

# APPENDIX D<sub>2</sub>

Ecological Report

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## Report on the floristic and ecological assessment of the proposed Waste Water Treatment Works (WWTW) near the settlement of Ganspan, Jan Kempdorp, Northern Cape Province.

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## **Vegetation and ecological assessment.**

### **1. Introduction**

#### **1.1 Background**

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

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 can be regarded as a country with a dry climate and it can be said that we inhabit a water scarce area. Thus, it should be clear that we need to protect our water resources so that we may be able to utilise this renewable resource sustainably. Areas that are regarded as crucial to maintain healthy water resources include wetlands, streams as well as the overall catchment of a river system. Any development that would degrade such a system must not be allowed to continue.

Through our usage of our water resources for our daily needs we are also degrading the quality of our water resources. Thus, it is vital to improve the quality of the water effluent before it is returned to our water-ways. Therefore, it is necessary to construct sewage plants at strategic locations to treat the waste water generated in residential and industrial areas on a daily basis.

Developments around towns are necessary to sufficiently accommodate and provide services to the ever-growing population. Areas along the boundaries of built up areas 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 new Waste Water Treatment Works (WWTW) will be situated to the south east of the settlement of Ganspan near the town of Jan Kempdorpe. The site is situated on a low hill and the area consists primarily of natural vegetation although cultivated fields occur to the east of the site. The coordinates for the site is S 27.979442°, E 24.770777° (Map 1).

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

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

A site assessment was conducted on 11 November 2016.

## 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 WWTW development.
- To identify possible negative impacts that could be caused by the proposed construction of a WWTW.

### **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**

The recent drought has caused a low vegetation cover and many species, especially grass, herb and bulbous, were not identifiable.

The area is subjected to high levels of overgrazing which prevents the identification of many grass species.

Several bulb species commence growth and flowering later in the season and may have been overlooked.

Some animal species may not have been observed as a result of their nocturnal and/or shy habits.

### **3. Methodology**

#### **3.1 Several literature works were used for additional information.**

Vegetation:

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

Vegetation types (Mucina & Rutherford 2006)

Field guides used for species identification (Adams 1976, Bromilow 1995, 2010, Coates-Palgrave 2002, Court 2010, Manning 2009, Roberts & Fourie 1975, Shearing & Van Heerden 2008, Smith & Crouch 2009, Smith & Van Wyk 2003, Van Oudtshoorn 2004, Van Wyk & Van Wyk 1997,)

Terrestrial fauna:

Field guides for species identification (Smithers 1986a).

#### **3.2 Survey**

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

Noted species include rare and dominant species.

The broad vegetation types present on the site were determined.

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

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

The state of the habitat was also assessed.

#### **3.3 Criteria used to assess sites**

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

##### **Vegetation characteristics**

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

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

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

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

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

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

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

Degree of rarity/conservation value:

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

### **Vegetation condition**

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

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

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

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

Scoring: All layers still intact and showing specimens of all age classes – 1, Sub-shrubs and/or grass layers highly grazed while tree layer still fairly intact (bush partly opened up) – 2, Mono-layered structure often dominated by a few unpalatable species (presence of barren patches notable) – 3.

Infestation with exotic weeds and invader plants or encroachers:

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

Degree of grazing/browsing impact:

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

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

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

### **Faunal characteristics**

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

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



### 3.4 Biodiversity sensitivity rating (BSR)

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

Table 1: Biodiversity sensitivity ranking

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

## 4. Ecological overview of the site

### 4.1 Overview of ecology and vegetation types

The vegetation in the area consists of Kimberley Thornveld (SVk 4). The vegetation type is currently listed as being of Least Concern under the National List of Threatened Ecosystems (Notice 1477 of 2009)(National Environmental Management Biodiversity Act, 2004) (Map 2). The vegetation type is not currently subjected to any pronounced development pressures. Landscape features of this vegetation type are dominated by plains with a well developed tree layer and low percentage vegetation cover (Mucina & Ruterford 2006).

