PB CONSULT
ENVIRONMENTAL MANAGEMENT SERVICES

BOTANICAL ASSESSMENT

Revision 2

PROPOSED LAIR TRUST AGRI-DEVELOPMENT

Development of ±20 ha, including new Vineyards and a dam,
Portion 91 of the Farm Orange Falls No. 16, Augrabies
KHAI !GARIB LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE.

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SUMMARY - MAIN CONCLUSIONS

VEGETATION TYPE	**Bushmanland Arid Grassland** Bushmanland Arid Grassland is not considered a threatened vegetation type, with more than 99% remaining. However only 4% is formally conserved (Augrabies Falls National Park). Further conservation options must thus be investigated. Botanically the proposed site is not considered sensitive, but it does overlap a proposed CBA and will impact on a small number of protected species.
VEGETATION ENCOUNTERED	The proposed development footprint is located on private property, zoned for agriculture. As is typical of this part of the Northern Cape, ephemeral drainage lines tend to criss-cross the landscape and the proposed site will cross a number of such drainage lines. The vegetation on the property in general can be described as a sparse, slightly disturbed, low shrubland, with the small ephemeral drainage lines the most prominent feature, especially in the area to the west of the proposed site. No special features were observed on the property and the site itself is not considered of any special significance in terms of vegetation other than potential migration route and the fact that it supported a number of protected plant species.
CONSERVATION PRIORITY AREAS	According to the NCCBA the proposed site will impact on a CBA area (Figure 6). The site will not impact on any recognised centre of endemism.
GEOLOGY & SOILS	No special geological, soil condition or geographical features such as wetlands, true quarts patches or heuweltjies were observed in or near to the proposed footprint, which might result in special vegetation type.
CONNECTIVITY	The proposed activity will have a permanent impact on almost 20 ha of land within a CBA. The natural vegetation on the property is still well connected to the south and west, but agricultural practices to the north and east have compromised connectivity in that direction. It must be noted that the proposed site is located in an area almost surrounded by similar intensive agriculture. The additional impact on connectivity is not seen as significant, since the vegetation to the north and east are already subject to agricultural related pressures.
LAND-USE	The land is currently fallow-land, sometimes used for stock grazing. The impact on socio-economic activities will be localised and will only impact the owner himself, but is likely to be positive (gain in income and potential additional work opportunities).
PROTECTED PLANT SPECIES	The following protected or endangered species was encountered / expected: • No red-listed species (Refer to Par. 4.6.1); • No NEM: BA protected plant (Refer to Par. 4.6.2); • No NFA protected trees were encountered (Heading 4.6.3); • Four NCNCA protected plant species (Heading 4.6.4, Table 3), most notably a number of *Aloe claviflora* and *Boscia foetida* individuals.
WATER COURSES AND WETLANDS	As is typical of this part of the Northern Cape, ephemeral drainage lines tend to criss-cross the landscape and the proposed site will cross a number of such drainage lines. However, none of them is seen as of special significance, apart from the fact that some protected plant species are associated with them, most notably a small number of *Boscia foetida* individuals.
MAIN CONCLUSION	According Table 6, the main impact associated with the proposed activity will be the potential impact on the CBA, connectivity and protected plant species. However, the impact on connectivity should be insignificant and the impact on the CBA will be more related to migration corridors than to vegetation itself. The impact on protected species is also relatively low and can be mitigated to some extent Even without mitigation the cumulative impact is expected to be borderline Low, but it can be reduced with mitigation.

With the correct mitigation it is considered highly unlikely that the proposed development will contributed 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.

WITH THE AVAILABLE INFORMATION IT IS RECOMMENDED THAT PROJECT BE APPROVED, WITH ALL MITIGATION RECOMMENDATIONS.

NO-GO OPTION

The development is relative small and may result in potential beneficial socio-economic gain, while the no-go option will not contribute significantly to national or provincial conservation targets.

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. 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 OTB 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 and 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 EIA applications, biodiversity assessment, botanical assessment, environmental compliance audits and environmental control work.

Mr. Botes is also 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.

