Report on the floristic and ecological assessment of the proposed borrow pit on the farm Sydenham 445, Bloemfontein District.

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Vegetation and ecological assessment.

1. Introduction

Natural vegetation is an important component of ecosystems. Some of the vegetation units in a region can be more sensitive than others, usually as a result of a variety of environmental factors and species composition.

Some vegetation units perform vital functions in the larger ecosystem. 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.

Development around cities and towns are inevitable. 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.

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.

In recent times the state of South Africa's roads has become a priority. It is imperative to build new roads and maintain and upgrade existing roads. However, road building requires a significant amount of resources to be spent. One such a resource is the removal of rock and earth materials from borrow pits. Through continuous road building and upgrading, borrow pits has started to litter our roadsides and are often an eye sore where they occur in natural veld. We should therefore try to minimise the amount of borrow pits as well as where they are located. If possible existing borrow pits should be re-opened so that new borrow pits are not opened in natural, undisturbed veld.

When opening a borrow pit in natural veld a survey should be done to ensure that the area does not consist of sensitive habitats or contain endangered or protected species. It would be ideal to open borrow pits only in disturbed areas, in this manner the impact would be kept to a minimum.

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

The proposed borrow pit will be situated adjacent to the M30 Church Street road connecting the N1 National Road and the N6 National Road (Map 1). The borrow pit will be situated on the southern side of the tarred road on the farm Sydenham 445. The borrow pit will be utilised for the upgrading of the N6 National Road.

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

2. Scope and limitations

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

2.1 Vegetation

Aspects of the vegetation that will be assessed include:

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

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

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

2.2 Fauna

Aspects of the fauna that will be assessed include:

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

2.3 Limitations

Some of the bulbous species may have been overlooked. Many species have a spring/summer flowering period.
Some 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, Van Wyk & Malan 1998, Van Oudtshoorn 2004, Manning 2009)

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

3.2 Survey

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

Noted species include rare and dominant species.
The broad vegetation types present on the site were determined.
The state of the environment was assessed in terms of condition, grazing impacts, disturbance by humans, erosion and presence of invader and exotic species.

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

3.3 Criteria used to assess sites

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

Vegetation characteristics

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

Habitat diversity and species richness: normally a function of locality, habitat diversity and climatic conditions.
Scoring: Wide variety of species occupying a variety of niches – 1, Variety of species occupying a single nich – 2, Single species dominance over a large area containing a low diversity of species – 3.

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role on the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species can potentially be a fatal flaw.
Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely – 3.

Ecological function: All plant communities play a role in the ecosystem. The ecological importance of all areas though, can vary significantly e.g. wetlands, drainage lines, ecotones, etc.
Scoring: Ecological function critical for greater system – 1, Ecological function of medium importance – 2, No special ecological function (system will not fail if absent) – 3.

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

Vegetation condition

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

Percentage ground cover: Ground cover is under normal and natural conditions a function of climate and biophysical characteristics. Under poor grazing management, ground cover is one of the first signs of vegetation degradation.
Scoring: Good to excellent – 1, Fair – 2, Poor – 3.

Vegetation structure: This is the ratio between tree, shrub, sub-shrubs and grass layers. The ratio could be affected by grazing and browsing by animals.
Scoring: All layers still intact and showing specimens of all age classes – 1, Sub-shrubs and/or grass layers highly grazed while tree layer still fairly intact (bush partly opened up) – 2, Mono-layered structure often dominated by a few unpalatable species (presence of barren patches notable) – 3.

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

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

Signs of erosion: The formation of erosion scars can often give an indication of the severity and/or duration of vegetation degradation.
Scoring: No or very little signs of soil erosion – 1, Small erosion gullies present and/or evidence of slight sheet erosion – 2, Gully erosion well developed (medium to large dongas) and/or sheet erosion removed the topsoil over large areas – 3.

Faunal characteristics

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role on the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species or very unique and sensitive habitats can potentially be a fatal flaw.
Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely.

3.4 Biodiversity sensitivity rating (BSR)

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

Table 1: Biodiversity sensitivity ranking

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

4. Ecological overview of the site

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

The vegetation on the site consists of Bloemfontein Dry Grassland (Gh 5).