The topography of the site consists of a low hill with a moderate slope to the surrounding plains areas. A small water treatment facility is also located on top of the low hill. A drainage area is located to the south of the hill and dense woodland areas to the east (Map 1). Agricultural small holdings and crop fields are also situated to the north east and west of the site. The soils are shallow with a high percentage rock. Soils surrounding the low hill is much deeper and sandy enabling the establishment of tall trees. The vegetation on the site consists of short grassland with scattered shrubs. The species composition is still considered as largely natural although overgrazing has altered the vegetation structure to some degree. The site will be situated on top of the low hill with a portion along the slope of the hill and the adjacent plain area.

A large drainage area occurs to the south of the hill (Map 1). This area also contains earthen berms which act as an artificial impoundment (Map 2). Water drains from this impoundment in a north eastern direction. The drainage area does not form a distinct channel and drains in a diffuse surface pattern. The drainage area itself is dominated by the sedge, *Scirpoides dioecus*. A few exotic tree species has also established in this drainage area. These area *Eucalyptus camaldulensis* (Bluegum) and *Melia azedarach* (Syringa). Other scattered shrubs include *Lycium hirsutum*, *Searsia lancea*, *Asparagus suaveolens* and *Ziziphus zeyheriana*. This drainage area has been transformed by the earthen berms causing an alteration to the flow regime of the area. However, it still remains sensitive and construction of WWTW in this area should be avoided. The construction of the WWTW on top of the low hill is however unlikely to affect this system.

A dense woodland vegetation occurs to the east of the site (Map 1). It is dominated by large specimens of *Vachellia erioloba* (Camel Thorn) and *Vachellia tortilis* (Umbrella Thorn). *V. erioloba* is a protected species and is also listed as a Declining species in the National Red List (Appendix B). As a result these large specimens are of conservation significance. They cannot be transplanted and construction in this area will require their removal. The site proposed for the WWTW will however be situated on top of the low hill and will not require the removal of any large specimens. It is still likely that small specimens occur on the site and for these permits will have to be obtained to remove them.

The top of the hill consists of shallow soils and vegetation consisting of a short grass layer with scattered shrubs and small trees. Grass species were not easily identifiable due to overgrazing and the drought at the time of the site visit. Two identifiable species consist of *Aristida congesta* and *Eragrostis lehmanniana*. The low suffrutex, *Elephantorrhiza elephantina*, is common on the hill. Shrubs are dominated by *Tarchonanthus camphoratus* and other shrubs and trees include *Grewia flava*, *Vachellia tortilis* and *V. erioloba*. As mentioned previously *V. erioloba* is a protected species and where specimens will be affected by construction permits must be obtained to remove them (Appendix B). The site however, excludes the portion of large Camel

Thorn trees and therefore the number of specimens and size of those which will be affected will be low. Several small succulents and herbs occur on top of the hill. These include *Crassula capitella*, *Aloe grandidentata*, *Anancampseros filamentosa*, *Pellaea calomelanos* and *Portulaca kermesina*. Of these species the succulents *C. capitella*, *A. grandidentata* and *A. filamentosa* are listed as protected species in the Northern Cape Province (Appendix B). They are all relatively widespread and common and therefore not of high conservation significance. However, they are protected and transplant easily and permits can be obtained to transplant them to areas adjacent to the site.

The site is situated adjacent to the agricultural small holdings of Ganspan and the land use on the site is primarily associated with these agricultural areas (Map 1). As a result the site is subjected to significant levels of overgrazing. This is notable in the grazing of grasses on the site and the stunting of shrubs. Several indicators of overgrazing are also abundant. These include the proliferation of species such as *T. camphoratus*, *V. tortilis* and *E. elephantina*. This impact leads to some degradation of the vegetation layer. Observations on the site were also likely exacerbated by the current drought which has further decreased the percentage vegetation cover. The cutting of trees on the site for use as firewood is also common and likely to have a significant impact. Large stumps and resprouting stumps are common on the site and indicate significant tree cutting occurring.

The site does not contain a significant weed infestation but this is likely to increase after recent rains in the area, annual weeds being dormant at the time of the site visit.