Yours sincerely,

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Registered Professional Botanical, Environmental and Ecological Scientist

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1. INTRODUCTION

The Lair Trust development proposes the development of a further approximately 20 ha of Vineyards adjacent to existing vineyards on Portion 19 of the Farm Orange Falls No. 16, Kenhardt, near the small town of Augrabies, in the Khai !Garib local Municipality of the Northern Cape Province. Please note that PB Consult did a previous botanical on the same property (Refer to Botes, 2017). The Farm is located approximately 10 km West of Augrabies, just of the R359. The proposed development will trigger listed activities under the National Environmental Management Act, (Act 107 of 1998) (NEMA) and the EIA regulations (as amended). EnviroAfrica was appointed to perform the NEMA EIA application. The proposed development is located in an area with remaining natural veld and PB Consult was appointed to conduct a botanical assessment of the site.

The farm is located in the intensively cultivated belt associated with the Orange River. Water is pumped from the Orange River and used for the cultivation of vineyards for wine, export grapes and the raisin markets. The proposed new vineyards will be located on an area currently still covered by natural veld in relative good condition, although historic stock grazing practices is expected to have impacted on the vegetation composition. The vegetation at the proposed site is expected to be Bushmanland Arid Grassland, which is considered a "Least Threatened" in terms of the National list of ecosystems that are threatened and in need of protection. The proposed dam will be located to the west of the agricultural area in the same vegetation type and will not result in any significant additional impact on vegetation.

As with almost all areas in the Northern Cape the site is criss-crossed by small drainage lines, which is the result of draining the relative flat landscapes during thunderstorm events. These drainage lines are often associated with slightly larger shrubs and small trees that are only found near such water ways.

In this case the vegetation encountered was typical of what was expected on gravelly soils with a shallow sandy layer sometimes present.

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

The property (Portion 91 of the Farm Orange Falls No. 61, Kenhardt) is located, just of the R359 (Augrabies Road) about 10 km west of the small town Augrabies within the Kai !Garib Local Municipality of the Northern Cape Province (Figure 1). Augrabies is about 25 km northwest of Kakamas. The property is approximately 81 ha in size (Figure 2), and the proposed new development will cover about 20 ha (Figure 2).

Figure 1: Map showing the location of property near Kakamas in the Northern Cape Province

Figure 2: Showing the property investigated (Red) as part of this study and the proposed development in white & blue

2.2. CLIMATE

All regions with a rainfall of less than 400 mm per year are regarded as arid. This area normally receives about 106 mm of rain per year (the climate is therefore regarded as arid to very arid). Kakamas normally receives about 134 mm of rain per year, with rainfall largely in late summer/early autumn (major peak) and very variable from year to year. It receives the lowest rainfall (3 mm) in June and the highest (27 mm) in March.

Table 1: Average rainfall and temperatures at Kakamas (https://en.climate-data.org)

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	27.3	26.4	24.4	21.1	16	13.1	12.2	14.5	17.3	20.9	23.5	26.3
Min. Temperature (°C)	18.9	18.3	16.7	12.8	7.8	4.6	3.7	5.4	8.1	11.6	14.3	17.2
Max. Temperature (°C)	35.7	34.5	32.2	29.5	24.3	21.7	20.8	23.6	26.5	30.3	32.8	35.4
Avg. Temperature (°F)	81.1	79.5	75.9	70.0	60.8	55.6	54.0	58.1	63.1	69.6	74.3	79.3
Min. Temperature (°F)	66.0	64.9	62.1	55.0	46.0	40.3	38.7	41.7	46.6	52.9	57.7	63.0
Max. Temperature (°F)	96.3	94.1	90.0	85.1	75.7	71.1	69.4	74.5	79.7	86.5	91.0	95.7
Precipitation / Rainfall (mm)	17	21	27	17	9	3	4	3	3	7	13	10

The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Kakamas range from 20°C in July to 35°C in January. The region is the coldest during July with temperatures as low as 3.7°C on average during the night (www.saexplorer.co.za). Table 1 gives a summary of temperatures and rainfall recorded at Kakamas (https://en.climate-data.org).

2.3. GEOLOGY AND SOILS

Geology 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.

