PB CONSULT
ENVIRONMENTAL MANAGEMENT SERVICES

BOTANICAL ASSESSMENT

PROPOSED SANDMINE

DEVELOPMENT OF A NEW SANDMINE AREA OF LESS THAN 5 HA, PLOT 2372, KAKAMAS 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.

But please note, that because of the deeper sandy soils, the vegetation composition is not typical of Bushmanland Arid Grassland, but more typical of vegetation associated with water courses or the Kalahari dune systems.

VEGETATION ENCOUNTERED

The proposed development footprint is located on private property on slightly disturbed natural veld (stock grazing over a long period of time has likely altered the vegetation composition). It is also located within deeper sandy soils of a small valley bottom (historical floodplains). Although the veld shows signs of degradation and a diminished species composition and the vegetation type itself are not considered vulnerable or endangered, the presence of so many protected tree species and the small seasonal stream enhances the value of the site in terms of botanical significance. The presence of so many of these magnificent trees is probably the single most defining feature of this site and its surroundings. However, the same vegetation and species composition can be found in most of the lower floodplains along the Hartbees and Kameelputs Rivers in this area. It is thus not a unique feature of this site alone.

CONSERVATION PRIORITY AREAS

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). According to the NCCBA the proposed site will impact on a CBA area (Refer to Figure 7).

The site will not impact on any recognised centre of endemism.

GEOLOGY & SOILS

The site is located on slightly deeper soils than normally expected in this vegetation type as it is located on historical floodplains. As a result the plant species composition changed to scattered woodland.

CONNECTIVITY

The proposed activity will have a long term impact on 5 ha of land within a CBA. The vegetation of the larger footprint is still well connected to the north and west. Too the south and east intensive agriculture is practiced. Connectivity might be slightly impaired, but should not result in a significant additional impact.

LAND-USE

Land use is primarily focused on livestock grazing by the owner. The possible impact on socio-economic activities will be localised and will only impact on the owner himself.

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);
- Three NFA protected trees were encountered (Heading 4.6.3, and Table 3 & 4);
- Four NCNCA protected plant species (Heading 4.6.4, Table 5).

WATER COURSES AND WETLANDS

The old Kameelputs River remains as a small seasonal stream running through the northern part of the proposed footprint. However, with correct placement the impact on this small stream should be minimal. Protection of the river and its riparian vegetation will also ensure protection of the number of larger trees, associated with this small stream.

MAIN CONCLUSION

According Table 8, the main impact associated with the proposed activity is associated with the potential impact on mature indigenous tree species (many of which are protected tree species) and to the potential impact on the small stream (especially the mature indigenous trees associated with the stream). Moving the site will not have any significant advantages, as the vegetation remains the same (wherever the deeper sands are encountered). However, the impact can be significantly reduced if sand mining is kept to the open areas away from the stream and away from the most significant trees on site (it should be easy to

place the footprint in such open areas and minimise the impact on mature trees).

Without mitigation the cumulative impact is expected to be Medium/High but with mitigation it can be reduced to a potential Low significance.

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, BUT WITH ALL MITIGATION RECOMMENDATIONS, WHICH IS UNLIKELY TO RESULT IN IRREVERSIBLE ENVIRONMENTAL IMPACT.

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,

P.J.J. Botes *(Pr.Sci.Nat: 400184/05)*
Registered Professional Botanical, Environmental and Ecological Scientist

CONTENTS

LIST OF TABLES:

1. INTRODUCTION

The owners of Plot 2372, Kakamas South Settlement, near Alheit, would like to establish small sand mine of less than 5ha on this property. Alheit is a small settlement near Kakamas in the Northern Cape Province. The property or farm (Plot 2372) is approximately 853.4794 ha in size. An area of approximately 10ha with suitable sandy soils was identified on the property. 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 evaluate the potential impact of such a development on significant botanical features that might be encountered. 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 larger property is a working farm, mostly used for cattle grazing, but also includes game farming. The camp in which the proposed sand mine is to be located is currently used for cattle grazing. The proposed larger (10ha) footprint is located within an area that supports relatively deep sandy soils. The owner proposed to remove the topsoil, excavate trenches to a depth of about 2-2.5m deep, after which the site will be rehabilitated.

During the site visit it was immediately evident, that even though the vegetation type itself is not considered threatened, the proposed footprint (and the rest of the property) supports quite a number of ecologically important tree species, many of which are protected nationally or provincially. One thing that is noteworthy is that it was also clear that the owner is not in the habit of harvesting any of these trees (wood from the Camel thorn tree, for instance is highly valued fire wood). Many dead branches and even dead trees were observed on the property an apart from the impact of grazing it seems as if the land owner actively discourage the harvesting of any wood from this property. This was further underlined by the owner who indicated that, apart from a few *Tamarix usneoides* (Abikwa) bushes and trees, he would like to protect all other significant indigenous trees on the site, especially the following: *Boscia albitrunca* (Shepard's tree), *Boscia foetida* (Stink-bush), *Euclea pseudebenus* (Black ebony tree), *Vachellia erioloba* (Came thorn) and also including *Ziziphus mucronata* (Buffalo-thorn).

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 (Plot 2372) is located just south of Alheit, which is a very small settlement about 10 km west of Kakamas (along the N14) within the Kai !Garib Local Municipality of the Northern Cape Province. Plot 2372 is approximately 853.4794 ha in size. The proposed sand mine will be located in the south-eastern corner of the property (Refer to Figure 1).

