

BOTANICAL ASSESSMENT

GARIEP HOUSING PROJECT

PROPOSED FORMALIZATION AND DEVELOPMENT OF 135 NEW ERVEN
ON PLOT 113, GARIEP SETTLEMENT
!KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE



20 July 2020

P.J.J. Botes (Pr.Sci.Nat: 400184/05)

Registered Professional Botanical, Environmental and Ecological Scientist

©

EXECUTIVE SUMMARY

VEGETATION TYPE	<p>Bushmanland Arid Grassland</p> <p>Classified as “Least Threatened” (GN 1002, December 2011) although statutory conservation targets have not yet been met.</p>
VEGETATION ENCOUNTERED	<p>Of the 15 ha footprint about 4.16 ha are already disturbed or settled. The remainder of the site supported a very dry and reduced vegetation layer. Site 1 still supported remaining natural veld in relative good condition, but Site 2 & 3 were much more disturbed and only supported a disturbed and very sparse vegetation layer.</p>
CONSERVATION PRIORITY AREAS	<p>According to the Northern Cape CBA maps the proposed site falls within a CBA area. However, there is no alternative on Municipal land that will not impact on the CBA.</p> <p>The site will not impact on any recognised centre of endemism.</p>
CONNECTIVITY	<p>The transformation of the site will destroy connectivity on the site, but should not result in a significant impact on the surrounding area, where connectivity is still excellent.</p>
LAND-USE	<p>The footprint is on municipal land in close proximity to the town of Gariep. About 30% of the footprint is disturbed or already settled. The area is grazed by livestock, which can be seen in the poor condition of many of the plant species (coupled with the recent on-going drought).</p>
PROTECTED PLANT SPECIES	<p>The most significant botanical aspect of this site is the presence of a 4 protected <i>Vachellia erioloba</i> trees and a number of protected Sheppard trees (<i>Boscia albitrunca</i>) (refer to Table 2) and a number of Northern Cape Nature Conservation Act, protected species (Refer to Table 3).</p>
MAIN CONCLUSION	<p>The proposed development footprint is located on Municipal property, adjacent to existing town developments. The activity is expected to result in a permanent transformation of approximately 15 ha of land, of which approximately 70% is still covered by disturbed indigenous vegetation. The site overlaps an identified critical biodiversity area (according to the 2016, Northern Cape Critical Biodiversity Areas maps). In addition, protected Camel Thorn (<i>Vachellia erioloba</i>) and Sheppard trees (<i>Boscia albitrunca</i>), and a number of Northern Cape Nature Conservation Act, protected species were observed within the footprint.</p> <p>According to the impact assessment given in Table 6 the development is likely to result in a Medium-Low impact, which can be reduced to a Low impact with good environmental control during construction.</p> <p>With the correct mitigation it is unlikely that the development will contribute significantly to any of the following:</p> <ul style="list-style-type: none"> • Significant loss of vegetation type and associated habitat. • Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities. • Loss of local biodiversity and threatened plant species. • Loss of ecosystem connectivity. <p>WITH THE AVAILABLE INFORMATION IT IS RECOMMENDED THAT PROJECT BE APPROVED, WITH THE PROPOSED MITIGATION ACTIONS.</p>
NO-GO OPTION	<p>The No-Go option is not likely to result in a “no-impact” scenario, as constant slow degradation is expected to continue as a result of urban activities and poor management of the site.</p> <p>There is also an urgent need for the establishment of additional residential erven in the !Kheis Municipality, which is likely to outweigh the No-Go option.</p>

INDEPENDENCE & CONDITIONS

PB Consult is an independent entity with no interest in the activity other than fair remuneration for services rendered. Remunerations for services are not linked to approval by decision making authorities and PB Consult have no interest in secondary or downstream development as a result of the authorization of this proposed project. There are no circumstances that compromise the objectivity of this report. The findings, results, observations and recommendations given in this report are based on the author's best scientific and professional knowledge and available information. PB Consult reserve the right to modify aspects of this report, including the recommendations if new information become available which may have a significant impact on the findings of this report.

RELEVANT QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Mr Peet Botes holds a BSc. (Hons.) degree in Plant Ecology from the University of Stellenbosch (Nature Conservation III & IV as extra subjects). Since qualifying with his degree, he had worked for more than 20 years in the environmental management field, first at the Overberg Test Range (a Division of Denel) managing the environmental department of OTR and being responsible for developing and implementing an ISO14001 environmental management system, ensuring environmental compliance, performing environmental risk assessments with regards to missile tests and planning the management of the 26 000 ha of natural veld, working closely with CapeNature (De Hoop Nature Reserve).

In 2005 he joined Enviroscientific, an independent environmental consultancy specializing in wastewater management, botanical and biodiversity assessments, developing environmental management plans and strategies, environmental control work as well as doing environmental compliance audits and was also responsible for helping develop the biodiversity part of the Farming for the Future audit system implemented by Woolworths. During his time with Enviroscientific he performed more than 400 biodiversity environmental legal compliance audits.

During 2010 he joined EnviroAfrica in order to move back to the biodiversity aspects of environmental management. Experience with EnviroAfrica includes NEMA EIA applications, environmental management plans for various industries, environmental compliance audits, environmental control work as well as more than 70 biodiversity & botanical specialist studies.

Towards the end of 2017, Mr Botes started his own small environmental consulting business focusing on biodiversity & botanical assessments, biodiversity management plans and environmental compliance audits.

Mr Botes is a registered Professional Botanical, Environmental and Ecological Scientists at SACNASP (South African Council for Natural Scientific Professions) as required in terms of Section 18(1)(a) of the Natural Scientific Professions Act, 2003, since 2005.

DECLARATION OF INDEPENDENCE

THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS

I Petrus, Jacobus, Johannes Botes, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014, as amended, and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 326) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 13 of GN No. R. 326.

Note: The terms of reference must be attached.



Signature of the specialist:

PB Consult (Sole Proprietor)

Name of company:

20 July 2020

Date:

CONTENTS	
EXECUTIVE SUMMARY	I
INDEPENDENCE & CONDITIONS	II
RELEVANT QUALIFICATIONS & EXPERIENCE OF THE AUTHOR	II
DECLARATION OF INDEPENDENCE	III
1. INTRODUCTION	1
1.1. Terms of reference	1
2. STUDY AREA	2
2.1. Location & Layout	2
2.2. Climate	3
2.3. Topography & soils	3
3. EVALUATION METHOD	4
4. THE VEGETATION	5
4.1. The Vegetation in context.....	5
4.1.1. Nama-Karoo Biome	5
4.2. Vegetation encountered.....	6
4.2.1. Existing disturbance footprint	7
4.2.2. Remaining natural veld.....	9
4.3. Critical biodiversity areas maps	13
4.4. Potential impact on centres of endemism	15
4.5. Flora encountered	15
4.6. Threatened and protected plant species	16
4.6.1. Red list of South African plant species	16
4.6.2. NEM: BA protected plant species	17
4.6.3. NFA Protected plant species.....	17
4.6.4. NCNCA protected plant species.....	18
5. IMPACT ASSESSMENT METHOD	19
5.1. Determining significance	19
5.2. Significance categories	20
6. DISCUSSING BOTANICAL SENSITIVITY	22
6.1. Impact assessment	23
7. IMPACT MINIMISATION RECOMMENDATIONS	25
7.1. Mitigation actions	25
8. REFERENCES	26
APPENDIX 1: COMPLIANCE WITH APPENDIX 6 OF GN. NO. 982 (4 DECEMBER 2014)	27
APPENDIX 2: CURRICULUM VITAE – P.J.J. BOTES	28

LIST OF TABLES:

Table 1: List of indigenous species encountered within or near the proposed footprint	15
Table 2: Location of NFA protected trees observed within or near the footprint	17
Table 3: Plant species protected in terms of the NCNCA encountered within the study area.....	18
Table 4: Categories and criteria used for the evaluation of the significance of a potential impact	19
Table 5: Categories used to describe significance rating (adjusted from DEAT, 2002)	21
Table 6: Impact assessment associated with the proposed development	23

LIST OF PHOTOS:

Photo 1: Some of the areas already settled in Site 2, the southern portion of the proposed footprint (Figure 6), looking west to east.	7
Photo 2: Looking into Gariep from south to north, from southern part of the footprint (purple area to the south in Site 2 of Figure 6).	7
Photo 3: Goat and sheep pens encountered in the eastern portion of the proposed new site (purple area to the east in Site 2 of Figure 6).	7
Photo 4: Some of the spoil heaps encountered to the north east of the new proposed footprint (Orange area in Site 2 of Figure 6).	8
Photo 5: Further disturbance visible in the area marked with Orange in Figure 6 (The north eastern corner of Site 2).	8
Photo 6: Showing some of the disturbed areas within Site 3 (Orange area to the north of Gariep Figure 6), looking from east to west.	8
Photo 7: Another of the disturbed areas within Site 3 (Figure 6), also looking from east to west.	8
Photo 8: Typical sparse shrubland dominated on shallow soils, south of the school grounds in Site 1.	9
Photo 9: One of the bush clumps observed on Site 1 (Note the slightly deeper sandy soils in this area).	9
Photo 10: Two of the <i>Boscia albitrunca</i> individuals observed in Site 1. Note the poor condition of the plants.	10
Photo 11: One of relative young <i>Vachellia erioloba</i> individual observed in Site 1.	10
Photo 12: Typical veld observed in the south western corner of Site 1. Note the white grass dominated low shrubland.	11
Photo 13: A photo of the vegetation encountered on the eastern slope of Site 2. Note the calcrete outcrops between the banded iron deposits.	11
Photo 14: Vegetation encountered in the eastern portion of Site 2. Note the low growing <i>Senegalia mellifera</i> , with the close cropped remains of <i>Aptosimum spinescens</i> and <i>Tetraena decumbens</i> in between.	11
Photo 15: Denser stands of <i>Senegalia mellifera</i> associated with one of the drainage lines	12
Photo 16: Typical vegetation observed near the disturbed areas of Site 3. Note the <i>Boscia albitrunca</i> individual in the foreground.	12
Photo 17: Vegetation encountered on the lower slopes of the small hill in the north western corner of Site 3 (looking back towards Gariep).	12
Photo 18: One of the more impressive Sheppard trees (<i>Boscia albitrunca</i>) observed in the valley between buildings in Site 3.	13
Photo 19: One of the <i>Vachellia erioloba</i> (Camel Thorn) trees observed in the valley between buildings in Site 3.	13

1. INTRODUCTION

There is an urgent need for the establishment of additional residential erven in the sub-economical market in the !Kheis Local Municipality. Seven towns have been identified for the proposed development of a number of new erven at each town. They are:

- Boegoeberg: 550 erven;
- Gariep: 135 erven;
- Groblershoop: 1500 erven;
- Grootdrink: 370 erven;
- Opwag: 730 erven;
- Topline: 248 erven; and
- Wegdraai: 360 erven.