In conclusion, the drainage area to the south of the site is transformed to a large degree but should still be considered as sensitive. This area is excluded from the development and is therefore unlikely to be affected by the proposed WWTW (Map 1). The woodland area to the east of the site contains dense and large stands of the protected Camel Thorn (*V. erioloba*) and is therefore considered as undesirable for the development as impacts on these trees will be high. This area is however also excluded from the development (Map 1). The hilltop, slope and plain portion which is proposed for the site does not contain such sensitive landscape elements as discussed above, the diversity of habitat and species are not significant and is not considered to have a high conservation value. The site does however still contain several protected species which although they are widespread still retain a conservation value and the required mitigation should be implemented as discussed above (Appendix B).

#### **4.2 Overview of terrestrial mammals (actual & possible)**

The site is still largely natural but has been degraded to some extent by overgrazing and cutting of trees for firewood. The site is also located close to agricultural activities and relatively isolated from other large natural areas. As a result it is not anticipated to contain a large and varied faunal population. Despite this several mammals are still anticipated to inhabit the area. Small foraging excavation were observed on the site made by a small mammal of which the species could not be determined. This also confirms that small mammals still inhabit the site.

The most prominent impact that the development will have on the faunal population is the transformation of habitat. The extent of the WWTW is however not large and impact is anticipated to remain moderate.

Furthermore, as long as the hunting, trapping and capturing is prevented and strictly controlled the impact on the faunal population will not be high.

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

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

It is considered unlikely that any these species would occur in the vicinity but the possibility cannot be discounted.

## 5. Site specific results

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

Habitat diversity on the site is considered moderate. The site contains the plateau of a low hill, eastern slope and portion of the plain. Despite this the species diversity is relatively low. This may however been skewed by the recent drought.

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

The Camel Thorn tree (*Vachellia erioloba*) is abundant in the woodland portion to the east of the site (Map 1). However, small specimens also occur on the site. This species is protected and listed as being Declining in the National Red List. Small specimens occurring on the site will still require permits to remove them (Appendix B). Furthermore, several small succulents on the site, *Crassula capitella*, *Aloe grandidentata* and *Anacampseros filamentosa*, are listed as protected and although widespread they transplant easily and permits should be obtained to transplant them to an adjacent area (Appendix B).

### **Ecological function:**

The ecological function remains largely natural although somewhat isolated from surrounding natural areas due to the extensive agricultural activities in the surrounding area.

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

The vegetation in the area consists of Kimberley Thornveld (SVk 4). The vegetation type is currently listed as being of Least Concern under the National List of Threatened Ecosystems (Notice 1477 of 2009)(National Environmental Management Biodiversity Act, 2004) (Map 2). The vegetation type is not currently subjected to any pronounced development pressures (Mucina & Ruterford 2006).

A rough estimate of the percentage of vegetation condition on the site consist of roughly 50% near natural and 50% degraded vegetation in comparison to natural vegetation of the region in pristine condition with no impacts.

The drainage area and Camel Thorn woodland adjacent to the site have high conservation values (Map 1). These are however excluded from the development footprint. The site itself is still largely natural but has been somewhat degraded by land use. The site do not contain any elements of significant conservation value.

### **Percentage ground cover:**

The percentage ground cover is exceptionally low over the majority of the site. This is largely due to high levels of overgrazing as well as the current drought.

### **Vegetation structure:**

The vegetation structure is still largely natural but has been transformed to a low degree by overgrazing and cutting of trees for firewood.

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

The site does not contain a significant weed infestation although two exotic tree species occur in the drainage area to the south of the site. The site also does not contain a significant weed infestation but this is likely to increase after recent rains in the area, annual weeds being dormant at the time of the site visit.

**Degree of grazing/browsing impact:**

Overgrazing of the site by domestic stock is high.

**Signs of erosion:**

Erosion is considered as moderate.

**Terrestrial animals:**

The site is still largely natural but has been degraded to some extent by overgrazing and cutting of trees for firewood. The site is also located close to agricultural activities and relatively isolated from other large natural areas. As a result it is not anticipated to contain a large and varied faunal population. Despite this several mammals are still anticipated to inhabit the area. Small foraging excavation were observed on the site made by a small mammal of which the species could not be determined. This also confirms that small mammals still inhabit the site. It is considered unlikely that any species of conservation significance would occur in the vicinity but the possibility cannot be discounted.