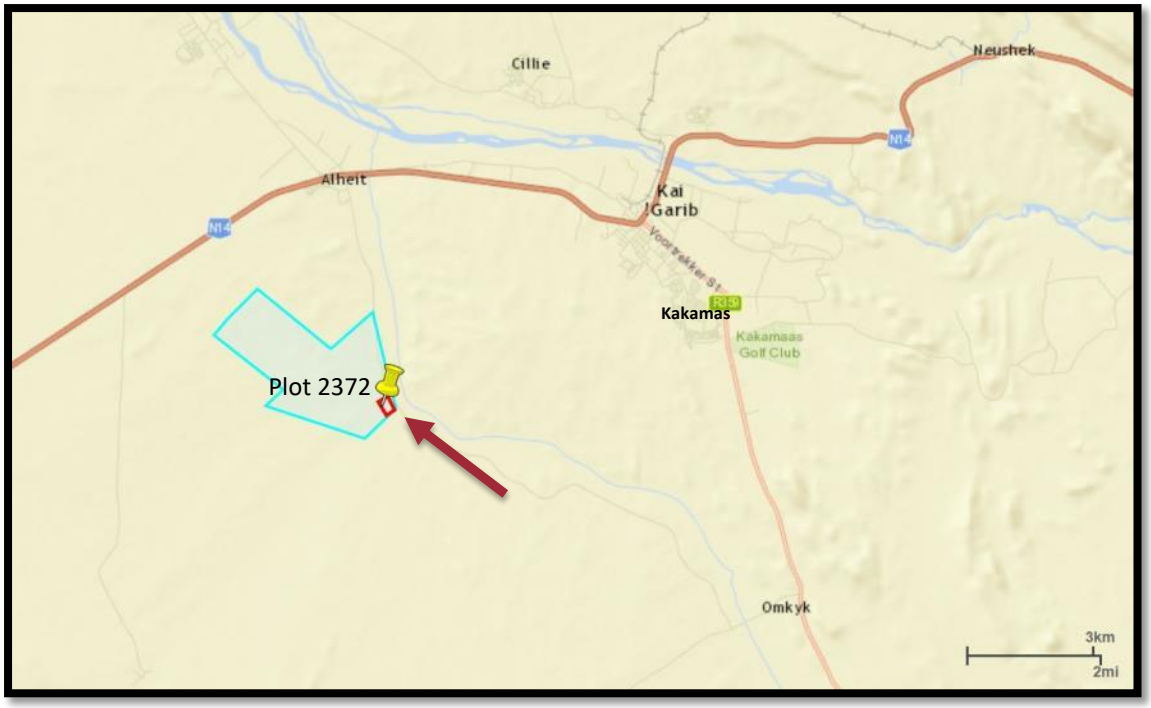


Figure 1: Map showing the location of property near Kakamas in the Northern Cape Province

Figure 2: Shows the larger (±10ha) footprint investigated within this study (in red)

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.

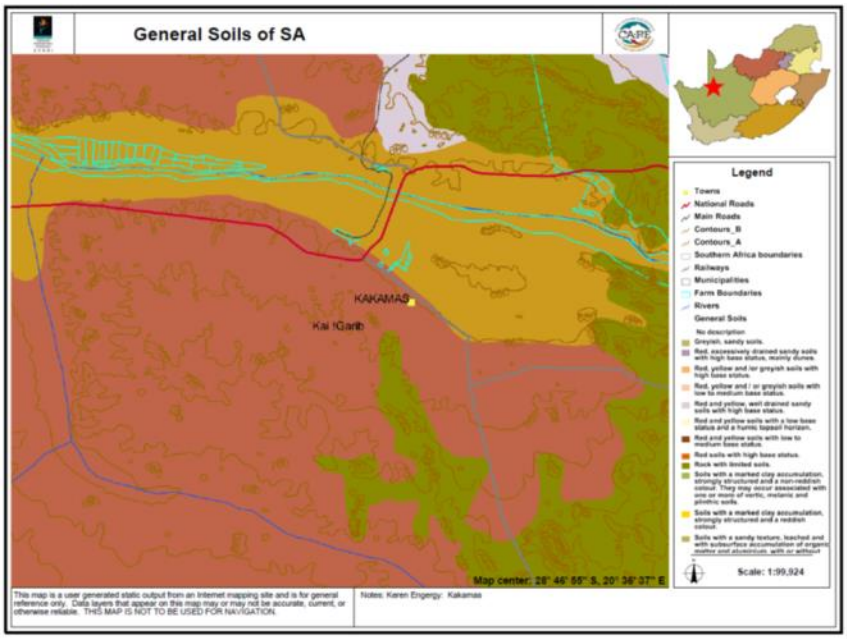


Figure 3: General soils map for the area (SANBI BGIS)

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 site is located on slightly deeper soils than normally expected in this vegetation type as it is located on historical floodplains. As a result the plant species composition changed to scattered woodland.

2.4. TOPOGRAPHY

The proposed footprint is located on almost level sandy soils, with a slight slope towards the north-east (down towards the Hartbees River (a tributary to the Orange River). A seasonal drainage line (The Kameelputs) cross the northern part of the proposed footprint. Even though this stream seems to be named, it is not a well-defined stream, but it does support a number of tree species which associated with streams in the Northern Cape. In general aspect did not have any significant influence on the vegetation of this site but geographical features such as the small seasonal drainage lines results in differences in vegetation combination. As is typical of this part of the Northern Cape, small drainage lines tend to criss-cross the landscape. In terms of vegetation, most of these drainage lines are probably not significant, apart from the larger indigenous trees that is often associated with such drainage lines and which in turns can support its own little ecological habitat system.

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.

