughing (south of site). The artificial channel on the site is also indicated.



## Prepared for:

Turn 180 Environmental Consultants  
Suite 221, Private Bag X01  
Brandhof  
9324

## Legend:

- Property boundaries
- Site location
- Road network
- Watercourses
- Wetlands and impoundments

## Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:15 000

DPR Ecologists

Contact Darius van Rensburg at:

darius@dprecologists.co.za

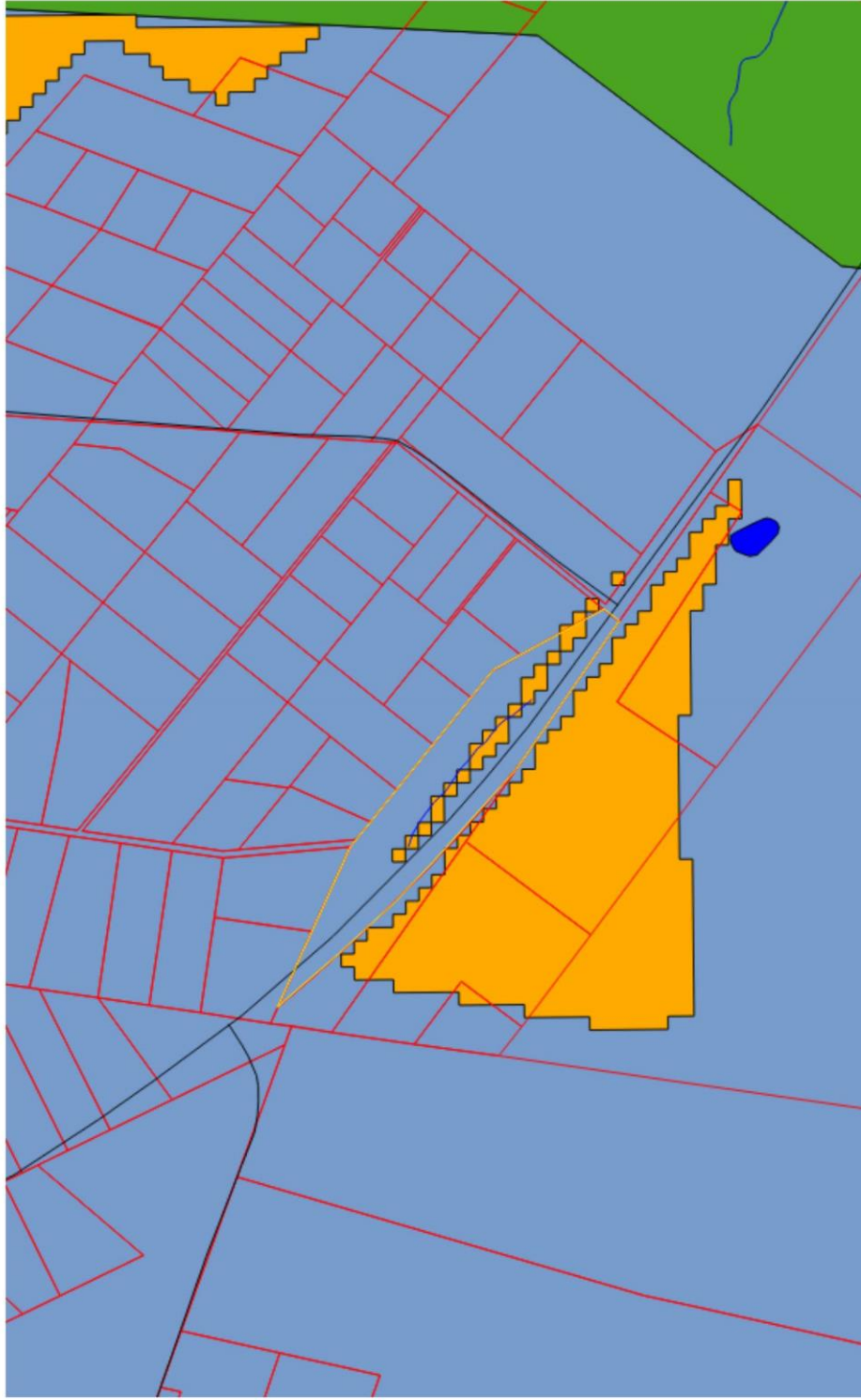
P.O. Box 12726, Brandhof, 9324

Tel: 083 410 0770





**General ecology map of a proposed development on the Remainder of the Farm Outspan 1960 in the Bainsvlei Small Holdings, Bloemfontein, Free State Province.**