Table 2: Biodiversity Sensitivity Rating for the proposed WWTW.

	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		2	
Degree of grazing/browsing impact	3		
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species		2	
Sub total	9	14	
Total		23	

**6. Biodiversity sensitivity rating (BSR) interpretation**

Table 3: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
Ganspan WWTW	23	Acceptable	3

## 7. Discussion and conclusions

The site proposed for the Waste Water Treatment Works (WWTW) has been rated as being acceptable for the development.

The vegetation in the area consists of Kimberley Thornveld (SVk 4). The vegetation type is currently listed as being of Least Concern under the National List of Threatened Ecosystems (Notice 1477 of 2009)(National Environmental Management Biodiversity Act, 2004) (Map 2). The vegetation type is not currently subjected to any pronounced development pressures.

The topography of the site consists of a low hill with a moderate slope to the surrounding plains areas. A small water treatment facility is also located on top of the low hill. A drainage area is located to the south of the hill and dense woodland areas to the east (Map 1). Agricultural small holdings and crop fields are also situated to the north east and west of the site. The vegetation on the site consists of short grassland with scattered shrubs. The species composition is still considered as largely natural although overgrazing has altered the vegetation structure to some degree. The site will be situated on top of the low hill with a portion along the slope of the hill and the adjacent plain area.

A large drainage area occurs to the south of the hill (Map 1) This area also contains earthen berms which act as an artificial impoundment (Map 2). Water drains from this impoundment in a north eastern direction. The drainage area does not form a distinct channel and drains in a diffuse surface pattern. This drainage area has been transformed by the earthen berms causing an alteration to the flow regime of the area. However, it still remains sensitive and construction of WWTW in this area should be avoided. The construction of the WWTW on top of the low hill is however unlikely to affect this system.

A dense woodland vegetation occurs to the east of the site (Map 1). It is dominated by large specimens of *Vachellia erioloba* (Camel Thorn) and *Vachellia tortilis* (Umbrella Thorn). *V. erioloba* is a protected species and is also listed as a Declining species in the National Red List. As a result these large specimens are of conservation significance. The site proposed for the WWTW will however be situated on top of the low hill and will not require the removal of any large specimens. It is still likely that small specimens occur on the site and for these permits will have to be obtained to remove them (Appendix B).

The top of the hill consists of shallow soils and vegetation consisting of a short grass layer with scattered shrubs and small trees. Grass species were not easily identifiable due to overgrazing and the drought at the time of the site visit. As mentioned previously *V. erioloba* is a protected species and where specimens will be affected by construction permits must be obtained to remove them (Appendix B). Several small succulents and herbs occur on top of the hill. Of these species the succulents *Crassula capitella*, *Aloe grandidentata* and *Anacampseros filamentosa* are listed as protected species in the Northern Cape Province. They are all relatively widespread and common and therefore not of high conservation significance. However, they are protected and transplant easily and permits can be obtained to transplant them to areas adjacent to the site (Appendix B).

The site is situated adjacent to the agricultural small holdings of Ganspan and the land use on the site is primarily associated with these agricultural areas (Map 1). As a result the site is subjected to significant levels of overgrazing. This is notable in the grazing of grasses on the site and the stunting of shrubs. Several indicators of overgrazing are also abundant. This

impact leads to some degradation of the vegetation layer. Observations on the site were also likely exacerbated by the current drought which has further decreased the percentage vegetation cover. The cutting of trees on the site for use as firewood is also common and likely to have a significant impact. Large stumps and resprouting stumps are common on the site and indicate significant tree cutting occurring.