Figure 4: Shows the larger area footprint area and special features encountered (mostly protected tree species)

The timing of the site visit was reasonable in that essentially all perennial plants were identifiable, although annual flowers were mostly not present (no resent rains) and it is difficult to determine what part they can play in the species composition. 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 (20016), 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.

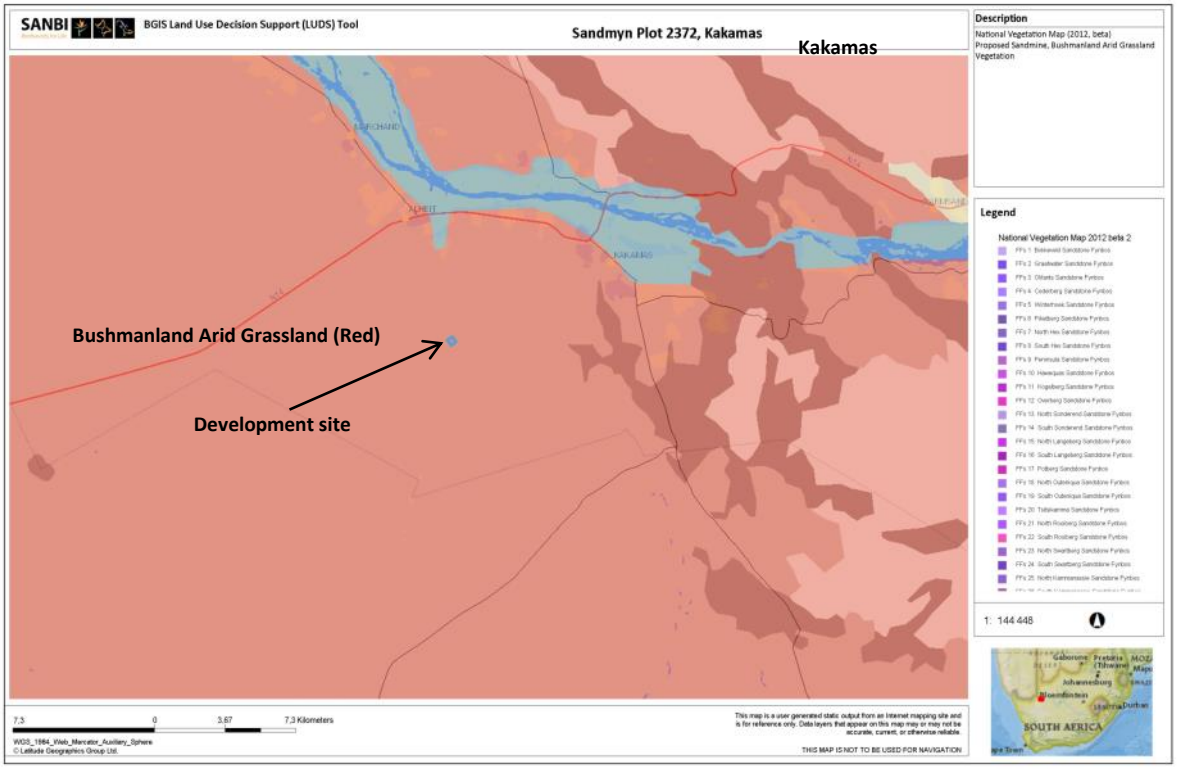


Figure 5: Vegetation map of South Africa (2012 beta 2 version), showing the expected vegetation

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 area that will be impacted by the proposed development is located in area of deeper sandy soils within a valley area of the old Kameelputs River bed which drained into the Hartbees River (Refer to Figure 7). Today only the sandy plains remain, and the Kameelputs River only remains as a small seasonal drainage line to the north of the proposed site. However, scattered along this valley bottom as well as the old floodplains associated with the Hartbees River many magnificent indigenous trees associated with water courses or

deeper sandy soils can be observed. The presence of so many of these magnificent trees is probably the single most significant feature of this area.