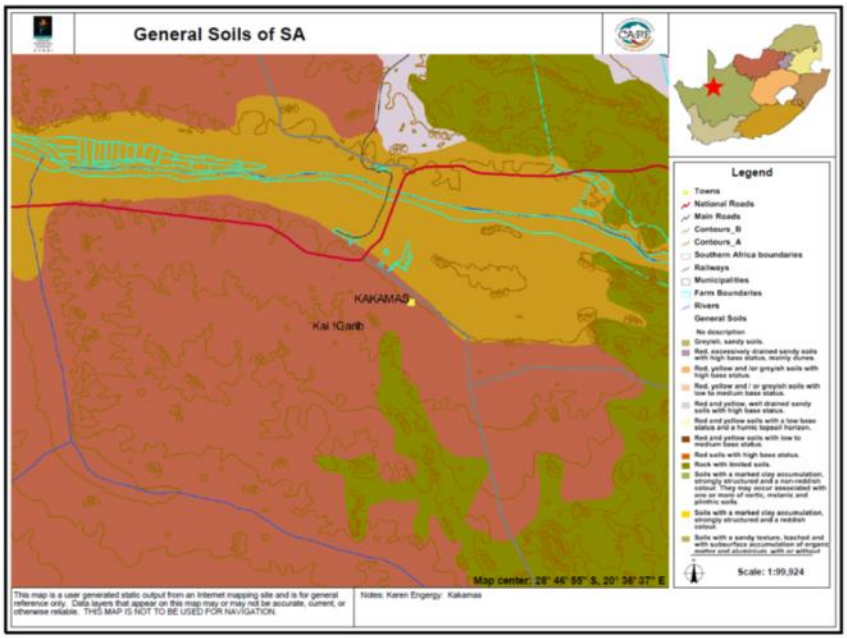

Figure 3: General soils map for the area (SANBI BGIS)

Soils (Refer to Figure 3) 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 (Mucina & Rutherford, 2006).

The whole of the site is underlain by weathered dolerite rock.

2.4. TOPOGRAPHY

The property is relatively small and located on an almost flat plains area, with very little slope. Elevation varies from about 666 m at the northern boundary of the property to 675 at the southern part of the property (Sloping slightly from south to north, towards the Orange River). It was clear that aspect did not have any significant influence on the vegetation of this site but differences in geographical features such as small ephemeral drainage lines and rocky outcrops sometimes resulted in differences in vegetation combination. As is typical of this part of the Northern Cape, ephemeral drainage lines tend to criss-cross the landscape and the proposed site will cross a number of such drainage lines. In terms of vegetation, most of these drainage lines are probably not significant, apart from larger indigenous trees that sometimes associated with these features.

3. EVALUATION METHOD

Desktop studies and a site visit were performed to evaluate the proposed sites in terms of potential impacts on botanical features. The site visits was conducted during August of 2017. Please note that the findings of the study done during June 2017, was also taken into account, giving a better perspective on vegetation.

Figure 4: Showing the property (red) and proposed footprint (white & blue) investigated as part of this study

The timing of the site visit was reasonable in that essentially all perennial plants were identifiable, although annual flowers were mostly not present (but during 2017, many of these were identifiable). It is seen as a limitation to a certain extent. However, a good understanding of the veld and vegetation was obtained and confidence in the findings is high. The survey was conducted by walking the site and examining, marking and photographing any area of interest. During the site visit the author endeavoured to identify and locate all significant features, including rivers, streams or wetlands, special plant species and or specific soil conditions (e.g. rocky outcrops or silcrete patches) that may result in special botanical features.

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 (NDBSP, 2008).

The Kakamas 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) only one broad vegetation type is expected in the proposed area and its immediate vicinity, namely **Bushmanland Arid Grassland**. More than 99% of this vegetation still remains, but only 4% is formally conserved (Augrabies Falls National Park). According to the National list of ecosystems that are threatened and in need of protection (GN 1002, December 2011), Bushmanland Arid Grassland, remains classified as *Least Threatened*.

According to Mucina and Rutherford (2006), Bushmanland Arid Grassland is found in the Northern Cape Province spanning about one degree of latitude from around Aggeneys in the west to Prieska in the east. The southern border of the unit is formed by edges of the Bushmanland Basin while in the north-west this vegetation unit borders on desert vegetation (north-west of Aggeneys and Pofadder). The northern border (in the vicinity of Upington) and the eastern border (between Upington and Prieska) are formed with often intermingling units of Lower Gariep Broken Veld, Kalahari Karroid Shrubland and Gordonia Duneveld. Most of the western border is formed by the edge of the Namaqualand hills. Altitude varies from 600 – 1 200 m.