Macroplan has been appointed by the Barzani Group (on behalf of COGHSTA) as Town and Regional Planners to manage the town planning process in terms of SPLUMA (Act 16 of 2013).

The proposed project will trigger listed activities under the National Environmental Management Act, (Act 107 of 1998) (NEMA) and the EIA regulations (as amended). As result EnviroAfrica was appointed to perform the NEMA EIA application and PB Consult was appointed to conduct a botanical assessment of the proposed sites, which, although disturbed in some areas, still supports natural vegetation.

This report refers to the proposed development of approximately 135 new erven on a 15 ha of municipal land adjacent to Gariep.

The proposed footprint is expected to Bushmanland Arid Grassland with a potential intrusion of Lower Gariep Alluvial Vegetation, closer to the Orange River. Bushmanland Arid Grassland is considered “Least Threatened”, while Lower Gariep Alluvial Vegetation is considered “**Endangered**” in terms of the National list of ecosystems that are threatened and in need of protection). Desktop studies shows that the site overlaps a terrestrial critical biodiversity area (CBA1) as identified in the 2017 Northern Cape Biodiversity Spatial Plan.

The vegetation encountered within the proposed footprint was a dry and degraded (e.g. continual grazing & construction related impacts) version of Bushmanland Arid Grassland. However, the site visit confirmed that the proposed footprint were elevated out of the Orange River Alluvial floodplain and did not support Lower Gariep Alluvial Vegetation. The larger shrubs were more typically associated with drainage lines within the Bushmanland Arid Grassland vegetation type.

1.1. TERMS OF REFERENCE

The terms of reference for this appointment were to:

- Evaluate the proposed site(s) in order to determine whether any significant botanical features will be impacted as a result of the proposed development.
- Determine and record the position of any plant species of special significance (e.g. protected tree species, or rare or endangered plant species) that should be avoided or that may require “search & rescue” intervention.
- Locate and record sensitive areas from a botanical perspective within the proposed development footprint that may be interpreted as obstacles to the proposed development.
- Make recommendations on impact minimization should it be required
- Consider short- to long-term implications of impacts on biodiversity and highlight irreversible impacts or irreplaceable loss of species.

2. STUDY AREA

2.1. LOCATION & LAYOUT

Gariiep is located just off the gravel road running parallel with the Orange River on its eastern banks, about 43 km north of Groblershoop and about 10 km south-south-east of Grootdrink (on the other side of the Orange River) in the !Kheis Local Municipality of the Northern Cape Province (Figure 1). The proposed new erven will be located next to the existing erven at Gariiep, on Plot 113, Gariiep Settlement (GPS Coordinates 28° 36' 37.71"S; 21° 46' 54.93"E).

Figure 1: Map showing the location of Gariiep in relation to Upington and Groblershoop in the Northern Cape

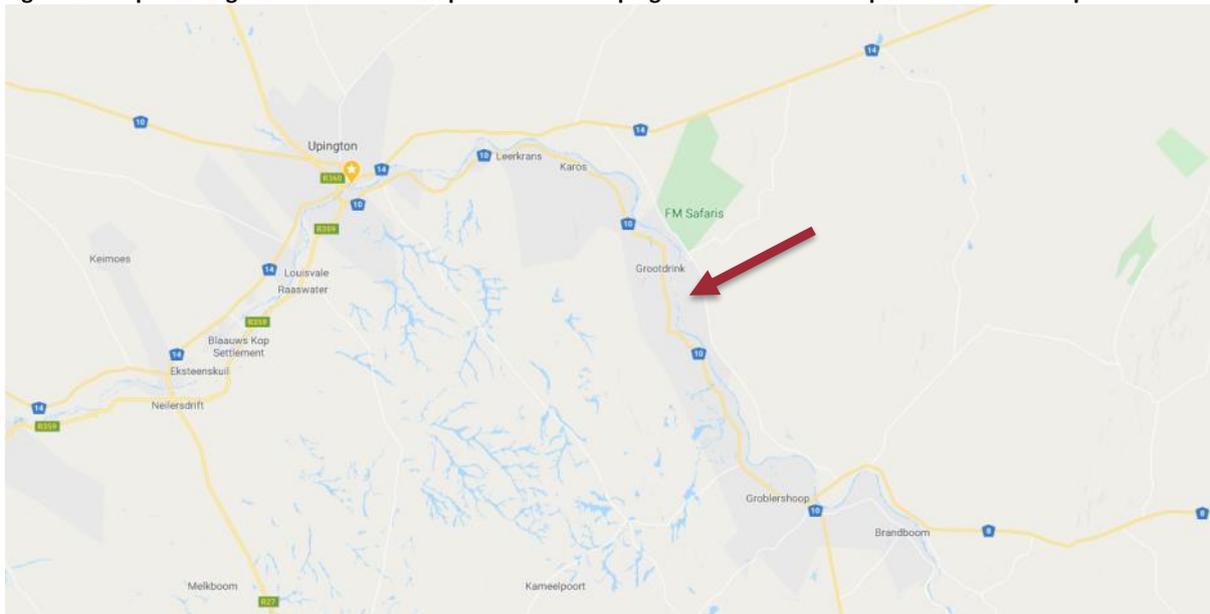


Figure 2: The proposed location of the new erven at Gariiep



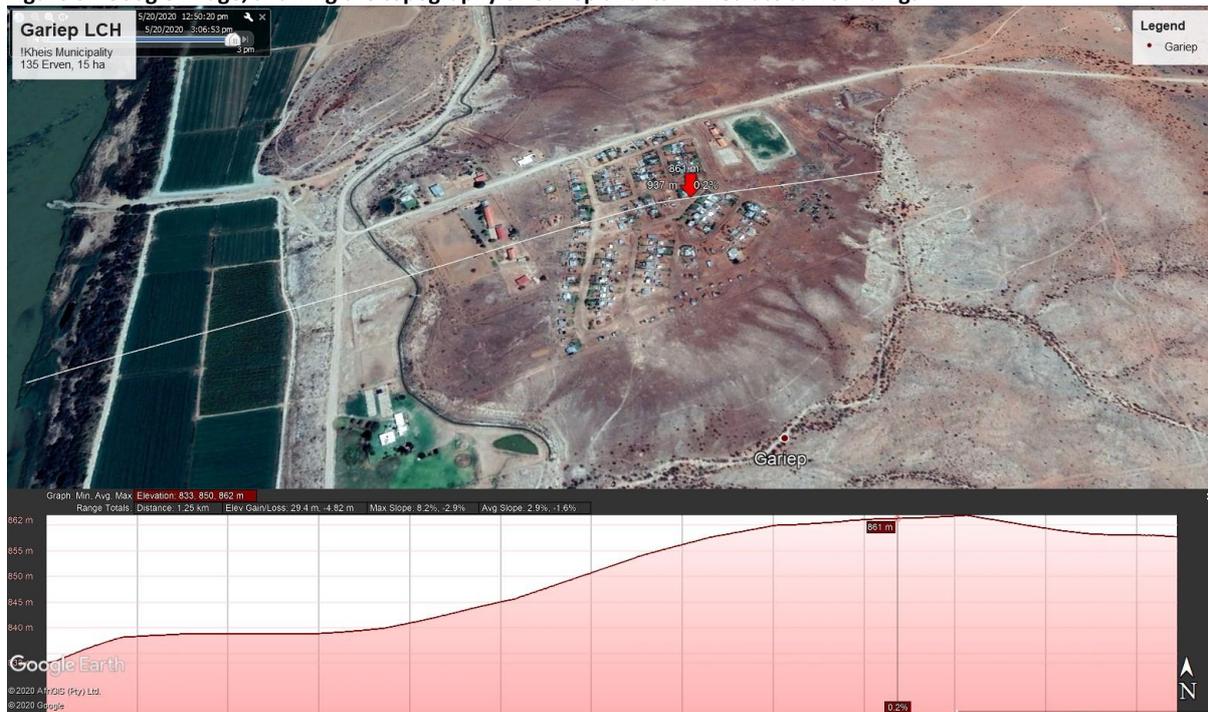
2.2. CLIMATE

All regions with a rainfall of less than 400 mm per year are regarded as arid. Gariep receives less than a 100 mm of rain per year, mainly in mid-summer December to March the highest (40 mm) in February/March, with its lowest rainfall (0 mm) during winter (June to August). It is also important to note that rainfall can be highly erratic and can vary significantly per annum on any specific location. Daily temperatures vary from 23°C – 37°C during the hot summer months (December / January) and drops down to between 8°C - 17°C during the colder winter months (June – July) (www.worldweatheronline.com).

2.3. TOPOGRAPHY & SOILS

The Gariep settlement is located on top of a small koppies or hill, surrounded by smaller drainage lines which drain the landscape towards the Orange River (Figure 3). The average slope is about 3%, with a maximum slope of about 8%. What is interesting (and differ from the soils of all the other sites done as part of the !Kheis LCH project) is that the presence of banded iron stones, which dominates the soils. The rounded shape (eroded by water) of the banded iron stones, suggest that it is river deposits, but both calcrete and quartz stones were observed in between the banded iron stones.

Figure 3: Google image, showing the topography of Gariep and its immediate surroundings



According to Mucina & Rutherford (2006), the geology for Bushmanland Arid Grassland vegetation is dominated by mudstones and shales of the Ecca Group (Prince Albert and Volksrust Formations) and Dwyka tillites, both of the early Karoo age. About 20% of rock outcrops are formed by Jurassic intrusive dolerite sheets and dykes. The soils are described as soils with minimal development, usually shallow on hard or weathering rock, Glenrosa and Mispah forms, with lime generally present in the entire landscape (Fc land type) and, to a lesser extent, red-yellow apedal, freely drained soils with a high base status and usually <15% clay (Ah and Ai land types) are also found. The salt content in these soils is very high. The soils on site were generally shallow on weathering rock with high quartz and calcrete content.