Bloemfontein Dry Grassland (Gh 5) is listed as an Endangered vegetation type. This is largely due to transformation for crop production and urbanisation.

The topography of the area consists of undulating plains. The site itself consists of natural grassland sloping towards the west where a seasonal stream/wetland occurs. The proposed borrow pit is situated on the southern border of the city of Bloemfontein. As a result the area and surroundings are subjected to numerous disturbance factors.

The site is located on the experimental farm of the Department of Agriculture of the University of the Free State. Currently the area is being used for intensive grazing. The immediate surroundings also contain agricultural fields used for dryland crop production. Other land uses in the surrounding area include intensive and poorly managed grazing by domestic stock, illegal dumping sites and high density low income residential settlements.

The site consists of natural grassland and slopes towards the west. A seasonal stream/wetland occurs approximately 300m towards the west of the site. The grassland is dominated by several grass species as well as a high abundance of annual weeds and pioneers. The grass species on the site include *Themeda triandra, Hyperhenia hirta, Eragrostis curvula, E. superba* and *Heteropogon contortus*. These species are natural to this vegetation type although the dominance of *E. curvula* is indicative of overgrazing and disturbance. The site also contains a high abundance of annual weeds and pioneers that dominate the site in many areas. These species include *Chenopodium album, Salvia verbenaca, Arctotis venusta, Senecio consanguineus* and *Nidorella resedifolia*. These species are all indicators of disturbance and their dominance indicates high levels of disturbance and overgrazing.

The small succulent shrub, *Ruschia puterrillii*, is rare on the site. This species is natural to the vegetation type but is not protected, rare or endangered. The species is widespread, common and consequently not of a concern to the development. It is considered a remnant of the natural undisturbed grassland.

A wetland with a small associated annual stream is located approximately 300m west of the proposed borrow pit. This wetland and seasonal stream has its origins in the high density residential settlements to the north east of the site. As a result this wetland as well as the annual stream is severely degraded. The runoff from this high density residential area is highly polluted. The amount of runoff is also increased due to the lack of vegetation cover and tarred roads. Other factors that impact on the wetland include intensive and sustained grazing pressures by domestic stock, illegal dumping and littering near the wetland and the damming of the annual stream by dirt walled dams. Consequently this wetland and seasonal stream is severely degraded and transformed. However, the wetland and seasonal stream system remains sensitive environments with regard to water transporting and –regulating processes.

The flow regime and hydrology of this wetland and seasonal stream should not be altered in any way by the proposed borrow pit. Since the borrow pit would not be located near this wetland (approximately 300m) it is not anticipated that the borrow pit would have significant

negative impacts on this wetland. The only likely impact that could arise would be the erosion of sediments from the borrow pit into this wetland since the borrow pit would be situated on a gentle slope, sloping towards the wetland. This can be prevented by erecting a dirt berm along the western border of the borrow pit which will prevent sediment runoff from entering the wetland. Alternatively stormwater may also be directed around the borrow pit. This will also prevent sediment runoff from entering the wetland.

Although the area consists of Endangered Bloemfontein Dry Grassland (Gh 5) the following discussion illustrates why the site has a relatively low conservation value.

The vegetation on the site is degraded and is dominated by weeds and pioneer species. This is a result of heavy and sustained overgrazing. The site does not contain any species of conservation concern (protected, rare or endangered) and it is considered highly unlikely that the surrounding area would contain such species. The site is located at the southern border of the city of Bloemfontein and it is therefore already in a degraded state. This is a result of the impacts associated with the surrounding land uses which include agricultural fields used for dryland crop production, intensive and poorly managed grazing by domestic stock, illegal dumping sites and high density low income residential settlements.

As a result of the degraded condition of the site as well as the severely degraded and transformed nature of the surrounding area caused by the current land uses the site does not form part of a conservable portion of this vegetation type.

4.2 Overview of terrestrial mammals (actual & possible)

The site is riddled with the burrows of rodents. These burrows are most likely those of the Multimammate Mouse (*Mastomys coucha*) and the Striped Mouse (*Rhabdomys pumilio*). According to Avenant (2000) where extensive disturbance of grassland occur these species dominate. It has also been shown that these rodent species can be used as indicators of grassland degradation (Avenant & Cavallini 2007, MacFadyen *et al.* 2012).