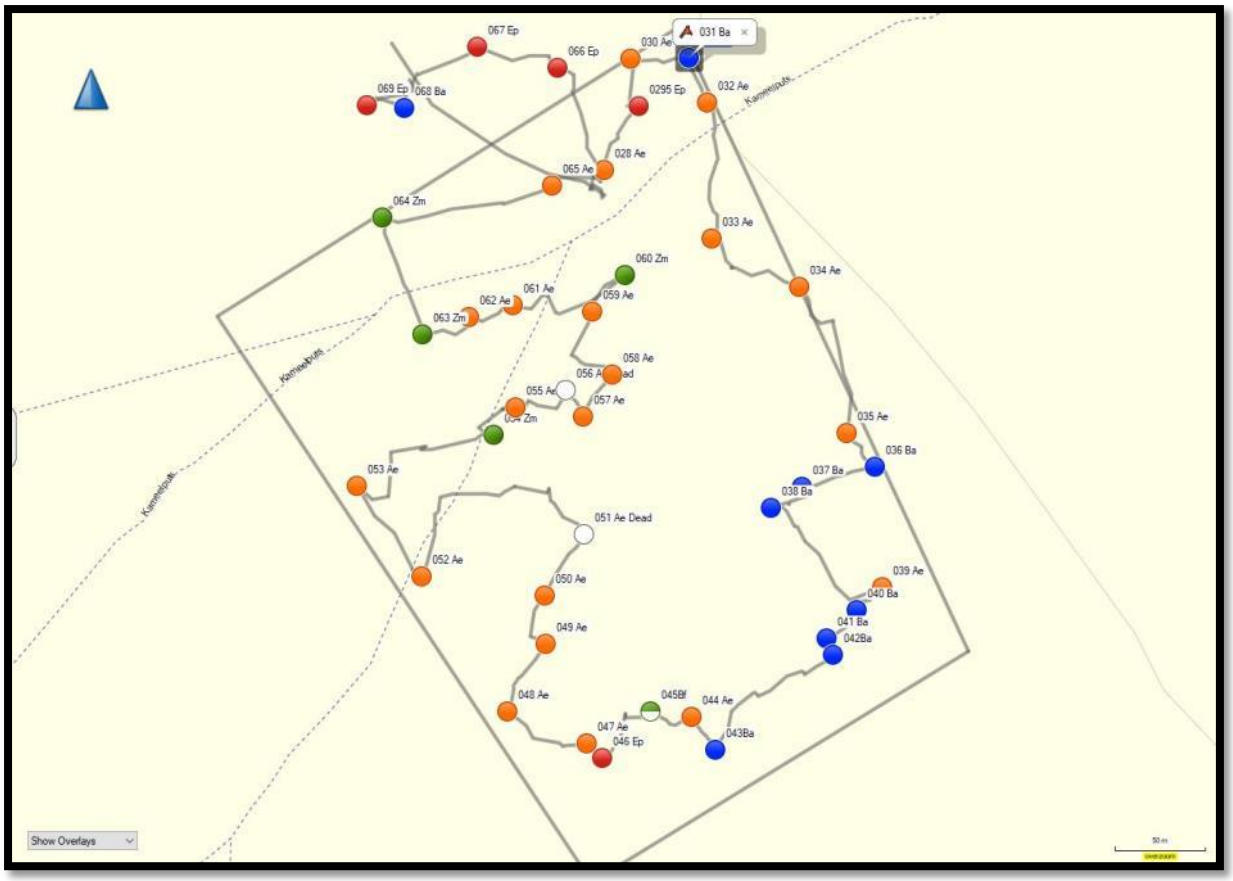
Figure 6: Google image showing the larger proposed footprint within the old river bed.

The vegetation encountered can be described as sparse woodland, dominated by magnificent *Vachellia erioloba* (Camel thorn) trees in its top stratum and the hardy and ecologically important grass, *Stipagrostis namaquensis* in its bottom layer. The site is currently utilised for cattle stock farming and maybe as a result there-off, species diversity was very low. The tree dominated top layer reached a height of up to 10-15 m. One thing that is noteworthy is that it was also clear that the owner is not in the habit of harvesting any of these trees (wood from the Camel thorn tree, for instance is highly valued fire wood). Many dead branches and even dead trees were observed on the property an apart from the impact of grazing it seems as if the land owner actively discourage the harvesting of any wood from this property. This was further underlined by the owner who indicated that, apart from a few *Tamarix usneoides* (Abikwa) bushes and trees, he would like to protect all other significant indigenous trees on the site.

Within the larger footprint (and its immediate surroundings) the following important trees was observed (Refer to Figure 8);

- ***Vachellia erioloba***: 23 individuals were encountered of which 12 were mature trees larger than 6 m in height, two were dead trees and the remainder being young or immature trees of 5m or less (Refer to the Orange dots marked with "*Ae*" in Figure 8);
- ***Euclea pseudebenus***: 5 individuals were encountered of which only 2 were in the proposed site (Refer to the Red dots marked with "*Ep*" in Figure 8);
- ***Boscia albitrunca***: 9 individuals were encountered of which one was outside of the footprint and most of the remainder to the south of the proposed footprint (Refer to the Blue dots marked with "*Ba*" in Figure 8);
- ***Boscia foetida***: Only one individual was encountered to the southwest of the property (Refer to the Green/White dot marked by Bf in Figure 8);
- ***Ziziphus mucronata***: 4 large individuals were encountered in along the small seasonal stream location (Refer to the Green dots marked with "*Zm*" in Figure 8);

- ***Tamarix usneoides***: a number (not marked) of these trees was also encountered, mostly forming clumps or large shrubs.



In between the trees (Photo 1), the vegetation was mostly dominated by *Stipagrostis namaquensis*, with scattered individuals of the small tree *Parkinsonia africana*, the tall shrubs *Lycium cinereum* and *Lycium bosciifolium*, the small tree *Senegalia mellifera,* the smaller shrubs, *Cadaba aphylla*, *Galenia africana*, *Grielum humifusum*, *Hermannia stricta*, *Justicia australis*, *Kleinia longifolia*, *Mesembryanthemum coriarium* and *Salsola* species.

Because of the arid nature of the region the carrying capacity of the veld is low and livestock grazing is expected to have resulted in degradation in species composition.

Photo 1: A typical view of the site, showing magnificent Camel thorn trees in the background, denser vegetation along the seasonal stream (background) and open sparsely vegetated soils dominated by Stipagrostis namaquensis.

Photo 2: One of the Euclea pseudebenus trees encountered to the northeast of the site.

Photo 3: *Tamarisk* clump in the background and smaller *Senegalia mellifera* trees in the foreground.

Photo 4: A view from north to south along the eastern boundary of the site showing a potential mining area.

Although the veld shows signs of degradation and a diminished species composition and the vegetation type itself are not considered vulnerable or endangered, the presence of so many protected tree species and the small seasonal stream enhances the value of the site in terms of botanical significance. Preferably one would have liked to protect this site in order to protect these features. However, the same vegetation and species composition can be found in most of the lower floodplains along the Hartbees and Kameelputs Rivers in this area. It is thus not a unique feature of this site alone.