3. EVALUATION METHOD

Desktop studies coupled with a site visit were performed. The site visit was conducted on the 20th of May 2020. The timing of the site visit was reasonable in that, even though the veld was very dry, almost all perennial plants were identifiable.

It is important to note that the Northern Cape is currently in the midst of one of its worst drought periods in a long time, and although some summer rains had fallen (deducted from the presence of a number of grass species) it was not yet enough to really trigger a display of annual herbs.

Figure 4: The proposed footprint and route walked (blue line within the site)



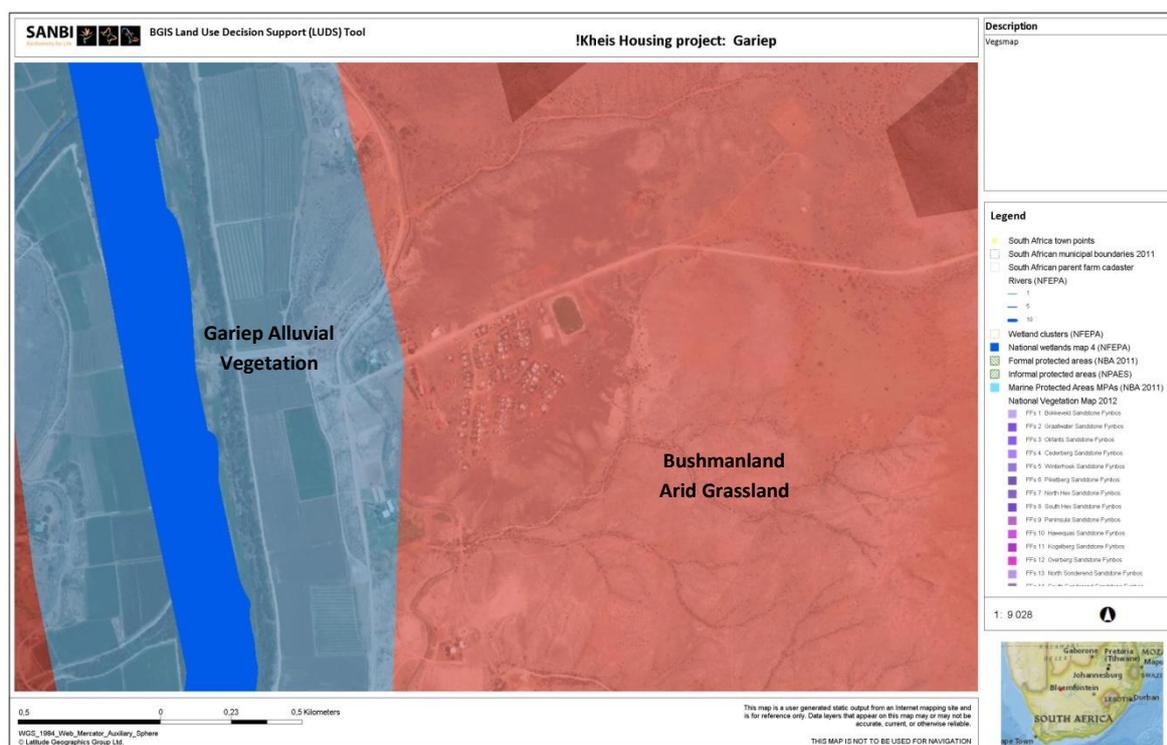
However, the author is confident that a fairly good understanding of the biodiversity status of the site was obtained. The survey was conducted by walking the site and examining, marking and photographing any area of interest. Confidence in the findings is high. During the site visit the author endeavoured to identify and locate all significant biodiversity features, special plant species and or specific soil conditions which might indicate special botanical features (e.g. rocky outcrops or silcrete patches).

4. THE VEGETATION

The Northern Cape contains about 3500 plant species in 135 families and 724 genera, with about 25% of this flora endemic to the region. It is also home to an exceptionally high level of insect and reptile endemism, with new species still being discovered. However, it must be noted that this remarkable diversity is not distributed evenly throughout the region, but is concentrated in many local centres of endemism. The Karoo used to support millions of antelope, mainly springbuck, but also numerous other larger antelope (and other grazing animal). These animals roamed the vast plains of the Karoo, utilizing different selections of plants and allowing for long “rest” periods as they move around, and as a result preventing overgrazing (Shearing, 1994).

The Gariep area would be classified as a desert region. In accordance with the Vegetation map of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006, as updated in the 2012 beta version) two broad vegetation types might be expected within the proposed footprint, namely **Bushmanland Arid Grassland** and **Gariep Alluvial Vegetation** (Figure 5). The Grassland vegetation type type is classified as “Least Threatened”, but Gariep Alluvial Vegetation is considered “**Endangered**” (GN 1002, December 2011). However, the site visit confirmed that the proposed footprint were elevated out of the Orange River Alluvial floodplain and did not support Lower Gariep Alluvial Vegetation.

Figure 5: Vegetation map of South Africa (2012 beta 2 version), showing the expected vegetation types



4.1. THE VEGETATION IN CONTEXT

4.1.1. Nama-Karoo Biome

Bushmanland Arid Grassland is part of the Nama-Karoo Biome, which is a large arid landlocked region on the central plateau of the western half of South Africa, extending into Namibia. It is flanked by the Succulent Karoo to the west and south, desert to the northwest, arid Kalahari Savanna to the north, Grassland to the northeast, Albany Thicket to the southeast and small parts of Fynbos to the south. In South Africa, only the Desert Biome has a higher variability in annual rainfall and only the Kalahari Savanna greater extremes in

temperature. The Nama-Karoo receives most of its rainfall in summer, especially in late summer (Mucina *et. al.*, 2006).

Climate is essentially continental and with almost no effect of the ameliorating influences of the oceans. Rainfall is low and unreliable, peaking in March. Droughts are unpredictable and often prolonged. Summers are hot and winters cold with temperature extremes ranging from -5°C in winter to 43°C in summer. However, rainfall intensity can be high (e.g. episodic thunderstorm and hail storm events). This coupled with the generally low vegetation cover associated with aridity and grazing pressure by domestic stock over the last two centuries, raises the potential for soil erosion. In semi-arid environments such as the Nama-Karoo, nutrients are generally located near the soil surface, making it vulnerable to sheet erosion (Mucina *et. al.*, 2006). In contrast with the Succulent Karoo, the Nama-Karoo is not particularly rich in plant species and does not contain any centre of endemism. Local endemism is very low, which might indicate a relative youthful biome linked to the remarkable geological and environmental homogeneity of the Nama-Karoo. Rainfall seasonality and frequency are too unpredictable and winter temperatures too low to enable leaf succulent dominance (as in the Succulent Karoo). It is also too dry in summer for dominance by perennial grasses alone and the soils generally too shallow and rainfall too low for dominance by trees. But soil type, soil depth and local differences in moisture availability can cause abrupt changes in vegetation structure and composition (e.g. small drainage lines support more plant species than surrounding plains) (Mucina *et. al.*, 2006).

4.2. VEGETATION ENCOUNTERED

The proposed development footprint is about 15 ha in size (marked as 3 separate areas in Figure 6). Site 1 is located along the west and south-western corner of Gariep, Site 2 to the south and west of Gariep and Site 3 to the north of Gariep (Figure 6). Of this footprint about 4.16 ha are either disturbed or already settled. The remainder of the site supported a very dry and reduced vegetation layer. Site 1 still supported remaining natural veld in relative good condition, but Site 2 & 3 were much more disturbed and only supported a disturbed and very sparse vegetation layer.

Figure 6: An overview of the site, showing most significant disturbed areas



4.2.1. Existing disturbance footprint

Figure 6 gives an overview of the disturbed areas, which includes;

- Purple areas: Are as already settled or being settled, about 3.27 ha in size (Photo 1 – Photo 4).
- Orange areas: Areas of physical disturbance, which include areas excavated or areas where spoil and other material were dumped (stored), about 1.87 ha in size (Photo 5 to **Error! Reference source not found.**);



Photo 1: Some of the areas already settled in Site 2, the southern portion of the proposed footprint (Figure 6), looking west to east.



Photo 2: Looking into Gariep from south to north, from southern part of the footprint (purple area to the south in Site 2 of Figure 6).



Photo 3: Goat and sheep pens encountered in the eastern portion of the proposed new site (purple area to the east in Site 2 of Figure 6).



Photo 4: Some of the spoil heaps encountered to the north east of the new proposed footprint (Orange area in Site 2 of Figure 6).



Photo 5: Further disturbance visible in the area marked with Orange in Figure 6 (The north eastern corner of Site 2).



Photo 6: Showing some of the disturbed areas within Site 3 (Orange area to the north of Gariép Figure 6), looking from east to west.



Photo 7: Another of the disturbed areas within Site 3 (Figure 6), also looking from east to west.

4.2.2. Remaining natural veld

Of the 3 sites, only Site 1 still supports indigenous vegetation of some note. To the east (below the school grounds) the veld was generally degraded and criss-crossed by numerous footpaths and grazing paths. However, it was also in this area that Lower Gariep Alluvial Vegetation was expected. However, the site was physically elevated above the Orange River floodplain (about 6 – 10 m higher than the edge of the Orange River), and the vegetation encountered conformed more to what is expected to be found in Bushmanland Arid Grassland. Still in areas with slightly deeper soils (Photo 9) a number of *Boscia albitrunca* shrubs and even a few *Vachellia erioloba* trees were observed within the narrow area between the school grounds and the concrete water channel marking the edge of this site. However, most of site was covered by a sparse low shrubland on shallow soils (Photo 8).



Photo 8: Typical sparse shrubland dominated on shallow soils, south of the school grounds in Site 1.



Photo 9: One of the bush clumps observed on Site 1 (Note the slightly deeper sandy soils in this area).