The dominance of these rodents on the site substantiates the degraded condition of the vegetation. The species are not of concern to the proposed development.

No other mammal species could be identified on the site and it is considered highly unlikely that other species would occur on the site. Due to the surrounding human activities, overgrazing of the site and the dominance of rodents it is regarded as highly unlikely that any species of concern would occur on the site.

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

Pangolin	*Manis temminckii*
South African Hedgehog	*Atelerix frontalis*
Aardwolf	*Proteles cristatus*
African Wild Cat	*Felis lybica*
Small-Spotted Cat	*Felis nigripes*
Bat-Eared Fox	*Otocyon megalotis*
Striped Weasel	*Poecilogale albinucha*

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

5. Site specific results

Habitat diversity and species richness:

Habitat diversity on the site is relatively low. Habitats comprise of a single severely overgrazed grass layer. As a result of the degraded state of the grassland the species diversity on the site is low and dominated by weeds and pioneer species. Bare areas where the grass layer has been destroyed are also common.

Presence of rare and endangered species:

No species of concern could be identified on the site. Due to the degraded state of the vegetation it is considered highly unlikely that any species of concern would occur on the site or immediate surroundings.

Ecological function:

The ecological function of the area is largely intact but degraded to a large extent. The area does not perform a vital ecological in respect to the surrounding ecology of the region. The area does act as part of the catchment of the nearby wetland and seasonal stream. The proposed development would not have a negative impact on the wetland and seasonal stream provided that sediment runoff is prevented from entering the wetland.

Degree of rarity/conservation value:

The vegetation type on the site consists of Dry Bloemfontein Grassland (Gh 5). This vegetation type is considered as Endangered. This is due to the large scale transformation of the vegetation type as a result of agriculture and urbanisation.

Although the area consists of Endangered Bloemfontein Dry Grassland (Gh 5) the following discussion illustrates why the site has a relatively low conservation value.

The vegetation on the site is degraded and is dominated by weeds and pioneer species. This is a result of heavy and sustained overgrazing. The site does not contain any species of conservation concern (protected, rare or endangered) and it is considered highly unlikely that the surrounding area would contain such species. The site is located at the southern border of the city of Bloemfontein and it is therefore already in a degraded state. This is a result of the impacts associated with the surrounding land uses which include agricultural fields used for dryland crop production, intensive and poorly managed grazing by domestic stock, illegal dumping sites and high density low income residential settlements.

As a result of the degraded condition of the site as well as the severely degraded and transformed nature of the surrounding area caused by the current land uses the site does not form part of a conservable portion of this vegetation type.

Percentage ground cover:

Percentage ground cover is low. This is due to heavy and sustained overgrazing. As a result the site contains large bare patches where limited vegetation occurs and is dominated by weeds and pioneer species.

Vegetation structure:
The vegetation structure consists of a grass layer; this is natural to the region. However, the vegetation structure has been severely degraded by overgrazing. As a result the grass layer has been replaced in many areas by pioneer species and weeds and bare patches are large and common on the site.

Infestation with exotic weeds and invader plants:
Weeds dominate in many areas on the site. These weeds are mostly pioneers and are indicative of the heavy overgrazing currently occurring.

Degree of grazing/browsing impact:
Grazing by domestic stock on the site is high and sustained. This has resulted in degradation of the grass layer.

Signs of erosion:
Due to the heavy overgrazing the area has been degraded and bare patches are common on the site. These bare areas in conjunction with the slight slope of the site lead to sheet erosion of the site. Erosion is therefore considered to be moderate.

Terrestrial animals:
Due to the degraded condition of the vegetation on the site the area is not able to sustain a viable mammal population. The area is riddled with rodent burrows, coupled with the degraded condition of the vegetation this is indicative of a degraded grassland system. It is considered that the occurrence of any mammal species of concern is highly unlikely. The dominance of rodents on the site is not of a concern for the development, on the contrary, these rodents are regarded as a pest on the site and are indicative of the degraded state of the area.