On the other hand the protection of these trees should be a high priority in any future development in this area. Still it should be quite feasible to accommodate a certain amount of sand mining while still protecting almost all (if not all) of the trees marked during this site visit.

For instance if the mining is limited to the open sandy areas away from the seasonal stream and further than at least a meter away from the "drip-line" of each tree, it is very likely that both mining and the protection of these features can be accommodated. However, it would be imperative that the mining areas be rehabilitated afterwards, preferably by sloping the sides of the mining areas back to a more natural state.

Photo 5: A Camel thorn tree in the foreground with Shepard trees in the background.

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).

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

No.	Species name	FAMILY	Status	Alien & invader species (AIS)
1.	*Boscia albitrunca*	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)**
2.	*Boscia foetida*	BRASSICACEAE (CAPPARACEAE)	LC NCNCA, Schedule 2 Protected (all species in this Genus)	**Apply for a NCNCA Flora permit (DENC)**
3.	*Cadaba aphylla*	CAPPARACEAE	LC	
4.	*Euclea pseudebenus*	EBENACEAE	LC NFA protected species	
5.	*Galenia africana*	AIZOACEAE	LC Protected in terms of schedule 2 of the NCNCA	**Apply for a NCNCA Flora permit (DENC)**
6.	*Grielum humifusum*	NEURADACEAE	LC	
7.	*Hermannia stricta*	STERCULIACEAE	LC	
8.	*Justicia australis (=Monechma genistifolium)*	ACANTHACEAE	LC	
9.	*Kleinia longiflora*	ASTERACEAE	LC	

No.	Species name	FAMILY	Status	Alien & invader species (AIS)
10.	*Lycium bosciifolium*	SOLANACEAE	LC	
11.	*Lycium cinereum*	SOLANACEAE	LC	
12.	*Mesembryanthemum coriarium (=Psilocaulon coriarium)*	AIZOACEAE	LC Protected in terms of schedule 2 of the NCNCA	**Apply for a NCNCA Flora permit (DENC)**
13.	*Parkinsonia africana*	FABACEAE	LC	
14.	*Salsola* species	AMARANTHACEAE	LC	
15.	*Senegalia mellifera (=Acacia mellifera)*	FABACEAE	LC	
16.	*Stipagrostis namaquensis*	POACEAE	LC	
17.	*Tapinanthus oleifolius*	LORANTHACEAE	LC	
18.	*Vachellia erioloba*	FABACEAE	LC NFA protected species	**Apply for a NFA Tree permit (DAFF)**
19.	*Ziziphus mucronata*	RHAMNACEAE	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.

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.

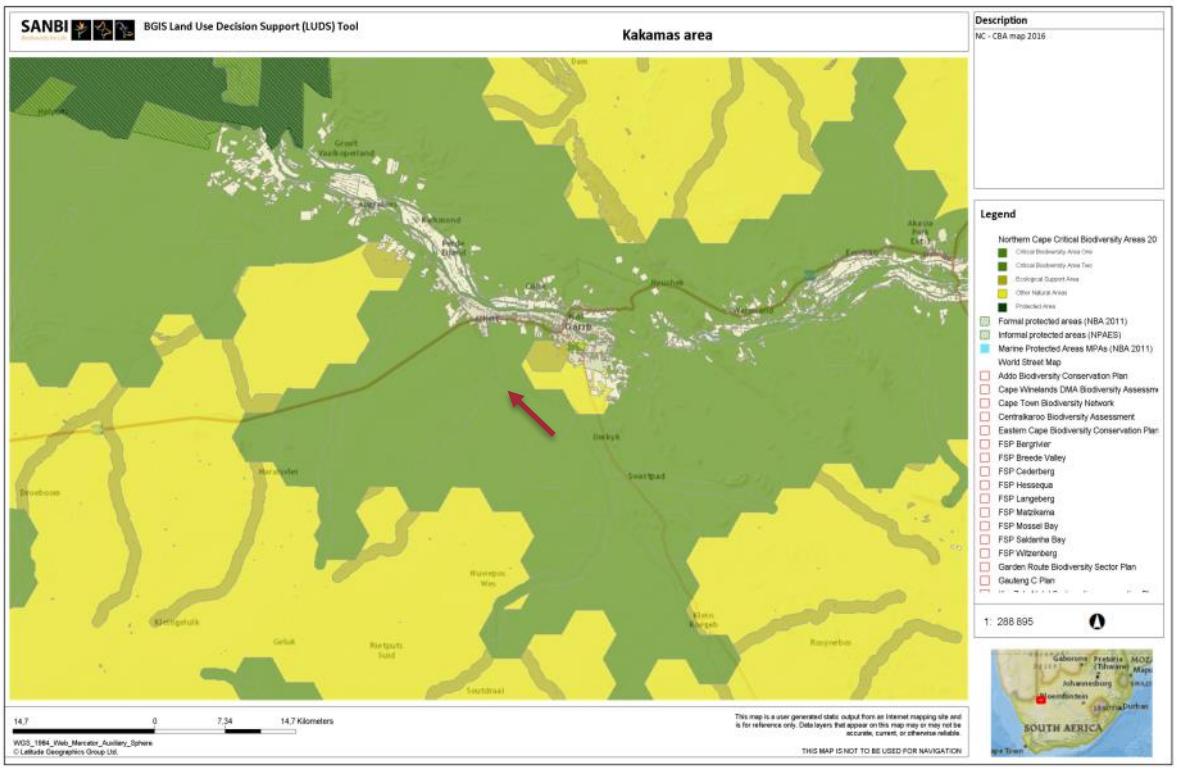


Figure 7: The Northern Cape Critical Biodiversity Areas (2016) showing proposed development footprint

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).