Unfortunately, the Sheppard trees (*Boscia albitrunca*) encountered were in very poor condition (mostly reduced to shrubby individuals less than 1.5 m in height) (Photo 10). The two (2) Camel thorn (*Vachellia erioloba*) trees were both relatively young (approximately 1.8 m in height) (Photo 11). *Senegalia mellifera* were also observed in bush clumps together with other larger shrubs like *Phaeoptilum spinosum*, *Cynanchum viminalis* and *Rhigozum trichotomum* and the disturbance indicator *Mesembryanthemum subnodosum*.

The alien invasive *Prosopis* tree was also commonly observed and is in process of becoming a serious invader in this area.



Photo 10: Two of the *Boscia albitrunca* individuals observed in Site 1. Note the poor condition of the plants.



Photo 11: One of relative young *Vachellia erioloba* individual observed in Site 1.

Site 1 was characterised by shallow rocky soils dominated by banded iron deposits (Photo 12), but calcrete and quarts were also observed. The vegetation can be described as a low open shrubland (<0.75 m in height) dominated by white grasses and the shrubs *Aptosimum spinescens*, *Justicia australis* and *Tetraena decumbens*. It must be pointed out, that even though grasses were present (indicating at least some recent rains), the vegetation still seemed to be very stressed as result of the recent drought. The dried-out remains of many shrubs were observed, while many plants were only recognisable from seedpods on dried out remains (e.g. *Aptosimum spinescens*). As a result species diversity were low, but the following plants were also observed in this patch of land namely: a low growing shrub that is likely to be *Aptosimum albomarginatum*, *Blepharis*

mitrata, *Geigeria ornativa*, *Kleinia longiflora*, *Leucosphaera bainesii*, and even the low growing herb *Limeum aethiopicum*, *Rogeria longiflora* and *Tetraena rigida*.



Photo 12: Typical veld observed in the south western corner of Site 1. Note the white grass dominated low shrubland.

The vegetation in Site 2 and 3 (Photo 13 & Photo 14) was mostly reduced to an open trampled terrain with only a very sparse low shrubland remaining. Species diversity was again very low, which is most probably the result of continuous overgrazing, the effect being so near to the urban edge coupled with the current drought conditions. Grasses were less common and the vegetation seemed to be reduced to hardy or pioneer species.



Photo 13: A photo of the vegetation encountered on the eastern slope of Site 2. Note the calcrete outcrops between the banded iron deposits.



Photo 14: Vegetation encountered in the eastern portion of Site 2. Note the low growing *Senegalia mellifera*, with the close cropped remains of *Aptosimum spinescens* and *Tetraena decumbens* in between.

Along the western portion of Site 2, some areas (near to the livestock pens) were becoming increasingly overgrown with the alien invasive *Prosopis* tree (Photo 15Error! Reference source not found.).



Photo 15: Denser stands of *Senegalia mellifera* associated with one of the drainage lines

Large portions of Site 3 were disturbed or levelled at some stage and the disturbance is still very evident. The remainder of the site was covered in a very sparse shrubland dominated by short white grasses. As with the other two sites, species diversity was very low, with only a few plant species observed (no doubt a number of species were not visible as a result of the on-going drought). The vegetation also differed slightly from that found on the south western corner of Site 1 in species composition. The veld now seems to be dominated by *Aptosimum spinescens*, with *Justicia australis* and *Tetraena decumbens* less dominant (although still present). A plant that is believed to be *Aptosimum albomarginatum* (difficult to be sure because of a lack of flowers and the plants were usually very dry) was also prominent. *Leucosphaera bainesii*, *Rhigozum trichotomum*, *Rogeria longiflora* and *Senegalia mellifera* were still encountered, while the following plants were now observed for the first time: *Aloe claviflora*, *Aizoon burchellii*, *Euphorbia braunsii*, *Quaqua species* (3 individuals observed) *Salsola zeyheri* and *Tetraena microcarpa*.



Photo 16: Typical vegetation observed near the disturbed areas of Site 3. Note the *Boscia albitrunca* individual in the foreground.



Photo 17: Vegetation encountered on the lower slopes of the small hill in the north western corner of Site 3 (looking back towards Gariep).

Scattered over Site 3 a few individuals of *Boscia albitrunca* were again observed. But the most notably of these were the two *Boscia albitrunca* (Photo 18) and the two *Vachellia erioloba* trees (Photo 19) observed in the far western corner of Site 3, in between existing buildings.

Along the lower slopes nearer to the ephemeral drainage lines *Senegalia mellifera* became more prominent (denser and higher) while species like *Parkinsonia africana* were also observed (though not in the footprint).



Photo 18: One of the more impressive Sheppard trees (*Boscia albitrunca*) observed in the valley between buildings in Site 3.



Photo 19: One of the *Vachellia erioloba* (Camel Thorn) trees observed in the valley between buildings in Site 3.

4.3. CRITICAL BIODIVERSITY AREAS MAPS

The Northern Cape CBA Map (2016) identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape as a whole (Holness & Oosthuysen, 2016). The 2016 Northern Cape Critical Biodiversity Area (CBA) Map updates, revises and replaces all older systematic biodiversity plans and associated products for the province (including the Namakwa District Biodiversity Sector Plan, 2008). Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, National Estuary Priorities, and the National Freshwater Ecosystem Priority Areas were incorporated. Targets

for terrestrial ecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes.

Critical biodiversity areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI 2007). The primary purpose of CBA's is to inform land-use planning in order to promote sustainable development and protection of important natural habitat and landscapes. CBA's can also be used to inform protected area expansion and development plans.

- **Critical biodiversity areas (CBA's)** are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.
- **Ecological support areas (ESA's)** are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.

Figure 7: The Northern Cape Critical Biodiversity Areas Map (2016) showing the proposed development



From a land-use planning perspective it is useful to think of the difference between CBA's and ESA's in terms of where in the landscape the biodiversity impact of any land-use activity action is most significant:

- For CBA's the impact on biodiversity of a change in land-use that results in a change from the desired ecological state is most significant locally at the point of impact through the direct loss of a biodiversity feature (e.g. loss of a populations or habitat).

- For ESA's a change from the desired ecological state is most significant elsewhere in the landscape through the indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway (e.g. removing a corridor results in a population going extinct elsewhere or a new plantation locally results in a reduction in stream flow at the exit to the catchment which affects downstream biodiversity).

According to the Northern Cape CBA map (Figure 7), the proposed development falls within a **terrestrial CBA**. However, there is no alternative site within the Municipal town boundaries that is not located within the CBA.

4.4. POTENTIAL IMPACT ON CENTRES OF ENDEMISM

The proposed development will not impact on any recognised centre of endemism (Van Wyk & Smith, 2001).

4.5. FLORA ENCOUNTERED

Table 2 gives a list of the plant species encountered during this study. Because of the limitations (timing and a single site visit as well as the drought) it is likely that a number of annuals might have been missed.

Table 1: List of indigenous species encountered within or near the proposed footprint

No.	Species name	FAMILY	Status	Alien & invader plant (AIP)
1.	<i>Aizoon burchellii</i>	AIZOACEAE	Not evaluated NCNCA, Schedule 2 Protected (all species in this Family)	Apply for a NCNCA Flora permit (DENC)
2.	<i>Aloe claviflora</i>	ASPODELACEAE	LC NCNCA, Schedule 2 Protected (all species in this Family)	Apply for a NCNCA Flora permit (DENC)
3.	<i>Aptosimum albomarginatum</i>	SCROPHULARIACEAE	LC	
4.	<i>Aptosimum spinescens</i>	SCROPHULARIACEAE	LC	
5.	<i>Blepharis mitrata</i>	ACANTHACEAE	LC	
6.	<i>Boscia albitrunca</i>	BRASSICACEAE (CAPPARACEAE)	LC NFA protected species NCNCA, Schedule 2 Protected (all species of Boscia)	Apply for a NFA Tree permit (DAFF) Apply for a NCNCA Flora permit (DENC)
7.	<i>Cynanchum viminale</i> (=Sarcostemma viminale)	APOCYNACEAE	LC NCNCA, Schedule 2 Protected (all species in this Family)	Apply for a NCNCA Flora permit (DENC)
8.	<i>Euphorbia braunsii</i>	EUPHORBIACEAE	LC NCNCA, Schedule 2 Protected (all species in this Genus)	Apply for a NCNCA Flora permit (DENC)
9.	<i>Geigeria ornativa</i>	ASTERACEAE	LC	
10.	<i>Justicia australis</i> (=Monechma genistifolium)	ACANTHACEAE	LC	
11.	<i>Kleinia longiflora</i>	ASTERACEAE	LC	
12.	<i>Leucosphaera bainesii</i>	AMARANTHACEAE	LC	
13.	<i>Limeum aethiopicum</i>	LIMEACEAE	NE (not evaluated)	
14.	<i>Mesembryanthemum subnodosum</i> (=Psilocalaon subnodosum)	AIZOACEAE	LC NCNCA, Schedule 2 Protected (all species in this Genus)	Apply for a NCNCA Flora permit (DENC)
15.	<i>Phaeoptilum spinosum</i>	NYCTAGINACEAE	LC	
16.	<i>Quaqua</i> species	APOCYNACEAE		

No.	Species name	FAMILY	Status	Alien & invader plant (AIP)
17.	<i>Rhigozum trichotomum</i>	BIGONACEAE	LC	
18.	<i>Rogeria longiflora</i>	PEDALIACEAE	LC	
19.	<i>Salsola zeyheri</i>	AMARANTHACEAE	LC	
20.	<i>Senegalia mellifera</i> (=Acacia mellifera)	FABACEAE	LC	
21.	<i>Tetraena decumbens</i> (=Zygophyllum decumbens)	ZYGOPHYLLACEAE	LC	
22.	<i>Tetraena microcarpa</i> (=Zygophyllum microcarpum))	ZYGOPHYLLACEAE	LC	
23.	<i>Tetraena rigida</i> (=Zygophyllum rigidum)	ZYGOPHYLLACEAE	LC	
24.	<i>Vachellia erioloba</i>	FABACEAE	LC NFA protected species	Apply for a NFA Tree permit (DAFF)

4.6. THREATENED AND PROTECTED PLANT SPECIES

South Africa has become the first country to fully assess the status of its entire flora. Major threats to the South African flora are identified in terms of the number of plant taxa Red-Listed as threatened with extinction as a result of threats like, habitat loss (e.g. infrastructure development, urban expansion, crop cultivation and mines), invasive alien plant infestation (e.g. outcompeting indigenous plant species), habitat degradation (e.g. overgrazing, inappropriate fire management etc.), unsustainable harvesting, demographic factors, pollution, loss of pollinators or dispersers, climate change and natural disasters (e.g. such as droughts and floods). South Africa uses the internationally endorsed IUCN Red List Categories and Criteria in the Red List of South African plants. However, due to its strong focus on determining risk of extinction, the IUCN system does not highlight species that are at low risk of extinction, but may nonetheless be of high conservation importance. As a result a SANBI uses an amended system of categories in order to highlight species that may be of low risk of extinction but are still of conservation concern (SANBI, 2015).