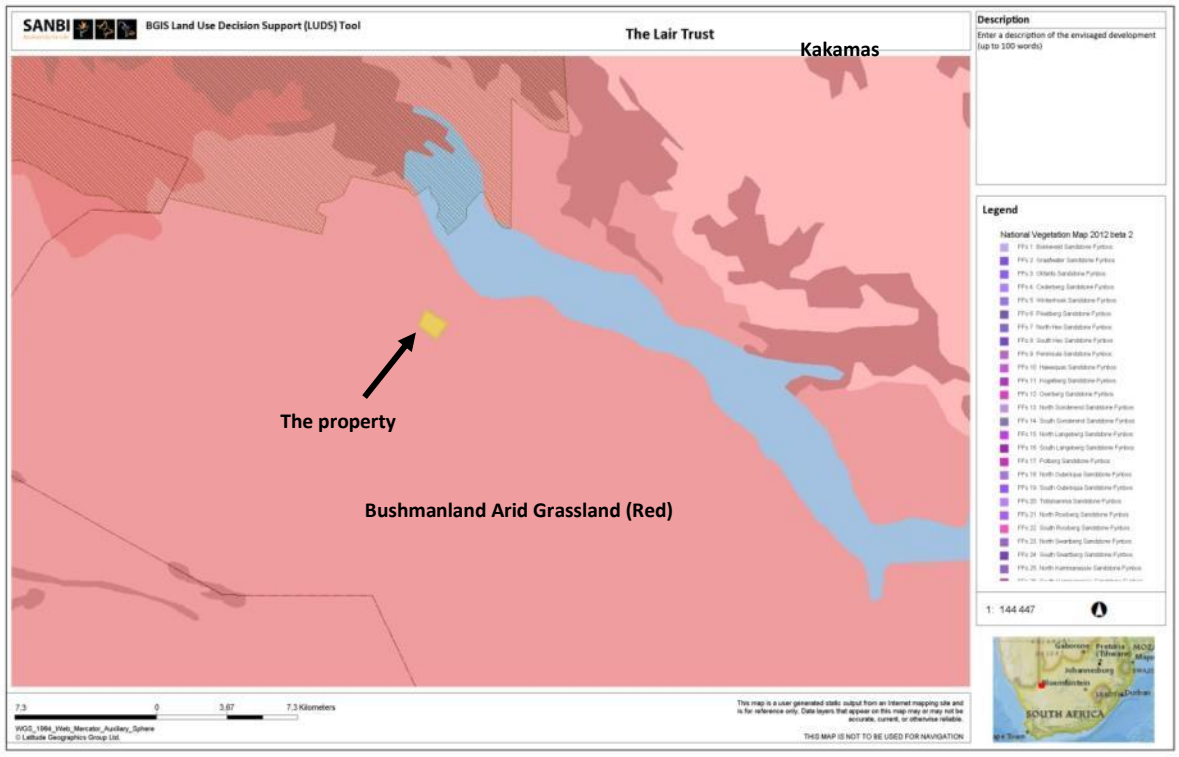

Figure 5: Vegetation map of South Africa (2012 beta 2 version), showing the expected vegetation

4.1. THE VEGETATION IN CONTEXT

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^{o}C in winter to 43^{o}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 plan 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 to 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).

Because of its aridity and unpredictable rainfall patterns, the Nama-Karoo region favours free moving herbivores such as ostrich and springbok nomadic birds and invertebrates with variable dormancy cued by rain. Plant defence against herbivores and seed adaption for dispersal by mammals are relatively uncommon, except along rivers and seasonal pans, suggesting the transient nature of herbivores, except near water where they would have lingered longer. However, since the 19th century the vast herds of migratory ungulates indigenous to this biome have been almost completely replaced by domestic stock. Once farmers started fencing their properties into camps (following the Fencing Act of 1912), stock numbers were dramatically increased with dire consequences to plant diversity. Grazing during and immediately after droughts periods is regarded as a major cause of detrimental change in vegetation composition and were ultimately responsible for the decline of large numbers of palatable plants (Mucina *et. al*., 2006).