Table 2: Biodiversity Sensitivity Rating for the proposed borrow pit.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness	3		
Presence of rare and endangered species	3		
Ecological function	3		
Uniqueness/conservation value		2	
Vegetation condition			
Percentage ground cover	3		
Vegetation structure	3		
Infestation with exotic weeds and invader plants or encroachers	3		
Degree of grazing/browsing impact	3		
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species	3		
Sub total	24	4	0
Total		28	

6. Biodiversity sensitivity rating (BSR) interpretation

Table 3: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
Sydenham Borrow Pit	28	Preferred	4

7. Discussion and conclusions

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

The site consists of Bloemfontein Dry Grassland (Gh 5). This vegetation type is listed as Endangered. Although the area consists of Endangered Bloemfontein Dry Grassland (Gh 5) the following discussion illustrates why the site has a relatively low conservation value.

The vegetation on the site is degraded and is dominated by weeds and pioneer species. This is a result of heavy and sustained overgrazing. The site does not contain any species of conservation concern (protected, rare or endangered) and it is considered highly unlikely that the surrounding area would contain such species. The species diversity on the site is relatively low due to the degraded state of the vegetation. The site is located at the southern border of the city of Bloemfontein and it is therefore already in a degraded state. This is a result of the impacts associated with the surrounding land uses which include agricultural fields used for dryland crop production, intensive and poorly managed grazing by domestic stock, illegal dumping sites and high density low income residential settlements.

As a result of the degraded condition of the site as well as the severely degraded and transformed nature of the surrounding area caused by the current land uses the site does not form part of a conservable portion of this vegetation type.

As a result of heavy overgrazing the site has developed areas of bare soil where vegetation has been destroyed. These areas are subject to water and wind erosion in the form of sheet erosion.

The ecological function of the site has been degraded to a large extent. The site does not have a vital ecological function in respect to the surrounding ecology. However, the site contributes to the catchment of the nearby wetland and seasonal stream.

A wetland with a small associated annuals stream is located approximately 300m west of the proposed borrow pit. This wetland and seasonal stream has its origins in the high density residential settlements to the north east of the site. As a result this wetland as well as the annual stream is severely degraded.

The flow regime and hydrology of this wetland and seasonal stream should not be altered in any way by the proposed borrow pit. Since the borrow pit would not be located near this wetland (approximately 300m) it is not anticipated that the borrow pit would have significant negative impacts on this wetland. The only likely impact that could arise would be the erosion of sediments from the borrow pit into this wetland since the borrow pit would be situated on a gentle slope, sloping towards the wetland. This can be prevented by erecting a dirt berm along the western border of the borrow pit which will prevent sediment runoff from entering the

wetland. Alternatively stormwater may also be directed around the borrow pit. This will also prevent sediment runoff from entering the wetland.

As a result of the degraded condition of the site itself as well as the surrounding activities the site is regarded as Preferred for the proposed borrow pit.

Although it is not anticipated that the borrow pit would entail any significant impacts on the surrounding environment certain recommendations should still be adhered to.

8. Recommendations

- Erosion measures should be implemented on the western border of the borrow pit as the site slopes towards the west. Erosion measures must include berms or other structures to prevent sediment from entering the wetland to the west of the site (approximately 300m from borrow pit). Alternatively stormwater may also be directed around the borrow pit. This will also prevent sediment runoff from entering the wetland.

- Topsoil should be removed and stockpiled. The topsoil stockpile should be kept free of weeds and erosion.

- Topsoil should be replaced in bare areas after cessation of excavation activities.

- The use of hydro-seeding should be investigated for rehabilitation of the borrow pit.

- The borrow pit should be adequately fenced at all times.

- Areas that have become compacted due to excavation activities should be ripped.

- All overburden should be replaced in the borrow pit and the area around the borrow pit should be levelled to its original state once excavation activities has ceased.

- Stormwater flow should be managed to ensure that the borrow pit remains free draining.

- After cessation of activities on the site the area should be rehabilitated to acceptable standards.

- After cessation of excavation activities the area should be monitored for any infestation by invader species.