Map 2: General ecology map of the proposed development on the Farm Outspan 1960 in the Bainsvlei Small Holdings. Note that the area consists of Bloemfontein Dry Grassland, a listed Threatened Ecosystem. However, the site only contains remnant patches of the vegetation. The remaining portion to the south is also clearly transformed (See Map 1). The artificial channel on the site is also indicated.



**Prepared for:**

Turn 180 Environmental Consultants  
Suite 221, Private Bag X01  
Brandhof  
9324

**Legend:**

- Property boundaries
- Site location
- Road network
- Watercourses
- Wetlands and impoundments
- Threatened Ecosystems
- Bloemfontein Dry Grassland
- Winburg Grassy Shrubland

**Map Information**

**Spheroid:** WGS 84

Quantum GIS

**Scale:** 1:15 000

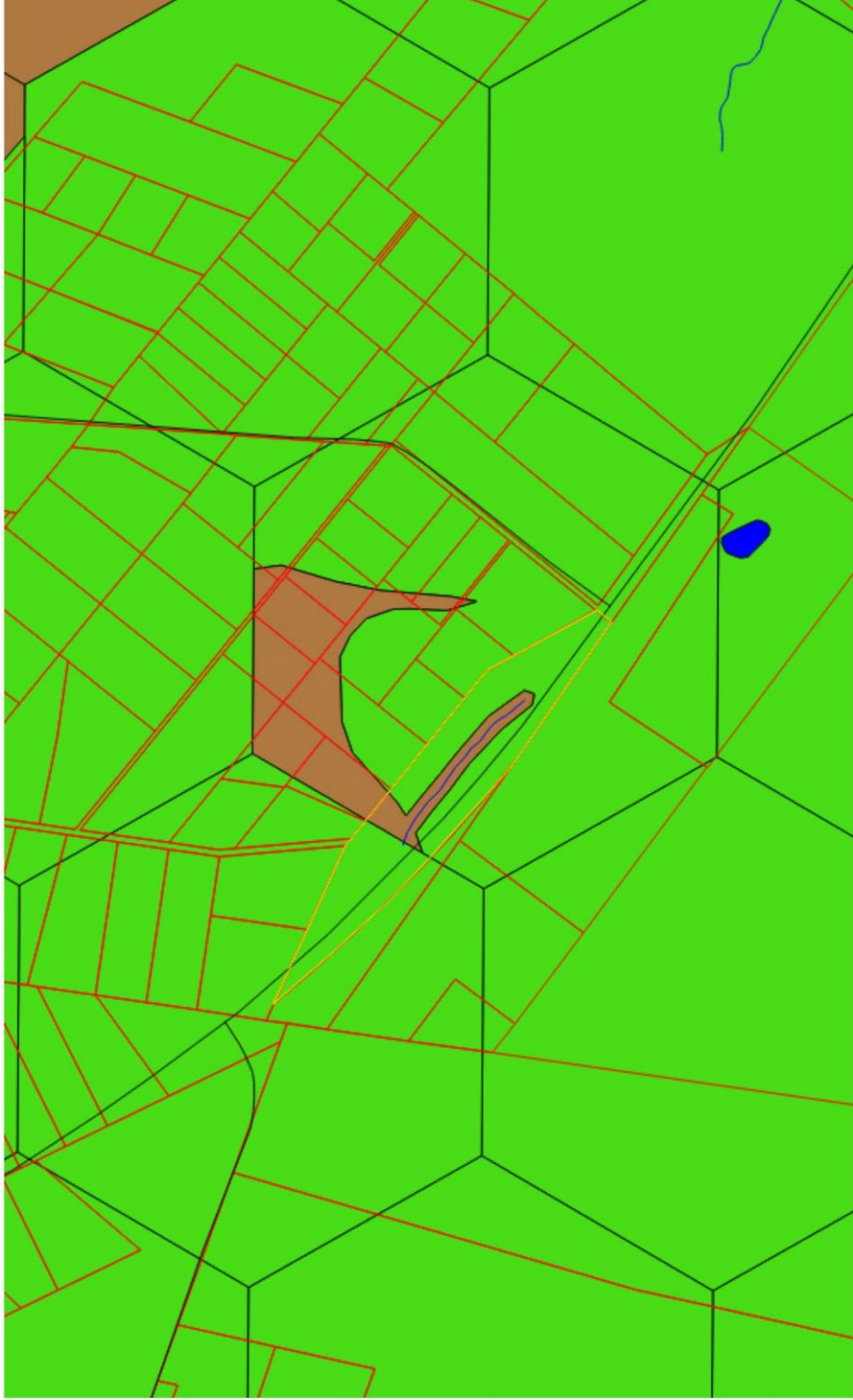
DPR Ecologists

**Contact Darius van Rensburg at:**

darius@dprecologists.co.za  
P.O. Box 12726, Brandhof, 9324  
Tel: 083 410 0770



**Free State Biodiversity Plan map of a proposed development on the Remainder of the Farm Outspan 1960 in the Bainsvlei Small Holdings, Bloemfontein, Free State Province.**



Map 3: Biodiversity plan map of the proposed development on the Farm Outspan 1960 in the Bainsvlei Small Holdings. The site is situated in a Degraded and Other categories.