In terms of status, very little of the Nama-Karoo has been transformed and the dominant land use is farming with small stock, cattle and game. Farms are fenced, but generally large, having a low grazing capacity. The biggest treat to this vegetation remains domestic livestock grazing pressure. Grazing by livestock particularly during the summer growing season, reduces the perennial grass component, while prolonged droughts kill a high proportion of perennial plants, rapidly changing vegetation composition in favour of short-lived species with soil stored seed banks. Overgrazing after drought periods can delay vegetation recovery, which will worsen the effect of subsequent droughts.

4.2. VEGETATION ENCOUNTERED

The proposed dam will be located just west of the proposed new orchards within the same vegetation type and is discussed as one unit. At the time of the site visit the area was dry (but a number of herbs were observed during the 2017 site visit). Because of the arid nature of the region the carrying capacity of the veld is very low. The vegetation on the property in general can be described as a sparse low shrubland, with vegetation associated with the small ephemeral drainage lines almost the most prominent feature, especially

in the area to the west of the proposed new site, where larger shrubs and occasionally smaller trees (like *Parkinsonia africana* and *Ozoroa dispar*) were common next to the ephemeral drainage lines.

The vegetation cover in the proposed footprint area can be described as a sparse open low shrubland with white grasses (e.g. *Schmidtia kalihariensis*, *Stipagrostis* species) occasionally present (as a result of the prevailing drought) and low growing species like *Justicia australis*, *Kleinia longiflora*, *Rhigozum trichotomum* and *Galenia africana* (Photo 1 & 2), with species like *Acanthopsis disperma*, *Aloe claviflora* (occasionally), *Aptosimum spinescens*, *Blepharis furcata*, *Hirpicium* cf. *echinus, Limeum aethiopicum*, *Rogeria longiflora*, *Salsola aphylla*, *Thesium lineatum, Tribulus cristatus* and *Zaluzianskya* cf. *benthamiana* also encountered, but less common. The small *Acanthopsis disperma* was often observed as large patches of small "verneuk-halfmensie" patches (Photo 4). Vegetation cover was generally between 20 – 30%, except near the ephemeral drainage lines where the vegetation composition and cover changed to a denser and slightly larger (reaching 1 m in height) shrub dominated vegetation.

Photo 1: Looking from west to east over the proposed site. Note the sparse open vegetation with ephemeral drainage lines in the background.

Photo 2: Looking from west to east over the proposed site.

In fact, because of the sparseness of the general vegetation the vegetation associated with the ephemeral streams appeared that more prominent. To the north west of the proposed footprint, rocky outcrops and even a number of *Ozoroa dispar* trees (reaching up to 2.5 m) were encountered. Within the proposed footprint these ephemeral streams (Photo 3) were mostly dominated by *Senegalia mellifera* and *Lycium cinereum*, in association with shrubs like, *Aptosimum lineare*, *Asparagus cooperi*, the occasional *Boscia foetida*, *Cynanchum viminale*, *Hermannia gariepina* (occasionally), *Justicia spartioides* (occasionally), *Lessertia* cf. *spinescens* (occasionally), *Parkinsonia africana*, *Ptycholobium biflorum* (occasionally), *Sericocoma avolans* ("gras-bo-bos-onder") and the parasitic *Tapinanthus oleifolius.*

Photo 3: A typical ephemeral drainage line within the proposed footprint, with *Lycium* and *Senegalia* prominent.

Photo 4: Patches of the "Verneuk-Halfmensie", *Acanthopsis disperma* encountered in the open areas.

4.3. FLORA ENCOUNTERED

Please note that during a one day site visit it is likely that some species might have been missed, but all efforts were made to ensure that all species encountered were identified and listed. It is also expected that because of the timing of the site visit a number of annuals might have been missed some of whom might be protected in terms of the Northern Cape Nature Conservation Act (NCNCA), Act, 9 of 2009 (especially referring to species of the Aizoaceae family).

Photo 5: *Sericocoma avolans*.