In conclusion, the drainage area to the south of the site is transformed to a large degree but should still be considered as sensitive. This area is excluded from the development and is therefore unlikely to be affected by the proposed WWTW (Map 1). The woodland area to the east of the site contains dense and large stands of the protected Camel Thorn (*V. erioloba*) and is therefore considered as undesirable for the development as impacts on these trees will be high. This area is however also excluded from the development (Map 1). The hilltop, slope and plain portion which is proposed for the site does not contain such sensitive landscape elements as discussed above, the diversity of habitat and species are not significant and is not considered to have a high conservation value. The site does however still contain several protected species which although they are widespread still retain a conservation value and the required mitigation should be implemented as discussed above (Appendix B).



## 8. Recommendations

- Weed eradication on the site must be done prior to construction and must be maintained after construction has ceased.
- All compacted areas must be ripped following construction. This must include compacted paths.
- After construction has ceased all construction materials should be removed from the area and no dumping of rubble or waste may occur on or around the site.
- No hunting, harming, capturing or trapping must be allowed and this must be strictly prohibited.
- In the event of poisonous snakes or other dangerous animals encountered on the site an experienced and certified snake handler or zoologist must remove these animals from the site and re-locate them to a suitable area.
- Monitoring of construction and compliance with recommended mitigation measures must take place.
- The drainage area to the south of the site and the woodland to the east of the site must be considered no-go areas and no activities should be permitted in these areas (Map 1).
- Small specimens of the protected and Red Listed Camel Thorn (*Vachellia erioloba*) are likely to occur on the site. The required permits must be obtained to remove any of these (Appendix B).
- Several small, protected succulents occur on the site. These include *Crassula capitella*, *Aloe grandidentata* and *Anacampseros filamentosa*. Permits must be obtained and these transplanted to an area adjacent to the site where they will not be affected (Appendix B).

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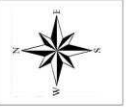
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## **Annexure A: Maps and Site photos**

**Layout map for the proposed construction of a Waste Water Treatment Works (WWTW) near the settlement of Ganspan, Northern Cape Province.**



Map 1: Layout of the proposed WWTW near the settlement of Ganspan. The drainage area and adjacent woodland is indicated. Note that the footprint of the WWTW will exclude both these sensitive areas. The earthen berms forming the artificial impoundment is also indicated. The existing access road and water treatment plant is also visible. Also take note of surrounding agricultural activities.