- **Three species protected in terms of the NFA** was observed (Refer to Table 2 & 3).

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

NO.	SPECIES NAME	COMMENTS	I
1.	*Boscia albitrunca* **Sheppard's tree**	9 individuals were encountered of which one was outside of the footprint and most of the remainder to the south of the proposed footprint (Refer to Figure 8).	**Do not disturb**: Mining to avoid coming nearer than 1 m of the canopy cover (or drip line) of any tree.
2.	*Euclea pseudebenus* **Black Ebony quarri**	5 individuals were encountered of which only 2 were in the proposed site (Refer to Figure 8);	**Do not disturb**: Mining to avoid coming nearer than 1 m of the canopy cover (or drip line) of any tree.
3.	*Vachellia erioloba* **Camel Thorn**	23 individuals were encountered of which 12 were mature trees larger than 6 m in height, two were dead trees and the remainder being young or immature trees of 5m or less (Refer to Figure 8);	**Do not disturb**: Mining to avoid coming nearer than 1 m of the canopy cover (or drip line) of any tree.

Table 4, gives the GPS coordinates (WGS 84 format) of each of the trees mentioned above (including Ziziphus mucronata individuals).

Table 4: GPS coordinates of protected tree species encountered

NO.	SPECIES NAME	Coordinates	COMMENTS
028 Ae	*Vachellia erioloba*	S28° 48' 30.9" E20° 33' 04.0"	Mature tree (± 10 m)
029 Ep	*Euclea pseudebenus*	S28° 48' 29.8" E20° 33' 04.6"	Mature tree (± 7 m)
030 Ae	*Vachellia erioloba*	S28° 48' 29.0" E20° 33' 04.5"	Mature tree (± 10 m)
031 Ba	*Boscia albitrunca*	S28° 48' 28.9" E20° 33' 05.6"	Mature tree (± 5 m)
032 Ae	*Vachellia erioloba*	S28° 48' 29.7" E20° 33' 05.9"	Young tree (± 4 m)
033 Ae	*Vachellia erioloba*	S28° 48' 32.2" E20° 33' 06.0"	Young tree (± 4 m)
034 Ae	*Vachellia erioloba*	S28° 48' 33.0" E20° 33' 07.7"	Young tree (± 3 m)
035 Ae	*Vachellia erioloba*	S28° 48' 35.6" E20° 33' 08.5"	Young tree (± 3 m)
036 Ba	*Boscia albitrunca*	S28° 48' 36.2" E20° 33' 09.1"	Mature tree (± 8 m)
037 Ba	*Boscia albitrunca*	S28° 48' 36.5" E20° 33' 07.7"	Mature tree (± 2.5 m)
038 Ba	*Boscia albitrunca*	S28° 48' 36.9" E20° 33' 07.1"	Mature tree (± 2 m)
039 Ae	*Vachellia erioloba*	S28° 48' 38.3" E20° 33' 09.2"	Young tree (± 2.5 m)
040 Ba	*Boscia albitrunca*	S28° 48' 38.7" E20° 33' 08.7"	Mature tree (± 4 m)
041 Ba	*Boscia albitrunca (x2)*	S28° 48' 39.2" E20° 33' 08.2"	Mature tree (± 5 m)
042 Ba	*Boscia albitrunca*	S28° 48' 39.5" E20° 33' 08.3"	Young tree (± 1.2 m)
043 Ba	*Boscia albitrunca*	S28° 48' 41.2" E20° 33' 06.1"	Mature tree (± 2.5 m)
044 Ae	*Vachellia erioloba*	S28° 48' 38.3" E20° 33' 09.2"	Mature tree (± 6 m)
045 Bf	*Boscia foetida*	S28° 48' 40.5" E20° 33' 04.9"	Mature tree (± 1.8 m)
046 Ep	*Euclea pseudebenus*	S28° 48' 41.4" E20° 33' 03.9"	Mature tree (± 2.5 m)
047 Ae	*Vachellia erioloba*	S28° 48' 41.1" E20° 33' 03.7"	Young tree (± 4.5 m)
048 Ae	*Vachellia erioloba*	S28° 48' 40.5" E20° 33' 02.2"	Mature tree (± 10 m)
049 Ae	*Vachellia erioloba*	S28° 48' 39.3" E20° 33' 02.9"	Mature tree (± 10 m)
050 Ae	*Vachellia erioloba*	S28° 48' 38.5" E20° 33' 02.9"	Mature tree (± 8 m)
051 Ae	*Vachellia erioloba*	S28° 48' 37.4" E20° 33' 03.6"	Dead tree
052 Ae	*Vachellia erioloba*	S28° 48' 38.1" E20° 33' 00.5"	Young tree (± 5 m)
053 Ae	*Vachellia erioloba*	S28° 48' 36.5" E20° 32' 59.3"	Mature tree (± 15 m)
054 Zm	*Ziziphus mucronata*	S28° 48' 35.6" E20° 33' 01.9"	Mature tree (± 12 m)
055 Ae	*Vachellia erioloba*	S28° 48' 35.1" E20° 33' 02.3"	Mature tree (± 15 m)