**Prepared for:**

Turn 180 Environmental Consultants  
Suite 221, Private Bag X01  
Brandhof  
9324

**Legend:**

- Property boundaries
- Site location
- Road network
- Watercourses
- Wetlands and impoundments
- Critical Biodiversity Area 1
- Critical Biodiversity Area 2
- Ecological Support Area 1
- Ecological Support Area 2
- Degraded
- Other

**Map Information**

**Spheroid:** WGS 84

Quantum GIS

**Scale:** 1:15 000

DPR Ecologists

**Contact Darius van Rensburg at:**

darius@dprecologists.co.za

P.O. Box 12726, Brandhof, 9324

Tel: 083 410 0770







Figure 1: Encroachment by a shrub/tree thicket is common on the site and is a consequence of past and present disturbance which promotes the establishment of trees and shrubs.



Figure 2: The natural grassland remain as remnants on the site with encroachment by thicket clearly visible.



Figure 3: Another view of remnant grassland patch on the site.





Figure 4: The longitudinal channel (blue) on the site is quite indistinct and most likely artificial in origin.

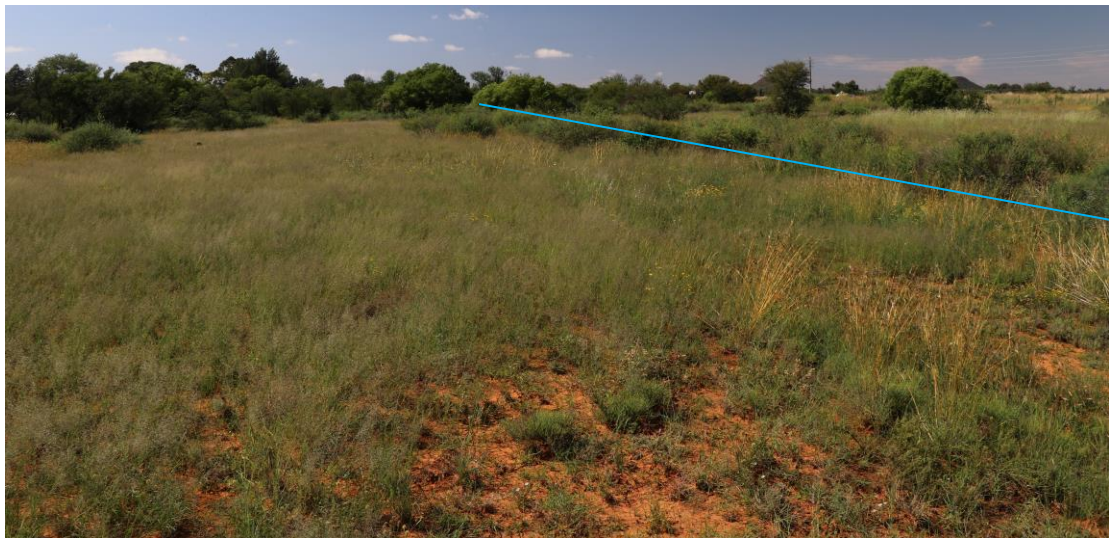


Figure 5: Another view of the longitudinal channel on the site (blue).