Table 2: List of species encountered within or near the proposed footprint

No.	Species name	FAMILY	Status	Alien & invader species (AIS)
1.	*Acanthopsis disperma*	ACANTHACEAE	LC	
2.	*Aloe claviflora*	ASPODELACEAE	LC NCNCA, Schedule 2 Protected (all species in this Family)	**Apply for a NCNCA Flora permit (DENC)**
3.	*Aptosimum lineare* *	SCROPHULARIACEAE	LC	
4.	*Aptosimum spinescens*	SCROPHULARIACEAE	LC	
5.	*Asparagus cooperi*	ASPARAGACEAE	LC	
6.	*Blepharis furcata*	ACANTHACEAE	LC	
7.	*Boscia foetida*	BRASSICACEAE (CAPPARACEAE)	LC NCNCA, Schedule 2 Protected (all species in this Genus)	**Apply for a NCNCA Flora permit (DENC)**
8.	*Cynanchum viminale (=Sarcostemma viminale)*	APOCYNACEAE	NCNCA, Schedule 2 Protected (all species in this Family)	**Apply for a NCNCA Flora permit (DENC)**
9.	*Galenia africana*	AIZOACEAE	LC Protected in terms of schedule 2 of the NCNCA	**Apply for a NCNCA Flora permit (DENC)**
10.	*Hermannia gariepina*	STERCULIACEAE	LC	
11.	*Hirpicium cf. echinus*	ASTERACEAE	LC	
12.	*Justicia australis (=Monechma genistifolium)*	ACANTHACEAE	LC	
13.	*Justicia spartioides (=Monechma spartioides)*	ACANTHACEAE	LC	
14.	*Kleinia longiflora*	ASTERACEAE	LC	
15.	*Lessertia* cf. *spinescens*		LC	
16.	*Limeum aethiopicum*		LC	
17.	*Lycium cinereum*	SOLANACEAE	LC	
18.	*Ozoroa dispar* (outside the footprint)	ANACARDIACEAE	LC	
19.	*Parkinsonia africana*	FABACEAE	LC	
20.	*Prosopis* species			
21.	*Ptycholobium biflorum*		LC	
22.	*Rhigozum trichotomum*	BIGONACEAE	LC	
23.	*Rogeria longiflora*	PEDALIACEAE	LC	
24.	*Salsola aphylla*	AMARANTHACEAE	LC	
25.	*Schmidtia kalihariensis*	POACEAE	LC	
26.	*Senegalia mellifera (=Acacia mellifera)*	FABACEAE	LC	
27.	*Sericocoma avolans*		LC	
28.	*Stipagrostis* species	POACEAE	LC	
29.	*Tapinanthus oleifolius*	LORANTHACEAE	LC	
30.	*Tribulus cristatus*		LC	
31.	*Zaluzianskya* cf. *benthamiana*		LC	

4.4. 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 6: The Northern Cape Critical Biodiversity Areas (2016) showing proposed development footprint

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).

The 2016 Northern Cape Critical Biodiversity Areas (NCCBA) gives both aquatic and terrestrial Critical Biodiversity Areas (CBAs) and ecological support areas for the Northern Cape.

According to the NCCBA (Refer to Figure 6), the proposed site falls within a CBA area.

4.5. POTENTIAL IMPACT ON CENTRES OF ENDEMISM

The proposed development does not impact on any recognised centre of endemism. The Gariep Centre is located to the north (quite a distance away) associated with Augrabies, Pella and Onseepkans along the border of South Africa and Namibia, while the Griqualand West Centre of Endemism starts to the east of Upington Northern Cape Province (Van Wyk & Smith, 2001).

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 "*specially 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 during the study (Refer to Table 2).

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 species** protected in terms of NEM: BA was observed (Refer to Table 2).

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).

- **No species** protected **in terms of the NFA** was observed (Refer to Table 2).

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 (Table 3) 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	I
1.	*Aloe claviflora* **Schedule 2 protected**	Occasionally found throughout the property.	**Search & Rescue** Individuals within the footprint should be taken out and replanted outside of the footprint. A watering program must be implemented and maintained until they have re-established themselves.
2.	*Boscia foetida* **Schedule 2 protected**	Occasionally encountered near ephemeral drainage lines.	Because of its deep root system these plants transplant poorly. Species protection through topsoil conservation.
3.	*Cynanchum viminale* **Schedule 2 protected**	Occasionally encountered near ephemeral drainage lines.	It is a common plant in the Northern Cape and is expected to transplant poorly. Species protection through topsoil conservation.
4.	*Galenia africana* **Schedule 2 protected**	This is a common weedy disturbance indicator.	No special measures needed, this is a weedy pioneer species.