In the Northern Cape, species of conservation concern are also protected in terms of national and provincial legislation, namely:

- The National Environmental Management: Biodiversity Act, Act 10 of 2004, provides for the protection of species through the “*Lists of critically endangered, endangered, vulnerable and protected species*” (GN. R. 152 of 23 February 2007).
- National Forest Act, Act 84 of 1998, provides for the protection of forests as well as specific tree species through the “*List of protected tree species*” (GN 908 of 21 November 2014).
- Northern Cape Nature Conservation Act, Act of 2009, provides for the protection of “*specialty protected species*” (Schedule 1), “*protected species*” (Schedule 2) and “*common indigenous species*” (Schedule 3).

4.6.1. Red list of South African plant species

The Red List of South African Plants online provides up to date information on the national conservation status of South Africa’s indigenous plants (SANBI, 2015).

- **No red-listed species** was observed.

4.6.2. NEM: BA protected plant species

The National Environmental Management: Biodiversity Act, Act 10 of 2004, provides for the protection of species through the "Lists of critically endangered, endangered, vulnerable and protected species" (GN. R. 152 of 23 February 2007).

- **No NEM: BA protected species was observed.**

4.6.3. NFA Protected plant species

The National Forests Act (NFA) of 1998 (Act 84 of 1998) provides for the protection of forests as well as specific tree species (as updated).

- **Two species protected in terms of the NFA** was observed, namely ***Vachellia erioloba*** and ***Boscia albitrunca***. Table 2 and Figure 8 give locations for each tree as well as recommendations for impact minimisation. A NFA permit as well as a NCNCA permit will be required for the removal of these plants.

Table 2: Location of NFA protected trees observed within or near the footprint

NO.	SPECIES NAME	COMMENTS	RECOMMENDATIONS
037 B albi	<i>Boscia albitrunca</i> S28° 36' 49.3" E21° 46' 41.7"	3 x Shrubs 1.5, 1.2 & 2 m in height.	To be protected A NFA & NCNCA permit required for removal.
038 B albi	<i>Boscia albitrunca</i> S28° 36' 50.0" E21° 46' 42.9"	2 x Shrubs 1.6 & 0.6 m in height.	To be protected A NFA & NCNCA permit required for removal.
039 B albi	<i>Boscia albitrunca</i> S28° 36' 50.4" E21° 46' 43.0"	2 x Shrubs 0.4 & 2.1 m in height.	To be protected A NFA & NCNCA permit required for removal.
040 B albi	<i>Boscia albitrunca</i> S28° 36' 51.6" E21° 46' 43.2"	Shrubs 1.6 m in height.	To be protected A NFA & NCNCA permit required for removal.
041 V erio	<i>Vachellia erioloba</i> S28° 36' 52.4" E21° 46' 43.7"	Medium sized tree (1.8 m tall) in good condition	To be protected A NFA permit required for removal.
042 V erio	<i>Vachellia erioloba</i> S28° 36' 52.0" E21° 46' 43.9"	Medium sized tree (1.8 m tall) in good condition.	To be protected A NFA permit required for removal.
043 B albi	<i>Boscia albitrunca</i> S28° 36' 53.2" E21° 46' 44.1"	Shrubs 0.4 m in height (poor condition).	To be protected A NFA & NCNCA permit required for removal.
044 B albi	<i>Boscia albitrunca</i> S28° 36' 37.1" E21° 47' 00.6"	Tree (2 m tall) in poor condition.	To be protected A NFA permit required for removal.
045 B albi	<i>Boscia albitrunca</i> S28° 36' 42.6" E21° 46' 44.7"	Large tree (3 m tall) in good condition (Photo 18)	To be protected A NFA & NCNCA permit required for removal.
046 V erio	<i>Vachellia erioloba</i> S28° 36' 43.1" E21° 46' 45.0"	Medium sized tree (3 m tall) in good condition.	To be protected A NFA permit required for removal.
047 B albi	<i>Boscia albitrunca</i> S28° 36' 43.3" E21° 46' 45.5"	Shrubs 1.5 m in height.	To be protected A NFA & NCNCA permit required for removal.
048 V erio	<i>Vachellia erioloba</i> S28° 36' 44.0" E21° 46' 45.7"	Medium sized tree (2.5 m tall) in good condition.	To be protected A NFA permit required for removal.

Figure 8: Google image showing the location of the protected trees encountered



4.6.4. NCNCA protected plant species

The Northern Cape Nature Conservation Act 9 of 2009 (NCNCA) came into effect on the 12th of December 2011, and also provides for the sustainable utilization of wild animals, aquatic biota and plants. Schedule 1 and 2 of the act give extensive lists of specially protected and protected fauna and flora species in accordance with this act. NB. Please note that all indigenous plant species are protected in terms of Schedule 3 of this act (e.g. any work within a road reserve).

- The following species protected in terms of the NCNCA were encountered. Recommendations on impact minimisation also included.

Table 3: Plant species protected in terms of the NCNCA encountered within the study area

NO.	SPECIES NAME	COMMENTS	RECOMMENDATIONS
1.	<i>Aizoon burchellii</i> Schedule 2 protected		Species protection through topsoil conservation.
2.	<i>Aloe claviflora</i> Schedule 2 protected	Very common throughout the site	Very common plant in this area. Protection through topsoil conservation.
3.	<i>Boscia albitrunca</i> Schedule 2 protected		Refer to Table 2.
4.	<i>Cynanchum viminale</i> Schedule 2 protected	Occasionally observed within the footprint.	Larger <i>Cynanchum</i> plants are expected to transplant poorly. Species protection through topsoil conservation.
5.	<i>Euphorbia braunsii</i> Schedule 2 protected		Search & rescue: Occasionally observed. Individuals within footprint to be transplanted to surrounding area.

5. IMPACT ASSESSMENT METHOD

The objective of this study was to evaluate the botanical diversity of the property area in order to identify significant environmental features which might have been impacted as a result of the development. The Ecosystem Guidelines for Environmental Assessment (De Villiers *et. al.*, 2005), were used to evaluate the botanical significance of the property with emphasis on:

- Significant ecosystems
 - Threatened or protected ecosystems
 - Special habitats
 - Corridors and or conservancy networks
- Significant species
 - Threatened or endangered species
 - Protected species

5.1. DETERMINING SIGNIFICANCE

Determining impact significance from predictions of the nature of the impact has been a source of debate and will remain a source of debate. The author used a combination of scaling and weighting methods to determine significance based on a simple formula. The formula used is based on the method proposed by Edwards (2011). However, the criteria used were adjusted to suite its use for botanical assessment. In this document significance rating was evaluated using the following criteria (Refer to Table 4).

$$\text{Significance} = \text{Conservation Value} \times (\text{Likelihood} + \text{Duration} + \text{Extent} + \text{Severity}) \text{ (Edwards 2011)}$$

Table 4: Categories and criteria used for the evaluation of the significance of a potential impact

ASPECT / CRITERIA	LOW (1)	MEDIUM/LOW (2)	MEDIUM (3)	MEDIUM/HIGH (4)	HIGH (5)
CONSERVATION VALUE Refers to the intrinsic value of an attribute or its relative importance towards the conservation of an ecosystem or species or even natural aesthetics. Conservation status is based on habitat function, its vulnerability to loss and	The attribute is transformed, degraded not sensitive (e.g. Least threatened), with unlikely possibility of species loss.	The attribute is in good condition but not sensitive (e.g. Least threatened), with unlikely possibility of species loss.	The attribute is in good condition, considered vulnerable (threatened), or falls within an ecological support area or a critical biodiversity area, but with	The attribute is considered endangered or, falls within an ecological support area or a critical biodiversity area, or provides core habitat for endemic or rare &	The attribute is considered critically endangered or is part of a proclaimed provincial or national protected area.

ASPECT / CRITERIA	LOW (1)	MEDIUM/LOW (2)	MEDIUM (3)	MEDIUM/HIGH (4)	HIGH (5)
fragmentation or its value in terms of the protection of habitat or species			unlikely possibility of species loss.	endangered species.	
LIKELIHOOD Refers to the probability of the specific impact occurring as a result of the proposed activity	Under normal circumstances it is almost certain that the impact will not occur.	The possibility of the impact occurring is very low, but there is a small likelihood under normal circumstances.	The likelihood of the impact occurring, under normal circumstances is 50/50, it may or it may not occur.	It is very likely that the impact will occur under normal circumstances.	The proposed activity is of such a nature that it is certain that the impact will occur under normal circumstances.
DURATION Refers to the length in time during which the activity is expected to impact on the environment.	Impact is temporary and easily reversible through natural process or with mitigation. Rehabilitation time is expected to be short (1-2 years).	Impact is temporary and reversible through natural process or with mitigation. Rehabilitation time is expected to be relative short (2-5 years).	Impact is medium-term and reversible with mitigation, but will last for some time after construction and may require on-going mitigation. Rehabilitation time is expected to be longer (5-15 years).	Impact is long-term and reversible but only with long term mitigation. It will last for a long time after construction and is likely to require on-going mitigation. Rehabilitation time is expected to be longer (15-50 years).	The impact is expected to be permanent.
EXTENT Refers to the spatial area that is likely to be impacted or over which the impact will have influence, should it occur.	Under normal circumstances the impact will be contained within the construction footprint.	Under normal circumstances the impact might extent outside of the construction site (e.g. within a 2 km radius), but will not affect surrounding properties.	Under normal circumstances the impact might extent outside of the property boundaries and will affect surrounding land owners or – users, but still within the local area (e.g. within a 50 km radius).	Under normal circumstances the impact might extent to the surrounding region (e.g. within a 200 km radius), and will regional land owners or –users.	Under normal circumstances the effects of the impact might extent to a large geographical area (>200 km radius).
SEVERITY Refers to the direct physical or biophysical impact of the activity on the surrounding environment should it occur.	It is expected that the impact will have little or no affect (barely perceptible) on the integrity of the surrounding environment. Rehabilitation not needed or easily achieved.	It is expected that the impact will have a perceptible impact on the surrounding environment, but it will maintain its function, even if slightly modified (overall integrity not compromised). Rehabilitation easily achieved.	It is expected that the impact will have an impact on the surrounding environment, but it will maintain its function, even if moderately modified (overall integrity not compromised). Rehabilitation easily achieved.	It is expected that the impact will have a severe impact on the surrounding environment. Functioning may be severely impaired and may temporarily cease. Rehabilitation will be needed to restore system integrity.	It is expected that the impact will have a very severe to permanent impact on the surrounding environment. Functioning irreversibly impaired. Rehabilitation often impossible or unfeasible due to cost.