NO.	SPECIES NAME	Coordinates	COMMENTS
056 Ae	*Vachellia erioloba*	S28° 48' 34.8" E20° 33' 03.3"	Dead tree
057 Ae	*Vachellia erioloba*	S28° 48' 35.3" E20° 33' 03.6"	Mature tree (± 6 m)
058 Ae	*Vachellia erioloba*	S28° 48' 34.6" E20° 33' 04.1"	Mature tree (± 6 m)
059 Ae	*Vachellia erioloba*	S28° 48' 33.4" E20° 33' 03.8"	Young tree (± 2 m)
060 Zm	*Ziziphus mucronata*	S28° 48' 32.8" E20° 33' 04.4"	Mature tree (± 8 m)
061 Ae	*Vachellia erioloba*	S28° 48' 33.3" E20° 33' 02.3"	Young tree (± 2.5 m)
062 Ae	*Vachellia erioloba*	S28° 48' 33.5" E20° 33' 01.4"	Mature tree (± 10m)
063 Zm	*Ziziphus mucronata*	S28° 48' 33.9" E20° 33' 00.6"	Mature tree (± 7 m)
064 Zm	*Ziziphus mucronata*	S28° 48' 31.8" E20° 32' 59.8"	Mature tree (± 6 m)
065 Ae	*Vachellia erioloba*	S28° 48' 31.2" E20° 33' 03.0"	Mature tree (± 6 m)
066 Ep	*Euclea pseudebenus*	S28° 48' 29.1" E20° 33' 03.1"	Mature tree (± 4.5 m); Outside footprint
067 Ep	*Euclea pseudebenus*	S28° 48' 28.8" E20° 33' 01.6"	Mature tree (± 4.5 m); Outside footprint
068 Ba	*Boscia albitrunca*	S28° 48' 29.8" E20° 33' 00.2"	Mature tree (± 5 m); Outside footprint
069 Ep	*Euclea pseudebenus*	S28° 48' 29.8" E20° 32' 59.5"	Mature tree (± 6 m); Outside footprint

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 5) protected in terms of the NCNCA were encountered. Recommendations on impact minimisation also included.

Table 5: Plant species protected in terms of the NCNCA encountered within the study area

NO.	SPECIES NAME	COMMENTS	I
1.	*Boscia albitrunca* **Schedule 2 protected**	9 individuals were encountered of which one was outside of the footprint and most of the remainder to the south of the proposed footprint (Refer to Figure 8).	**Do not disturb**: Mining to avoid coming nearer than 1 m of the canopy cover (or drip line) of any tree.
2.	*Boscia foetida* **Schedule 2 protected**	1 individual encountered.	**Do not disturb**: Mining to avoid coming nearer than 1 m of the canopy cover (or drip line) of any tree.
3.	*Galenia africana* **Schedule 2 protected**	This plant is weedy a disturbance indicator and commonly found in Erf 1654.	No special measures needed, this is a weedy pioneer species.
4.	*Mesembryanthemum coriarium* **Schedule 2 protected**	This plant is weedy a disturbance indicator and commonly found throughout.	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 6).

Significance = Conservation Value x (Likelihood + Duration + Extent + Severity) (Edwards 2011)

Table 6: 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 7: 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 on slightly disturbed natural veld (stock grazing over a long period of time has likely altered the vegetation composition). It is also located within deeper sandy soils of a small valley bottom (historical floodplains). Probably the most significant aspect of the vegetation is the presence of a number of mature indigenous trees (many of which is protected species) scattered within this valley bottom as well as the old floodplains associated with the adjacent Hartbees River. The presence of so many of these magnificent trees is probably the single most defining feature of this area.
- **Activity**: The proposed development is expected to result in a long term impact on approximately 5 ha of slightly disturbed Bushmanland Arid Grassland.
- **Geology & Soils**: The site is located on slightly deeper soils than normally expected in this vegetation type as it is located on historical floodplains. Today only the sandy plains remain, and the Kameelputs River only remains as a small seasonal drainage line to the north of the proposed site. But as a result of the deeper sandy soils the plant species composition changed to scattered woodland. Apart from the deeper sandy soils and the small seasonal drainage lines no other significant geographical features such as wetlands, true quarts patches or heuweltjies were observed in or near to the larger footprint area (rainfall in this area is too unpredictable to result in true quartz vegetation). The site is located on deeper sandy soils, probably the result of historic floodplains of old river systems draining into the Hartbees River.
- **Land use and cover**: Land use is primarily focused on livestock grazing by the owner. The possible impact on socio-economic activities will be localised and will only impact on the owner himself.
- **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. But please note, that because of the deeper sandy soils, the vegetation composition is not typical of Bushmanland Arid Grassland, but more typical of vegetation associated with water courses or the Kalahari dune systems.
- **Conservation priority areas:** 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). 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 long term impact on 5 ha of land within a CBA. The vegetation of the larger footprint is still well connected to the north and west. Too the south and east intensive agriculture is practiced. Connectivity might be slightly impaired, but should not result in a significant additional impact.
- **Watercourses and wetlands**: The old Kameelputs River remains as a small seasonal stream running through the northern part of the proposed footprint. However, with correct placement the impact on this small stream should be minimal. Protection of the river and its riparian vegetation will also ensure protection of the number of larger trees, associated with this small stream.
- **Protected or endangered plant species**: The single most significant feature of the site is the large number of magnificent protected trees scattered throughout the site and its surroundings (where-ever the deeper soils is encountered). Potentially the proposed mining activity can have a significant

impact on these trees. However, with correct placement it is quite possible that almost none of these trees are impacted.