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).

Significance = Conservation Value x (Likelihood + Duration + Extent + Severity) (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 fragmentation or its value in terms of the protection of habitat or species	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 unlikely possibility of species loss.	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 & endangered species.	The attribute is considered critically endangered or is part of a proclaimed provincial or national protected area.
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 7.

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. BOTANICAL IMPACT ASSESSMENT

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 private property, zoned for agriculture. As is typical of this part of the Northern Cape, ephemeral drainage lines tend to criss-cross the landscape and the proposed site will cross a number of such drainage lines. The proposed vineyards will be located next to existing vineyards, with intensive agriculture (primary vineyards) to its north, east and west. However, the site is located within a CBA and a number of protected plant species in terms of the NCNCA where observed.
- **Activity**: The proposed development is expected to result in a permanent impact on almost 20 ha of Bushmanland Arid Grassland.
- **Geology & Soils**: No special geological, soil condition or geographical features such as wetlands, true quarts patches or heuweltjies were observed in or near to the proposed footprint (rainfall in this area is too unpredictable to result in true quartz vegetation), which might result in a special vegetation type.
- **Land use and cover**: The land is currently fallow-land, used for stock grazing. The impact on socio-economic activities will be localised and will only impact the owner himself, but is likely to be positive (gain in income and potential additional work opportunities).
- **Vegetation status**: Bushmanland Arid Grassland is not considered a threatened vegetation type, with more than 99% remaining. However only 4% is formally conserved (Augrabies Falls National Park). Further conservation options must thus be investigated.
- **Conservation priority areas:** According to the NCCBA the proposed site will impact on a CBA area. The site will not impact on any recognised centre of endemism.
- **Connectivity**: The proposed activity will have a permanent impact on almost 20 ha of slightly disturbed natural veld within a CBA. The natural vegetation on the property is still well connected to the south and west, but agricultural practices to the north and east have compromised connectivity in that direction. It must be noted that the proposed site is located in an area almost surrounded by similar intensive agriculture. The additional impact on connectivity is not seen as significant, since the vegetation to the north and east are already subject to agricultural related pressures.
- **Watercourses and wetlands**: As is typical of this part of the Northern Cape, ephemeral drainage lines tend to criss-cross the landscape and the proposed site will cross a number of such drainage lines. However, none of them is seen as of special significance, apart from the fact that some protected plant species are associated with them, most notably a small number of *Boscia foetida* individuals.
- **Protected or endangered plant species**: No Red-listed plants, NEM:BA protected species or NFA protected species were encountered. However, 4 NCNCA protected plant species was encountered of which one (*Aloe claviflora*) is recommended for Search & Rescue. A NCNCA permit must be obtained for the potential impact on these species.
- **Invasive alien species**: Occasional *Prosopis* trees were observed and should be removed. Special care must be taken with their removal in order to ensure that they do not re-sprout.
- **Veld fires**: According to the National Veldfire risk classification (March 2010), Bushmanland Arid Grassland falls within an area with a Low fire risk classification. However, veld fire risk must be considered during construction.

6.1. IMPACT RATING

The following table rates the significance of environmental impacts associated with the proposed activity. 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 activity