5.2. SIGNIFICANCE CATEGORIES

The formal NEMA EIA application process was developed to assess the significance of impacts on the surrounding environment (including socio-economic factors), associated with any specific development proposal in order to allow the competent authority to make informed decisions. Specialist studies must advise the environmental assessment practitioner (EAP) on the significance of impacts in his field of specialty. In order to do this, the specialist must identify all potentially significant

environmental impacts, predict the nature of the impact and evaluate the significance of that impact should it occur. Potential significant impacts are evaluated, using the method described above, in order to determine its potential significance. The potential significance is then described in terms of the categories given in Table 5.

Table 5: Categories used to describe significance rating (adjusted from DEAT, 2002)

SIGNIFICANCE	DESCRIPTION
Insignificant or Positive (4-22)	There is no impact or the impact is insignificant in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site, or the impact may be positive.
Low (23-36)	An impact barely noticeable in scale or magnitude as a result of low sensitivity to change or low intrinsic value of the site, or will be of very short-term or is unlikely to occur. Impact is unlikely to have any real effect and no or little mitigation is required.
Medium Low (37-45)	Impact is of a low order and therefore likely to have little real effect. Mitigation is either easily achieved. Social, cultural and economic activities can continue unchanged, or impacts may have medium to short term effects on the social and/or natural environment within site boundaries.
Medium (46-55)	Impact is real, but not substantial. Mitigation is both feasible and fairly easily possible, but may require modification of the project design or layout. Social, cultural and economic activities of communities may be impacted, but can continue (albeit in a different form). These impacts will usually result in medium to long term effect on the social and/or natural environment, within site boundary.
Medium high (56-63)	Impact is real, substantial and undesirable, but mitigation is feasible. Modification of the project design or layout may be required. Social, cultural and economic activities may be impacted, but can continue (albeit in a different form). These impacts will usually result in medium to long-term effect on the social and/or natural environment, beyond site boundary within local area.
High (64-79)	An impact of high order. Mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural and economic activities of communities are disrupted and may come to a halt. These impacts will usually result in long-term change to the social and/or natural environment, beyond site boundaries, regional or widespread.
Unacceptable (80-100)	An impact of the highest order possible. There is no possible mitigation that could offset the impact. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt. The impact will result in permanent change. Very often these impacts cannot be mitigated and usually result in very severe effects, beyond site boundaries, national or international.

6. DISCUSSING BOTANICAL SENSITIVITY

The aim of impact assessment is to determine the vulnerability of a habitat to a specific impact. In order to do so, the sensitivity of the habitat should be determined by identifying and assessing the most significant environmental aspects of the site against the potential impact(s). For this development the following biodiversity aspects was considered:

- **Location:** The proposed development footprint is located on Municipal property, next to the existing town. Portions of the proposed footprint had already been settled.
- **Activity:** The proposed activity is expected to result in a permanent transformation of approximately 15 ha of land, of which more than 70% is still covered by disturbed indigenous vegetation.
- **Geology & Soils:** No special features such as true quartz patches or heuweltjies were observed in or near to the larger footprint area that may result in specialised plant habitat.
- **Land use and cover:** The footprint is on municipal land in close proximity to the town of Gariep. About 30% of the footprint is disturbed or already settled. The area is grazed by livestock, which can be seen in the poor condition of many of the plant species (coupled with the recent on-going drought).
- **Vegetation status:** The vegetation is not considered a threatened vegetation type, but conservation targets have not yet been met. Of the 15 ha footprint about 4.16 ha are already disturbed or settled. The remainder of the site supported a very dry and reduced vegetation layer. Site 1 still supported remaining natural veld in relative good condition, but Site 2 & 3 were much more disturbed and only supported a disturbed and very sparse vegetation layer.
- **Conservation priority areas:** According to the Northern Cape CBA maps the proposed site falls within a CBA area. However, there is no alternative on Municipal land that will not impact on the CBA. The site will not impact on any recognised centre of endemism.
- **Connectivity:** The transformation of the site will destroy connectivity on the site, but should not result in a significant impact on the surrounding area, where connectivity is still excellent.
- **Watercourses and wetlands:** Not evaluated in this study as a separate freshwater impact assessment has been commissioned as part of the NEMA EIA process.
- **Protected or endangered plant species:** The most significant botanical aspect of this site is the presence of a 4 protected *Vachellia erioloba* trees and a number of protected Sheppard trees (*Boscia albitrunca*) (refer to Table 2) and a number of Northern Cape Nature Conservation Act, protected species (Refer to Table 3).
- **Alien and Invasive Plant species:** Portions of the site has been heavily invaded by the alien invasive *Prosopis* tree. These plants should be removed responsibly before development commence.

6.1. IMPACT ASSESSMENT

Table 6 rates the significance of environmental impacts associated with the proposed development. It also evaluates the expected accumulative effect of the proposed development as well as the No-Go option.

Table 6: Impact assessment associated with the proposed development

Impact assessment								
Aspect	Mitigation	CV	Lik	Dur	Ext	Sev	Significance	Short discussion
Geology & soils: Potential impact on special habitats (e.g. true quartz or "heuweltjies")	Without mitigation	2	1	5	2	1	18	No special habitats observed.
	With mitigation	2	1	3	1	1	12	Refer to recommendations for NFA- & NCNCA protected plant species (Table 2 & 3).
Landuse and cover: Potential impact on socio-economic activities.	Without mitigation	2	3	5	1	1	20	Permanent transformation of approximately 15ha of indigenous vegetation used for grazing.
	With mitigation	2	2	3	1	1	14	Potential beneficial socio-economic impact (much needed housing project).
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	2	3	5	1	1	20	Permanent transformation of 15 ha of disturbed Bushmanland Arid Grassland (Least Threatened).
	With mitigation	2	2	3	1	1	14	Refer to recommendations for NFA- & NCNCA protected plant species (Table 2 & 3).
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	3	3	5	2	1	33	The development will impact on a proposed CBA. However, there is no alternative location on the property that will not impact on the same CBA.
	With mitigation	2	2	3	1	1	14	Refer to recommendations for NFA- & NCNCA protected plant species (Table 2 & 3).
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	2	3	5	1	1	20	The transformation will destroy connectivity within the site, but will not result in a significant impact on the surrounding area, where connectivity is still excellent
	With mitigation	2	2	3	1	1	14	Refer to recommendations for NFA- & NCNCA protected plant species (Table 2 & 3).
Watercourses and wetlands: Potential impact on natural water courses and it's ecological support areas.	Without mitigation						0	N/a (Refer to the Freshwater specialist report).
	With mitigation						0	
Protected & endangered plant species: Potential impact on threatened or protected plant species.	Without mitigation	3	3	5	2	2	36	A number of protected species were observed, most notably a number of nationally protected tree species.
	With mitigation	2	2	3	1	1	14	Refer to recommendations for NFA- & NCNCA protected plant species (Table 2 & 3).
Invasive alien plant species: Potential invasive plant infestation as a	Without mitigation	3	3	4	2	2	33	For most of the property, only the occasional Prosopis trees were observed. However, towards the northern portions of the site, denser stands were observed.

Impact assessment								
Aspect	Mitigation	CV	Lik	Dur	Ext	Sev	Significance	Short discussion
result of the activities.	With mitigation	2	1	2	1	1	10	Special care must be taken during their removal (in order to avoid re-sprouting).
Veld fire risk: Potential risk of veld fires as a result of the activities.	Without mitigation	1	2	3	2	2	9	Veld fire risk low.
	With mitigation	1	1	1	1	1	4	Address fire danger throughout construction.
Cumulative impacts: Cumulative impact associated with proposed activity.	Without mitigation	3	3	5	2	2	36	Permanent transformation of approximately 49 ha of natural veld for urban development.
	With mitigation	2	2	3	2	2	18	Refer to all the mitigation recommendations above.
The "No-Go" option: Potential impact associated with the No-Go alternative.	Without mitigation	3	3	4	2	2	33	Slow degradation of natural veld as a result of illegal dumping, physical disturbances and grazing practices.
	With mitigation						0	

According to Table 6, the main impacts associated with the proposed development will be:

- The transformation of 15 ha of indigenous vegetation within a proposed CBA; and
- The potential impact on a number of nationally protected trees as well as provincially protected plant species.

However, there is no logical alternative site, located on Municipal land that will not impact on the same CBA. In this case, about 30% of the proposed footprint is already impacted as result of existing settlement and the remaining veld can only be described as disturbed.

The No-Go option is not likely to result in a “no-impact” scenario, as constant slow degradation is expected to continue as a result of urban activities and poor management of the site.

The cumulative impact (even without mitigation) is expected to be **Medium-Low**, which can be reduced to **Low** through mitigation.

7. IMPACT MINIMISATION RECOMMENDATIONS

The proposed development footprint is located on Municipal property, adjacent to existing town developments. The activity is expected to result in a permanent transformation of approximately 15 ha of land, of which approximately 70% is still covered by disturbed indigenous vegetation. The site overlaps an identified critical biodiversity area (according to the 2016, Northern Cape Critical Biodiversity Areas maps). In addition, protected Camel Thorn (*Vachellia erioloba*) and Sheppard trees (*Boscia albitrunca*), and a number of Northern Cape Nature Conservation Act, protected species were observed within the footprint.