Figure 6: A view of the longitudinal channel (blue). Note dense tree/shrub thicket associated with it.





Figure 7: Rubbish dumping is evident in several areas.



Figure 8: Disturbance is especially evident along the border of the site.



Figure 9: Signs of mammals are rare on the site and was limited to soil mounds of the Common Molerat (*Cryptomys hottentotus*) (left) and foraging excavations by Porcupine (*Hystrix africaeaustralis*) (right).





Figure 10: Protected plant species occurring on the site include; top row, *Aloe jeppeae* and bottom row, *Raphionacme hirsuta*.



## Appendix B: Species list

Species indicated with an \* are exotic.

Protected species are coloured orange and Red Listed species red.

Species	Growth form
* <i>Alternanthera pungens</i>	Herb
* <i>Cestrum laevigatum</i>	Shrub
* <i>Echinopsis schikendantzii</i>	Succulent
* <i>Opuntia ficus-indica</i>	Succulent
* <i>Portulacca oleracea</i>	Succulent
* <i>Schinus molle</i>	Tree
* <i>Sphaeralcea bonariensis</i>	Herb
* <i>Verbena tenuisecta</i>	Herb
<i>Albuca cooperi</i>	Geophyte
<i>Aloe jeppeae</i>	Succulent
<i>Alternanthera sessilis</i>	Herb
<i>Aristida congesta</i>	Grass
<i>Asparagus larcinus</i>	Shrub
<i>Atriplex semibaccatta</i>	Herb
<i>Buddleja saligna</i>	Tree
<i>Bulbine narcissifolia</i>	Geophyte
<i>Chloris virgata</i>	Grass
<i>Commelina africana</i>	Herb
<i>Crabbea acaulis</i>	Herb
<i>Cynodon dactylon</i>	Grass
<i>Digitaria eriantha</i>	Grass
<i>Dimorphotheca zeyheri</i>	Herb
<i>Dipcadi ciliare</i>	Geophyte
<i>Dipcadi viride</i>	Geophyte
<i>Ehretia rigida</i>	Shrub
<i>Enneapogon cenchroides</i>	Grass
<i>Eragrostis curvula</i>	Grass
<i>Eragrostis lehmanniana</i>	Grass
<i>Eragrostis superb</i>	Grass
<i>Eriospermum porphyrium</i>	Geophyte
<i>Hermannia comosa</i>	Herb
<i>Hibiscus pusillus</i>	Herb
<i>Hypoxis hemerocallidae</i>	Geophyte
<i>Ipomoea oblongata</i>	Creeper
<i>Ledebouria luteola</i>	Geophyte
<i>Limeum aethiopicum</i>	Herb
<i>Lycium horridum</i>	Dwarf shrub
<i>Massonia ngustifolia</i>	Herb
<i>Menodora africana</i>	Herb
<i>Nidorella resedifolia</i>	Herb

<i>Nolletia ciliaris</i>	Dwarf shrub
<i>Osteospermum scariosum</i>	Herb
<i>Panicum coloratum</i>	Grass
<i>Raphionacme hirsutum</i>	Geophyte
<i>Rosenia humilis</i>	Dwarf shrub
<i>Ruschia hamata</i>	Dwarf shrub
<i>Searsia lancea</i>	Tree
<i>Selago densiflora</i>	Herb
<i>Setaria verticillata</i>	Grass
<i>Solanum supinum</i>	Herb
<i>Talinum cafferum</i>	Geophyte
<i>Teucrium trifidum</i>	Herb
<i>Themeda triandra</i>	Grass
<i>Trachyandra saltii</i>	Geophyte
<i>Tragus koelerioides</i>	Grass
<i>Tribulus terrestris</i>	Herb
<i>Urochloa panicoides</i>	Grass
<i>Vachellia karroo</i>	Tree
<i>Ziziphus mucronata</i>	Tree

## Appendix C: Impact methodology

The environmental significance assessment methodology is based on the following determination:

Environmental Significance = Overall Consequence x Overall Likelihood

### Determination of Consequence

Consequence analysis is a mixture of quantitative and qualitative information and the outcome can be positive or negative. Several factors can be used to determine consequence. For the purpose of determining the environmental significance in terms of consequence, the following factors were chosen: **Severity/Intensity, Duration and Extent/Spatial Scale**. Each factor is assigned a rating of 1 to 5, as described below and in tables 6, 7, 9 and 10.