9. References

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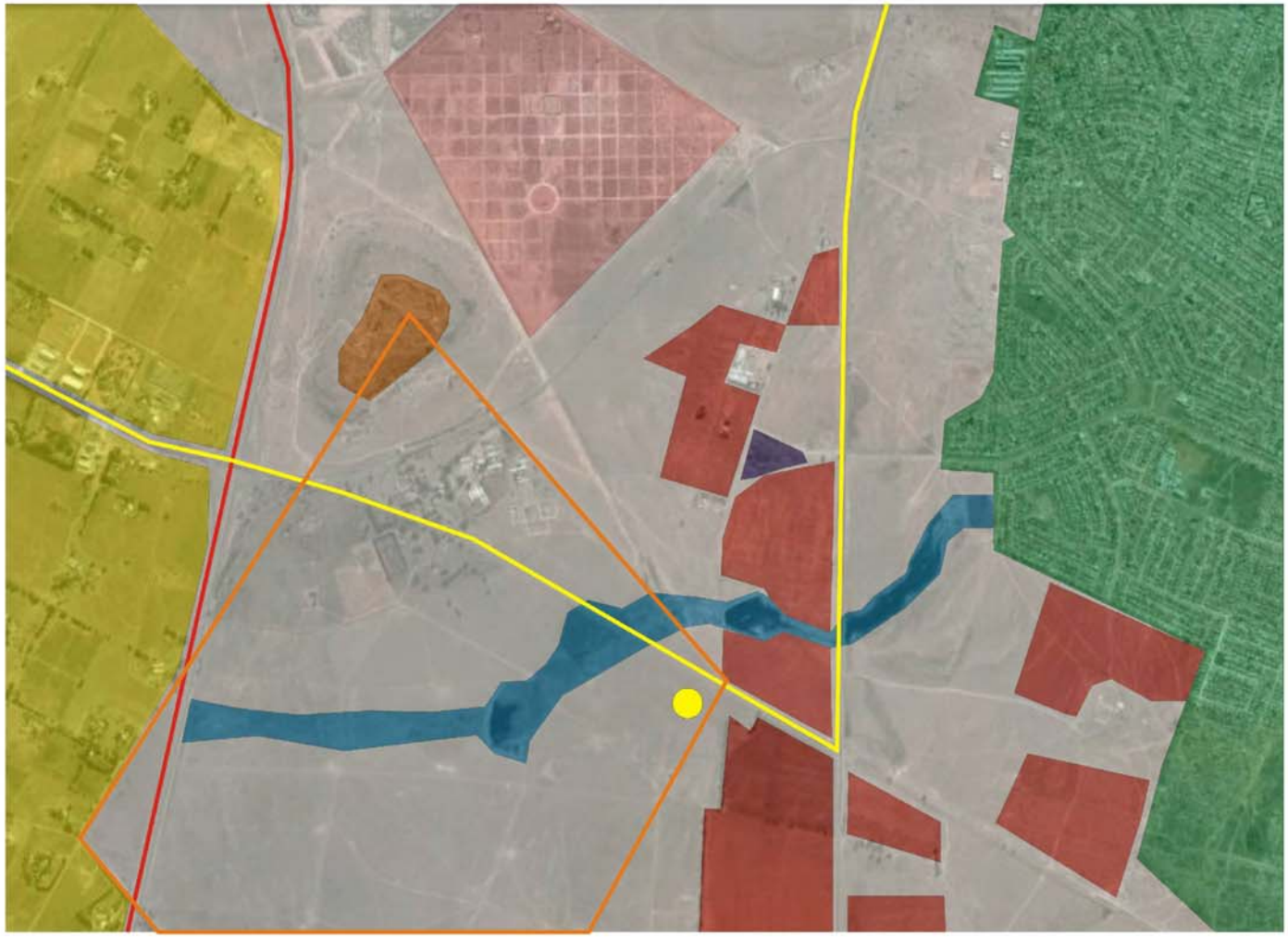
Annexure A: Maps and Site photos

Locality map for the establishment of the proposed borrow pit on the farm Sydenham 445.