According to the impact assessment given in Table 6 the development is likely to result in a **Medium-Low** impact, which can be reduced to a **Low** impact with good environmental control during construction.

With the correct mitigation it is unlikely that the development will contribute significantly to any of the following:

- Significant loss of vegetation type and associated habitat.
- Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to construction and operational activities.
- Loss of local biodiversity and threatened plant species.
- Loss of ecosystem connectivity.

7.1. MITIGATION ACTIONS

The following mitigation actions should be implemented to ensure that the proposed development does not pose a significant threat to the environment:

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must include the recommendations made in this report.
- A suitably qualified Environmental Control Officer must be appointed to monitor the construction phase in terms of the EMP and any other conditions pertaining to specialist studies.
- **Before any work is done** protected tree species must be marked and demarcated (Refer to Table 2).
- **Before any work is done** search & rescue as discussed in Table 3 must be completed.
- Lay-down areas or construction sites must be located within the construction footprint.
- No clearing of any area outside of the construction footprint may be allowed.
- All waste that had been illegally dumped within the footprint must be removed to a Municipal approved waste disposal site.
- An integrated waste management approach must be implemented during construction.
 - Construction related general and hazardous waste may only be disposed of at Municipal approved waste disposal sites.
- Alien invasive *Prosopis* plants within the footprint (and immediate surroundings) must be removed in a responsible way (to ensure against regrowth).
- The Municipality must ensure that adequate waste and sewerage facilities and or services are established to service this community.

8. REFERENCES

- Acocks, J.P.H. 1953.** Veld types of South Africa. *Mem. Bot. Surv. S. Afr.* No. 28: 1-192.
- Anon, 2008.** Guideline regarding the determination of bioregions and the preparation and publication of Bioregional Plans. April 2008. Government Notice No. 291 of 16 March 2009.
- De Villiers C.C., Driver, A., Brownlie, S., Clark, B., Day, E.G., Euston-Brown, D.I.W., Helme, N.A., Holmes, P.M., Job, N. & Rebelo, A.B. 2005.** Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape. Fynbos Forum, c/o Botanical Society of South Africa: Conservation Unit, Kirstenbosch, Cape Town.
- DEAT, 2002.** Impact significance. Integrated Environmental Management, Information series 5. Department of Environmental Affairs and Tourism (DEAT). Pretoria.
- Driver A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. & Maze, K. 2012.** National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria
- Driver, A., Maze, K., Rouget, M., Lombard, A.T., Nel, J.L., Turpie, J.K., Cowling, R.M., Desmet, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K. & Strauss, T. 2005.** National spatial biodiversity assessment 2004: priorities for biodiversity conservation in South Africa. *Strelitzia*, 17. South African National Biodiversity Institute, Pretoria.
- Edwards, R. 2011.** Environmental impact assessment method. Unpublished report for SiVest (Pty) Ltd. Environmental division. 9 May 2011.
- Holness, S. & Oosthuysen, E. 2016.** Critical Biodiversity Areas of the Northern Cape: Technical Report. Available from the Biodiversity GIS website at <http://bgis.sanbi.org/project.asp>
- Le Roux, A. 2015.** Wild flowers of Namaqualand. A botanical society guide. Fourth revised edition. Struik Nature. Cape Town.
- Low, A.B. & Rebelo, A.(T.)G. (eds.) 1996.** *Vegetation of South Africa, Lesotho and Swaziland.* Department of Environmental Affairs and Tourism, Pretoria.
- Manning, J. 2008.** Namaqualand Eco Guide. Briza Publications. Pretoria
- Mucina, L. & Rutherford, M.C. (eds.) 2006.** The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- Mucina, L., Rutherford, M.C., Palmer, A.R., Milton, S.J., Scott, L., Lloyd, J.W., Van der Merwe, B., Hoare, D.B., Bezuidenhout, H., Vlok, J.H.J., Euston-Brown, D.I.W., Powrie, L.W. and Dold, A.P. 2006.** Nama-Karoo Biome. In Mucina, L. & Rutherford, M.C. 2006. (Eds.). *The Vegetation of South Africa. Lesotho & Swaziland.* *Strelitzia* 19. South African National Biodiversity Institute, Pretoria. Pp. 325 – 347.
- NDBSP. 2008.** Namakwa District Biodiversity Sector Plan. A report compiled for the Namaqualand District Municipality in order to ensure that biodiversity information can be accessed and utilized by local municipalities within the Namakwa District Municipality (NDM) to inform land use planning and development as well as decision making processes within the NDM.
- Pool-Starvliet, R. 2017.** Northern Cape Biodiversity Spatial Plan Handbook. Biodiversity GIS Home. <http://bgis.sanbi.org>.
- Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2004.** South Africa National Spatial Biodiversity Assessment 2004: Technical report. Volume 1: Terrestrial Component. Pretoria: South African National Biodiversity Institute.
- Shearing, D. 1994.** Karoo. South African Wild Flower Guide 6. Botanical Society of South Africa. Kirstenbosch.
- South African National Biodiversity Institute. 2006.** South African National Botanical Institute: Biodiversity GIS Home. <http://bgis.sanbi.org> (as updated).
- South African National Biodiversity Institute. 2012.** Vegetation map of South Africa, Lesotho and Swaziland [vector geospatial dataset] 2012.
- South African National Biodiversity Institute. 2015.** Statistics: Red List of South African Plants version (as updated). Downloaded from Redlist.sanbi.org on 2017/06/15.
- Van Wyk, A.E., & Smith, G.F. 2001.** Regions of floristic endemism in South Africa. A review with emphasis on succulents. Umdaus press. Hatfield.

APPENDIX 1: COMPLIANCE WITH APPENDIX 6 OF GN. NO. 982 (4 DECEMBER 2014)

Specialist reports

1. A specialist report prepared in terms of these regulations must contain -	
	Refer to:
a) Details of –	
(i) The specialist who prepared the report; and	Refer to Page ii & Appendix 2
(ii) The expertise of the specialist to compile a specialist report including a curriculum vitae;	Refer to Appendix 2
b) A declaration that the specialist is independent in a form as may be specified by the competent authority;	Refer to Page ii
c) An indication of the scope of, and the purpose for which the report was prepared;	Refer to Heading 1.1
d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Refer to Heading 3
e) A description of the methodology adopted in preparing the report or carrying out the specialist process inclusive of equipment and modelling used;	Refer to Heading 3
f) Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructures, inclusive of a site plan identifying site alternatives;	Refer to Headings 4.1, 4.2, 4.3, 4.4, 4.6.
g) An identification of any areas to be avoided, including buffers;	Refer to Figure 8
h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Refer to Figure 8
i) A description of any assumptions made and any uncertainties or gaps of knowledge;	Refer to Heading 3
j) A description of the findings and potential implications of such findings on the impact of the proposed activity, [including identified alternatives on the environment] or activities;	Refer to Heading 6
k) Any mitigation measures for inclusion in the EMPr;	Refer to Heading 7.1
l) Any conditions for inclusion in the environmental authorization;	None
m) Any monitoring requirements for inclusion in the EMPr or environmental authorization;	Refer to Heading 7.1
n) A reasoned opinion -	
(i) [as to] whether the proposed activity, activities or portions thereof should be authorized;	Refer to the "Main conclusion" within the executive summary (Page i)
(iA) regarding the acceptability of the proposed activity or activities; and	
(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable the closure plan;	Refer to Heading 7.1
o) A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/a
p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/a
q) Any information requested by the competent authority.	N/a
2. Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	

Curriculum Vitae: Peet JJ Botes

Address: 22 Buitekant Street, Bredasdorp, 7280; **Cell:** 082 921 5949

Nationality:	South African
ID No.:	670329 5028 081
Language:	Afrikaans / English
Profession:	Environmental Consultant & Auditing
Specializations:	Botanical & Biodiversity Impact Assessments Environmental Compliance Audits Environmental Impact Assessment Environmental Management Systems
Qualifications:	BSc (Botany & Zoology), with Nature Conservation III & IV as extra subjects; Dept. of Natural Sciences, Stellenbosch University 1989. Hons. BSc (Plant Ecology), Stellenbosch University, 1989 More than 20 years of experience in the Environmental Management Field (Since 1997 to present).
Professional affiliation:	Registered Professional <u>Botanical, Environmental and Ecological Scientist</u> at SACNASP (South African Council for Natural Scientific Professions) since 2005.
SACNAP Reg. No.:	400184/05

BRIEF RESUME OF RELEVANT EXPERIENCE

1997-2005: Employed by the Overberg Test Range (a Division of Denel), responsible for managing the environmental department of OTB, developing and implementing an ISO14001 environmental management system, ensuring environmental compliance, performing environmental risk assessments with regards to missile tests and planning the management of the 26 000 ha of natural veld, working closely with CapeNature (De Hoop Nature Reserve).

2005-2010: Joined Enviroscentific, as an independent environmental consultant specializing in wastewater management, botanical and biodiversity assessments, developing environmental management plans and

strategies, environmental control work as well as doing environmental compliance audits and was also responsible for helping develop the biodiversity part of the Farming for the Future audit system implemented by Woolworths. During his time with Enviroscientific he performed more than 400 biodiversity and environmental legal compliance audits.

2010-2017: Joined EnviroAfrica, as an independent Environmental Assessment Practitioner and Biodiversity Specialist, responsible for Environmental Impact Assessments, Biodiversity & Botanical specialist reports and Environmental Compliance Audits. During this time Mr Botes compiled more than 70 specialist Biodiversity & Botanical impact assessment reports ranging from agricultural-, pipelines- and solar developments.

2017-Present: Establish a small independent consultancy (PB Consult) specialising in Environmental Audits, Biodiversity and Botanical specialist studies as well as Environmental Impact Assessment.