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**Legend:**

-  WWTW Footprint
-  Drainage area
-  Acacia woodland
-  Artificial impoundment

**Map Information**

Spheroid: WGS 84

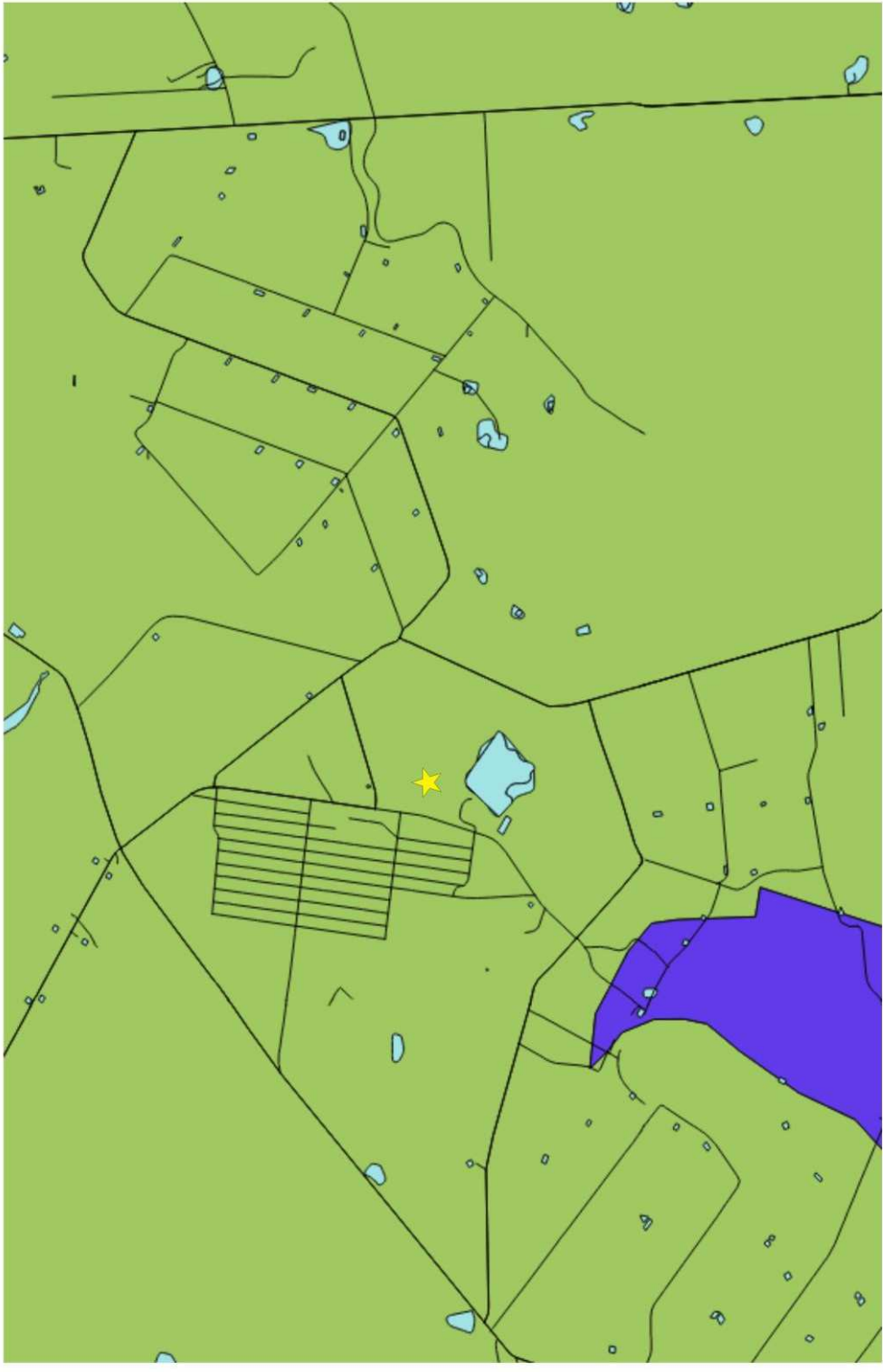
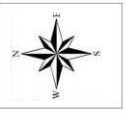


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**General ecology map for the proposed construction of a Waste Water Treatment Works (WWTW) near the settlement of Ganspan, Northern Cape Province.**



Map 2: General ecology of the proposed WWTW near the settlement of Ganspan. The vegetation types as well as any Threatened Ecosystem is indicated as well as wetlands and impoundments in the area. Note that the adjacent artificial impoundment is also indicated.



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**Legend:**

-  **WWTW Location**
-  **Wetlands and impoundments**
-  **Kimberley Thornveld**
-  **Schmidtsdrif Thornveld**
-  **Road network**

**Map Information**

**Spheroid:** WGS 84  
**Scale:** 1:40 000  
Quantum GIS

**Environmental Consultant**

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Figure 1: View of the site and towards the eastern adjacent areas. Note the low percentage vegetation cover, highly rocky terrain and the adjacent woodland area adjacent to the site. Large specimens of the protected Camel Thorn (*Vachellia erioloba*) is clearly visible in this area.



Figure 2: Panorama of the site and toward the south of the site. Note the rocky terrain and slope on the site. The drainage area to the south of the site is indicated.



Figure 3: Panorama of the drainage area to the south of the site. Note drainage gullies forming in the area.