Preparred for:
SANRAL
P.O. Box 100410
Scottsville
3201

Legend:
- N1 National Road
- M30 Church Street
- Sydenham 445 boundary
- Proposed site
- High density residential
- Current or previous cultivation
- Wetland and seasonal stream
- Illegal dumping site
- Graveyard
- Existing borrow pit
- Small holdings

Map Information

Spheroid: WGS 84
Topo Cadastre Sheet: T2926AA
Scale:

0 290 580 870 1160
Scale (m)

Environmental Consultant
H2ON Environmental Specialists
Contact Darius van Rensburg at:
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Map 1: Location of the proposed borrow pit on the farm Sydenham 445. The surrounding land uses are indicated, these cause extensive degradation of the surrounding area and isolate any remaining natural areas, decreasing the conservation value of any natural areas.

Figure 1: Panorama of the site as seen from the east toward the west. The adjacent public tarred road is indicated (Red line). Note the bare soil caused by overgrazing (Blue circles).

Figure 2: Panorama of the site as seen from the north of the site towards the south west. Leeuberg Hill is visible in the background. Note the large amount of bare areas where overgrazing has destroyed the grass layer.

Figure 3: Panorama of the site as seen from the west toward the east. Percentage grass cover is higher in this area, but bare areas are still evident.

Figure 4: The wetland and seasonal stream to the west of the site as viewed from the site (Red line). This wetland is located approximately 300m from the site and it is not anticipated that the development would have any significant impacts on this system.

Figure 5: Close-up view of the wetland. The area has not received rain yet and consequently the wetland is dry and not clearly visible. The wetland is visible as the light green areas (Red figure).

Figure 6: View of the site. Note the large bare areas where the grass layer has been destroyed by overgrazing.

Figure 7: Close-up view of the soil surface on the site. Note the absence of vegetation, this is caused by overgrazing.

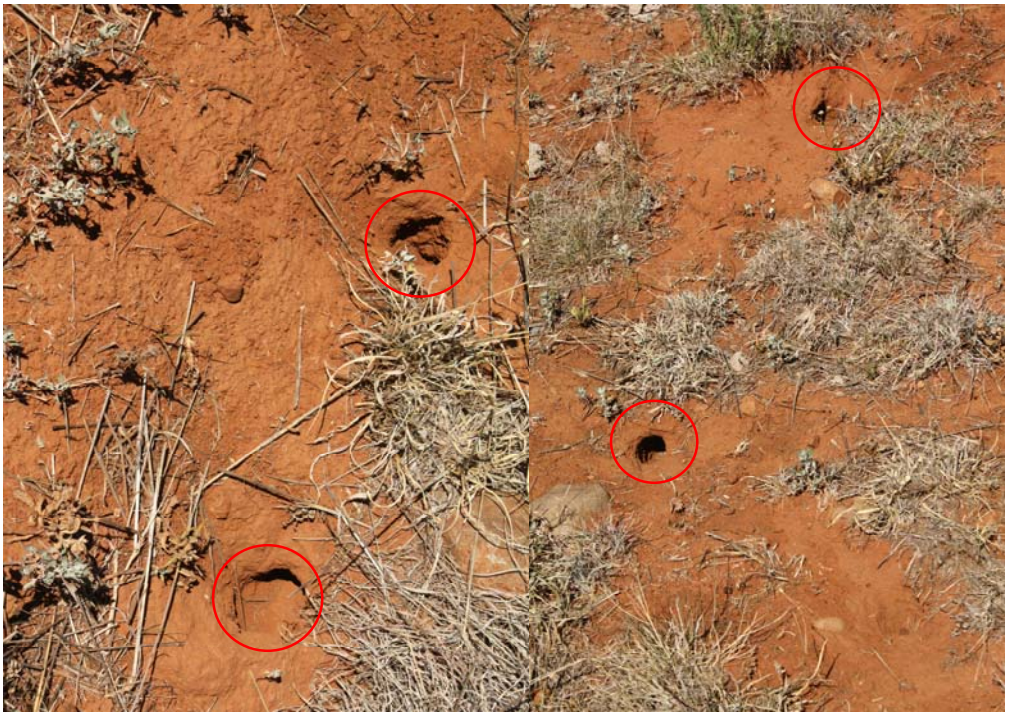

Figure 8: Photographs illustrating some of the rodent burrows on the site (Red circles). The site is riddled with these burrows, it is considered to be an indicator of disturbance.