LIST OF MOST RELEVANT BOTANICAL & BIODIVERSITY STUDIES

- Botes, P. 2007: Botanical assessment. Schaapkraal, Erf 644, Mitchell's Plain. A preliminary assessment of the vegetation in terms of the Fynbos Forum: Ecosystem guidelines. 13 November 2007.
- Botes, P. 2008: Botanical assessment. Schaapkraal Erf 1129, Cape Town. A preliminary assessment of the vegetation using the Fynbos Forum Terms of Reference: Ecosystem guidelines for environmental Assessment in the Northern Cape. 20 July 2008.
- Botes, P. 2010(a): Botanical assessment. Proposed subdivision of Erf 902, 34 Eskom Street, Napier. A Botanical scan and an assessment of the natural vegetation of the site to assess to what degree the site contributes towards conservation targets for the ecosystem. 15 September 2010.
- Botes, P. 2010(b): Botanical assessment. Proposed Loeriesfontein low cost housing project. A preliminary Botanical Assessment of the natural veld with regards to the proposed low cost housing project in/adjacent to Loeriesfontein, taking into consideration the National Spatial Biodiversity Assessment of South Africa. 10 August 2010.
- Botes, P. 2010(c): Botanical assessment: Proposed Sparrenberg dam, on Sparrenberg Farm, Ceres. . A Botanical scan and an assessment of the natural vegetation of the site. 15 September 2010.
- Botes, P. 2011: Botanical scan. Proposed Cathbert development on the Farm Wolfe Kloof, Paarl (Revised). A botanical scan of Portion 2 of the Farm Wolfe Kloof No. 966 (Cathbert) with regards to the proposed Cathbert Development, taking into consideration the National Spatial Biodiversity Assessment of South Africa. 28 September 2011.
- Botes, P. 2012(a): Proposed Danielskuil Keren Energy Holdings Solar Facility on Erf 753, Danielskuil. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 17 March 2012.
- Botes, P. 2012(b): Proposed Disselfontein Keren Energy Holdings Solar Facility on Farm Disselfontein no. 77, Hopetown. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 28 March 2012.
- Botes, P. 2012(c): Proposed Kakamas Keren Energy Holdings Solar Facility on Remainder of the Farm 666, Kakamas. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 13 March 2012.
- Botes, P. 2012(d): Proposed Keimoes Keren Energy Holdings Solar Facility at Keimoes. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 9 March 2012.
- Botes, P. 2012(e): Proposed Leeu-Gamka Keren Energy Holdings Solar Facility on Portion 40 of the Farm Kruidfontein no. 33, Prince Albert. A Biodiversity Assessment (with botanical input) taking

into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 27 March 2012.

- Botes, P. 2012(f): Proposed Mount Roper Keren Energy Holdings Solar Facility on Farm 321, Kuruman. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 28 March 2012.
- Botes, P. 2012(g): Proposed Whitebank Keren Energy Holdings Solar Facility on Farm no. 379, Kuruman. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 27 March 2012.
- Botes, P. 2012(h): Proposed Vanrhynsdorp Keren Energy Holdings Solar Facility on Farm Duinen Farm no. 258, Vanrhynsdorp. A Biodiversity Assessment (with botanical input) taking into consideration the findings of the National Spatial Biodiversity Assessment of South Africa. 13 April 2012.
- Botes, P. 2012(i): Askham (Kameelduin) proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). 1 November 2012.
- Botes, P. 2013(a): Groot Mier proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). January 2013.
- Botes, P. 2013(b): Loubos proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). January 2013.
- Botes, P. 2013(c): Noenieput proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). January 2013.
- Botes, P. 2013(d): Rietfontein proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). January 2013.
- Botes, P. 2013(e): Welkom proposed low cost housing, Mier Municipality Residential Project, Northern Cape. A preliminary Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). January 2013.
- Botes, P. 2013(f): Zyperfontein Dam Biodiversity & Botanical Scan. Proposed construction of a new irrigation dam on Portions 1, 3, 5 & 6 of the Farm Zyperfontein No. 66, Vanrhynsdorp (Northern Cape) and a scan of the proposed associated agricultural enlargement. September 2013.
- Botes, P. 2013(g): Onseepkans Canal: Repair and upgrade of the Onseepkans Water Supply and Flood Protection Infrastructure, Northern Cape. A Biodiversity & Botanical scan in order to identify significant environmental features (and to identify the need for additional studies if required). August 2013.
- Botes, P. 2013(h): Biodiversity scoping assessment with regards to a Jetty Construction On Erf 327, Malagas (Matjiespoort). 24 October 2013.
- Botes, P. 2013(i): Jacobsbaai pump station and rising main (Saldanha Bay Municipality). A Botanical Scan of the area that will be impacted by the proposed Jacobsbaai pump station and rising main. 30 October 2013.
- Botes, P. 2014(a): Brandvlei Bulk Water Supply: Proposed construction of a 51 km new bulk water supply pipeline (replacing the existing pipeline) from Romanskolk Reservoir to the Brandvlei Reservoir, Brandvlei (Northern Cape Province). A preliminary Biodiversity & Botanical scan

in order to identify significant environmental features (and to identify the need for additional studies if required). 24 February 2014.

- Botes, P. & McDonald Dr. D. 2014: Loeriesfontein Bulk Water Supply: Proposed construction of a new bulk water supply pipeline and associated infrastructure from the farm Rheeboekfontein to Loeriesfontein Reservoir, Loeriesfontein. Botanical scan of the proposed route to determine the possible impact on vegetation and plant species. 30 May 2014.
- Botes, P. 2014(b): Kalahari-East Water Supply Scheme Extension: Phase 1. Proposed extension of the Kalahari-East Water Supply Scheme and associated infrastructure to the Mier Municipality, ZF Mgcawu District Municipality, Mier Local Municipality (Northern Cape Province). Biodiversity & Botanical scan of the proposed route to determine the possible impact on biodiversity with emphasis on vegetation and plant species. 1 July 2014.
- Botes, P. 2014(c): The proposed Freudenberg Farm Homestead, Farm no. 419/0, Tulbagh (Wolseley Area). A Botanical scan of possible remaining natural veld on the property. 26 August 2014.
- Botes, P. 2014(d): Postmasburg WWTW: Proposed relocation of the Postmasburg wastewater treatment works and associated infrastructure, ZF Mgcawu District Municipality, Tsantsabane Local Municipality (Northern Cape Province). Biodiversity and botanical scan of the proposed pipeline route and WWTW site. 30 October 2014.
- Botes, P. 2015(a): Jacobsbaai pump station and rising main (Saldanha Bay Municipality) (Revision). A Botanical Scan of the area that will be impacted by the proposed Jacobsbaai pump station and rising main. 21 January 2015.
- Botes, P. 2015(b): Steenkampspan proving ground. Proposed establishment of a high speed proving (& associated infrastructure) on the farm Steenkampspan (No. 419/6), Upington, ZF Mgcawu (Siyanda) District Municipality, Northern Cape Province. Biodiversity and Botanical Scan of the proposed footprint. 20 February 2015.
- Botes, P. 2015(c): Proposed Bredasdorp Feedlot, Portion 10 of Farm 159, Bredasdorp, Cape Agulhas Municipality, Northern Cape Province. A Botanical scan of the area that will be impacted. 28 July 2015.
- Botes, P. 2016(a): OWK Raisin processing facility, Blaauwskop Settlement, Erf 151, Kenhardt, Northern Cape Province. A Botanical scan of the proposed footprint. 26 May 2016.
- Botes, P. 2016(b): Onseepkans Agricultural development. The proposed development of ±250 ha of new agricultural land at Onseepkans, Northern Cape Province. Biodiversity and Botanical Scan. January 2016.
- Botes, P. 2016(c): Henkries Mega-Agripark development. The proposed development of ±150 ha of high potential agricultural land at Henkries, Northern Cape Province. Biodiversity and Botanical Scan of the proposed footprint. 28 February 2016.
- Botes, P. 2016(d): Proposed Namaqualand Regional Water Supply Scheme high priority bulk water supply infrastructure upgrades from Okiep to Concordia and Corolusberg. Biodiversity Assessment of the proposed footprint. March 2016.
- Botes, P. 2017: The proposed new Namaqua N7 Truck Stop on Portion 62 of the Farm Biesjesfontein No. 218, Springbok, Northern Cape Province. Botanical scan of the proposed footprint. 10 July 2017.
- Botes, P. 2018(a): Kamieskroon Bulk Water Supply – Ground water desalination, borehole- and reservoir development, Kamiesberg, Northern Cape Province. Botanical scan of the proposed footprint. 20 February 2018
- Botes, P. 2018(b): Rooifontein Bulk Water Supply – Ground water desalination, borehole- and reservoir development, Rooifontein, Northern Cape Province. Botanical scan of the proposed footprint. 23 February 2018

- Botes, P. 2018(c): Paulshoek Bulk Water Supply – Ground water desalination, borehole- and reservoir development, Paulshoek, Northern Cape Province. Botanical scan of the proposed footprint. 27 March 2018.
- Botes, P. 2018(d): Kakamas Waste Water Treatment Works Upgrade – Construction of a new WWTW and rising main, Khai !Garib Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint. 1 August 2018.
- Botes, P. 2018(e): Kakamas Bulk Water Supply – New bulk water supply line for Kakamas, Lutzburg & Cillie, Khai !Garib Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint. 4 August 2018.
- Botes, P. 2018(f): Wagenboom Weir & Pipeline – Construction of a new pipeline and weir with the Snel River, Breede River Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint. 7 August 2018.
- Botes, P. 2018(g): Steynville (Hopetown) outfall sewer pipeline – Proposed development of a new sewer outfall pipeline, Hopetown, Northern Cape Province. Botanical assessment of the proposed footprint. 8 October 2018.
- Botes, P. 2018(h): Tripple D farm agricultural development – Development of a further 60 ha of vineyards, Erf 1178, Kakamas, Northern Cape Province. Botanical assessment of the proposed footprint. 8 October 2018.
- Botes, P. 2018(i): Steynville (Hopetown) outfall sewer pipeline – Proposed development of a new sewer outfall pipeline, Hopetown, Northern Cape Province. Botanical assessment of the proposed footprint. 8 October 2018.
- Botes, P. 2019(a): Lethabo Park Extension – Proposed extension of Lethabo Park (Housing Development) on the remainder of the Farm Roodepan No. 70, Erf 17725 and Erf 15089, Roodepan Kimberley. Sol Plaaitye Local Municipality, Northern Cape Province. Botanical assessment of the proposed footprint (with biodiversity inputs). 15 May 2019.
- Botes, P. 2019(b): Verneujkpan Trust agricultural development – The proposed development of an additional ±250 ha of agricultural land on Farms 1763, 2372 & 2363, Kakamas, Northern Cape Province. 27 June 2019.