### Determination of Severity

Severity relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects impact on the biophysical and socio-economic environment.

Table 7 will be used to obtain an overall rating for severity, taking into consideration the various criteria.

Table 7: Rating of severity

Type of criteria	Rating				
	1	2	3	4	5
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small Potentially harmful	Significant / Harmful	Great / Very harmful	Disastrous Extremely harmful
Social/ Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable/ Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Irreversibility	Very low cost to mitigate/ High potential to mitigate impacts to level of insignificance / Easily reversible	Low cost to mitigate	Substantial cost to mitigate / Potential to mitigate impacts / Potential to reverse impact	High cost to mitigate	Prohibitive cost to mitigate / Little or no mechanism to mitigate impact Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Moderate change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

### Determination of Duration

Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place.

Table 8: Rating of Duration

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

### Determination of Extent/Spatial Scale

Extent refer to the spatial influence of an impact be local (extending only as far as the activity, or will be limited to the site and its immediate surroundings), regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders).

Table 9: Rating of Extent / Spatial Scale

Rating	Description
1: Low	Immediate, fully contained area
2: Low-Medium	Surrounding area
3: Medium	Within Business Unit area of responsibility
4: Medium-High	Within Mining Boundary area
5: High	Regional, National, International

### Determination of Overall Consequence

Overall consequence is determined by adding the factors determined above and summarised below, and then dividing the sum by 4.

Table 10: Example of calculating Overall Consequence

Consequence	Rating
Severity	Example 4
Duration	Example 2
Extent	Example 4
SUBTOTAL	10
TOTAL CONSEQUENCE:(Subtotal divided by 4)	3.3

### Likelihood

The determination of likelihood is a combination of Frequency and Probability. Each factor is assigned a rating of 1 to 5, as described below and in Table 11 and Table 12.

### Determination of Frequency

Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken.

Table 11: Rating of frequency

Rating	Description
1: Low	Once a year or once/more during operation/LOM
2: Low-Medium	Once/more in 6 Months
3: Medium	Once/more a Month
4: Medium-High	Once/more a Week
5: High	Daily

### Determination of Probability

Probability refers to how often the activity/event or aspect has an impact on the environment.

Table 12: Rating of probability

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

### Overall Likelihood

Overall likelihood is calculated by adding the factors determined above and summarised below, and then dividing the sum by 2.

Table 13: Example of calculating the overall likelihood

Consequence	Rating
Frequency	Example 4
Probability	Example 2
SUBTOTAL	6
TOTAL LIKELIHOOD (Subtotal divided by 2)	3

### Determination of Overall Environmental Significance

The multiplication of overall consequence with overall likelihood will provide the environmental significance, which is a number that will then fall into a range of LOW, LOW-MEDIUM, MEDIUM, MEDIUM, MEDIUM-HIGH or HIGH, as shown in the table below.

Table 14: Determination of overall environmental significance

Significance or Risk	Low	Low-Moderate	Moderate	Moderate-High	High
Overall Consequence X Overall Likelihood	1 - 4.9	5 - 9.9	10 - 14.9	15 - 19.9	20 - 25

### Qualitative description or magnitude of Environmental Significance

This description is qualitative and is an indication of the nature or magnitude of the Environmental Significance. It also guides the prioritisations and decision making process associated with this event, aspect or impact.

Table 15: Description of the environmental significance and the related action required.

Significance	Low	Low-Moderate	Moderate	Moderate-High	High
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect. Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to the company	Impact is real and substantial in relation to other impacts. Pose a risk to the company. Unacceptable	Impact is of the highest order possible. Unacceptable. Fatal flaw.
Action Required	Maintain current management measures. Where possible improve.	Maintain current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible improve	Implement monitoring. Investigate mitigation measures and improve management measures to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.