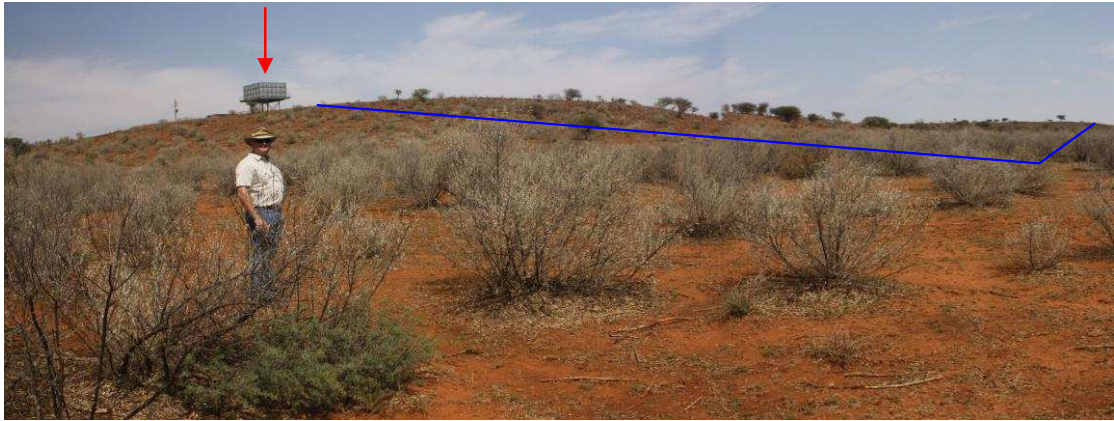


Figure 4: Panorama of the site (blue) as seen from the south. The topography and profile of the low hill is clearly visible. The small water treatment plant and reservoir is also visible (red arrow).



Figure 5: Panorama of the site. Note the dense woodland to the east of the site which will be excluded from the footprint.

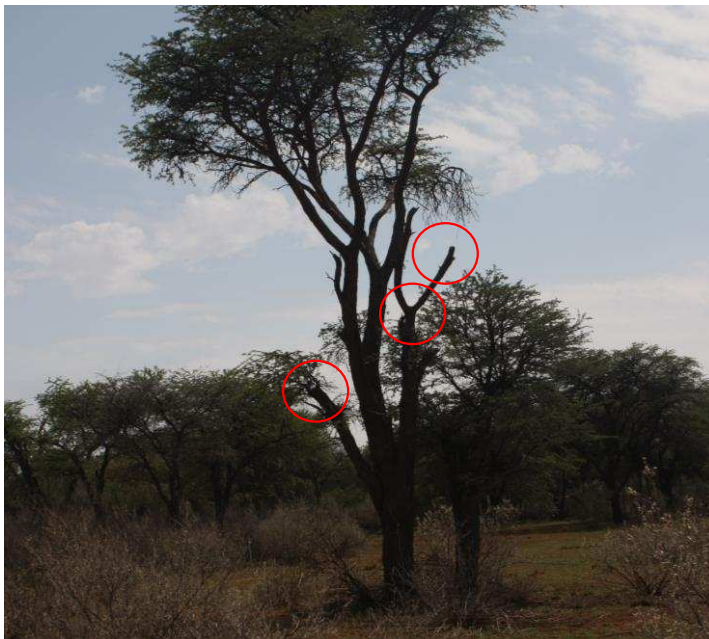


Figure 6: Cutting of trees on the site is common (red circles).





Figure 7: A sizable stump from a tree which was cut down for firewood.



Figure 8: Shallow foraging excavations made by a small unidentified mammal.

## Appendix B: Protected species on the site

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



***Aloe grandidentata***  
**Bont Aalwyn**

Protected in the Northern Cape Province

National Red List Status: **Least Concern**

**Method: The species is abundant on the site especially rocky terrain. Specimens which occur in the footprint should be transplanted to adjacent areas where they will not be affected. They transplant easily.**



***Anacampseros filamentosa***  
**Haaskos**

Protected in the Northern Cape Province

National Red Listed Status: **Least Concern**

**Method: Common but scattered on the site. Should be transplanted to adjacent areas where they will not be affected by the development. They transplant easily.**



***Crassula capitella***

Protected in the Northern Cape Province.

National Red List Status: **Least Concern**

Method: **Common on the site. Should be transplanted to adjacent areas where they will not be affected by the development. They transplant easily.**



***Acacia erioloba***

**Camel Thorn/Kameeldoring**

Protected species

National Red List Status: **Declining**

**The species is subjected to a continuing decline and is therefore listed as a Declining species.**

**Due to this listed category the species must be left intact wherever possible. A permit must be obtained to remove those specimens that will require removal.**



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