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	4	1	1	14	No significant geographical features such as wetlands, true quarts patches or heuweltjies were observed.
	With mitigation	2	1	4	1	1	14	Apply for NCNCA permit, search & rescue *Aloe* species.
Landuse and cover: Potential impact on socio-economic activities.	Without mitigation	2	1	4	1	1	14	Impacts on socio-economic activities will be localised, only impact the landowner, but may lead to job creation (potentially positive).
	With mitigation	2	1	4	1	1	14	Apply for NCNCA permit, search & rescue *Aloe* species.
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	2	2	4	1	1	16	Permanent impact on 20 ha Bushmanland Arid Grassland (Least Threatened), but it is located within a proposed CBA (future protection area).
	With mitigation	2	1	3	1	1	12	Apply for NCNCA permit, search & rescue *Aloe* species.
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	3	3	4	1	3	33	Site overlaps into a CBA (proposed future protection area).
	With mitigation	3	3	3	1	2	27	Apply for NCNCA permit, search & rescue *Aloe* species.
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	3	3	4	1	1	27	Disturbance will be relatively localised (small area) and permanent, but should not significantly increase the existing impact on connectivity.
	With mitigation	3	3	3	1	1	24	Apply for NCNCA permit, search & rescue *Aloe* species.
Watercourses and wetlands: Potential impact on natural water courses and its ecological support areas.	Without mitigation	2	3	4	1	2	20	The proposed site will impact on a number of small ephemeral drainage lines, however, no significant stream will be impacted.
	With mitigation	2	2	2	1	1	12	Ensure future erosion control measures are considered.
Protected & endangered plant species: Potential impact on threatened or protected plant species.	Without mitigation	3	3	4	1	2	30	A number of plants protected in terms of the NCNCA are likely to be impacted. However, no National protected or rare and endangered species was observed.
	With mitigation	3	2	2	1	1	18	Apply for NCNCA permit, search & rescue *Aloe* species.
Invasive alien plant species: Potential invasive plant infestation as a result of the activities.	Without mitigation	3	2	3	2	2	27	Single Prosopis trees were observed.
	With mitigation	3	1	1	1	1	12	Special care must be taken during their removal (in order to avoid re-sprouting).

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Veld fire risk: Potential risk of veld fires as a result of the activities.	Without mitigation	3	2	2	2	2	24	Veld fire risk very low
	With mitigation	3	1	1	1	1	12	Address fire danger throughout construction.
Cumulative impacts: Cumulative impact associated with proposed activity.	Without mitigation	3	3	4	2	3	36	Mostly associated with the fact that the site overlaps a CBA and that protected plant species were observed within the footprint.
	With mitigation	3	3	4	1	2	30	Apply for NCNCA permit, search & rescue *Aloe* species.
The "No-Go" option: Potential impact associated with the No-Go alternative.	Without mitigation	3	2	2	2	2	24	No impact on the CBA or mature indigenous tree species, but potential continual degradation as a result of agricultural related activities on the larger property.
	With mitigation						0	The No-Go option will not significantly add to conservation targets, but will avoid impact on a number of small ephemeral streams and protected plant species.

According Table 6, the main impact associated with the proposed activity will be the potential impact on the CBA, Connectivity and protected plant species. However, the impact on connectivity should be insignificant and the impact on the CBA will be more related to migration corridors than to vegetation itself. The impact on protected species is also relatively low and can be mitigated to some extent

Even without mitigation the cumulative impact is expected to be borderline Low, but it can be reduced with mitigation.

7. IMPACT MINIMISATION RECOMMENDATIONS

Botanically the proposed site is not considered sensitive, but it does overlap a proposed CBA and will impact on a small number of protected species. However, with mitigation it is considered highly unlikely that the proposed development will contributed 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.

Having evaluated the proposed site and its immediate surroundings, it is unlikely that the proposed development will lead to any significant impact on the botanical features as a result of its placement as long as the following impact minimisation recommendations are implemented:

- 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.
- An application must be made to DENC for a flora permit in terms of the NCNCA with regards to impacts on species protected in terms of the act.
- Before any work is done the final construction footprint and access routes must be clearly demarcated (with the aim at minimal width/smallest footprint). The demarcation must include the total footprint necessary to execute the work, but must aim at minimum disturbance.
- All ***Aloe*** species within the construction footprint must be searched & rescued and transplanted in nearby remaining natural veld. A watering program for searched & rescued plants must be implemented and maintained until these plants have re-established themselves.
- Topsoil must be removed to a depth of 15 – 20 cm and protected and stored separately for re-use during rehabilitation
- Access must be limited to routes approved by the ECO.
- Lay-down areas or construction sites must be located within already disturbed areas or areas of low ecological value and must be pre-approved by the ECO.
- Indiscriminate clearing of any area outside of the construction footprint must be avoided.
- All areas impacted as a result of construction must be rehabilitated on completion of the project.
- An integrated waste management approach must be implemented during construction.

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