- **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 8: 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	4	4	4	1	3	48	The site is located on deeper soils than normally expected in this vegetation type (being historical floodplains), which had allowed a scattered woodland to develop.
	With mitigation	4	2	2	1	2	28	Place the disturbance footprint away from watercourses, riparian vegetation and protect mature indigenous trees.
Landuse and cover: Potential impact on socio-economic activities.	Without mitigation	2	2	3	1	2	16	Land use is primarily focused on livestock grazing. Impacts on socio-economic activities will be localised and only impact on the owner himself.
	With mitigation	2	1	2	1	1	10	Place the disturbance footprint away from watercourses, riparian vegetation and protect mature indigenous trees.
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	3	4	4	1	3	36	Temporary impact on disturbed Bushmanland Arid Grassland (Least Threatened), but with atypical vegetation and it overlap a CBA (future protection area).
	With mitigation	3	2	2	1	2	21	Place the disturbance footprint away from watercourses, riparian vegetation and protect mature indigenous trees.
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	4	4	4	1	4	52	Site overlaps into a CBA (proposed future protection area), with atypical vegetation (specifically mature indigenous tree species).
	With mitigation	4	2	2	1	2	28	Place the disturbance footprint away from watercourses, riparian vegetation and protect mature indigenous trees.
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	3	2	4	1	2	27	Disturbance will be localised (small area) and long term, but not permanent and should not have a significant impact on connectivity.
	With mitigation	3	1	2	1	1	15	Place the disturbance footprint away from watercourses, riparian vegetation and protect mature indigenous trees.
Watercourses and wetlands: Potential impact on natural water courses and its ecological support areas.	Without mitigation	3	4	4	1	4	39	The site is located in a historical floodplain, and can potentially have an impact on a small seasonal stream.
	With mitigation	3	2	2	1	1	18	Ensure that the sand mining activity is located away from the small stream (which will also allow protection of the indigenous trees associated with this stream).

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Protected & endangered plant species: Potential impact on threatened or protected plant species.	Without mitigation	4	4	4	1	3	48	The most significant aspect of this site is the large number of mature indigenous trees that can potentially be impacted (many of them protected species).
	With mitigation	4	2	2	1	2	28	Ensure that the sand mining activity is located away from the small stream (which will also allow protection of the indigenous trees associated with this stream).
Invasive alien plant species: Potential invasive plant infestation as a result of the activities.	Without mitigation	3	3	4	2	3	36	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).
Veld fire risk: Potential risk of veld fires as a result of the activities.	Without mitigation	3	2	3	2	2	27	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	4	4	4	2	4	56	Mostly associated with the fact that the site overlaps a CBA and a number of mature protected tree (and plant) species within the footprint.
	With mitigation	4	2	2	1	2	28	Minimise the impact on protected plant species and minimise the disturbance footprint.
The "No-Go" option: Potential impact associated with the No-Go alternative.	Without mitigation	4	3	3	2	2	40	No impact on the CBA or mature indigenous tree species.
	With mitigation						0	The No-Go option will not significantly add to conservation targets, but will avoid impact on mature indigenous trees.

According Table 8, the main impact associated with the proposed activity is associated with the potential impact on mature indigenous tree species (many of which are protected tree species) and to the potential impact on the small stream (especially the mature indigenous trees associated with the stream). Moving the site will not have any significant advantages, as the vegetation remains the same, wherever the deeper sands is encountered. However, the impact can be significantly reduced if sand mining is kept to the open areas away from the stream and away from the most significant trees on site (it should be easy to place the footprint in such open areas and minimise the impact on mature trees).

Without mitigation the cumulative impact is expected to be Medium/High but with mitigation it can be reduced to a potential Low significance.

7. IMPACT MINIMISATION RECOMMENDATIONS

The proposed site is considered sensitive due to the number of large indigenous (many of them protected species) trees associated with the larger footprint. However, a similar composition of these trees are also found scattered throughout the surroundings where-ever deeper sands are encountered associated with the old floodplains of the surrounding river systems. If the impact on these trees can be minimised or even negated, sand mining in well-chosen site will have minimal impact on these trees.

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.

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:

- It is imperative that the mining footprint is placed in the open (already disturbed) areas away from the small seasonal stream (>32 m away) to the north and at least 1 m away from the canopy line (drip-line) of any mature indigenous tree. In fact there should be enough open areas, to avoid impact even on smaller protected species (e.g. young Camel thorn trees). Please refer to Figure 8 underneath, which proposes areas for potential sand mining, which will keep it away from the small stream and away from protected tree species.
- No development should be allowed within 1 m away from the canopy line of any of the *Euclea pseudebenus* trees (in other words no impact on any of these trees), which should be very easy to achieve.
- No impact should be allowed within 1 m away from the canopy line of any mature (>6 m in height) *Vachellia erioloba* (Camel Thorn) trees. In fact it should be easy to protect all Camel thorn trees and still be able to do sand mining. However, should any Camel Thorn tree have to be removed, a permit must first be applied for.
- No impact should be allowed within 1 m away from the canopy line of any of the mature *Boscia* species (both *Boscia albitrunca* and *Boscia foetida*). Again this should be easy to achieve. However, should any Shepard's tree have to be removed, a permit must first be applied for.
- No impact should be allowed on any other mature indigenous trees larger than 6 m (e.g. *Ziziphus mucronata*), even though they are not protected species. Large indigenous trees within an arid area such as this, plays an important role in the ecology of the area as a whole.
- Sand mining should preferably not exceed 2.5 m in depth (too enable better rehabilitation) and must be kept within the open areas between trees (Figure 8).
- Topsoil must be removed to a depth of 15 – 20 cm and protected and stored separately for re-use during rehabilitation
- Mining must consider rehabilitation and must ensure that enough sand remains too sloped the excavate areas back to a more natural state during rehabilitation.
- 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.
- Access must be limited to routes approved by the ECO.
- 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.
- 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.

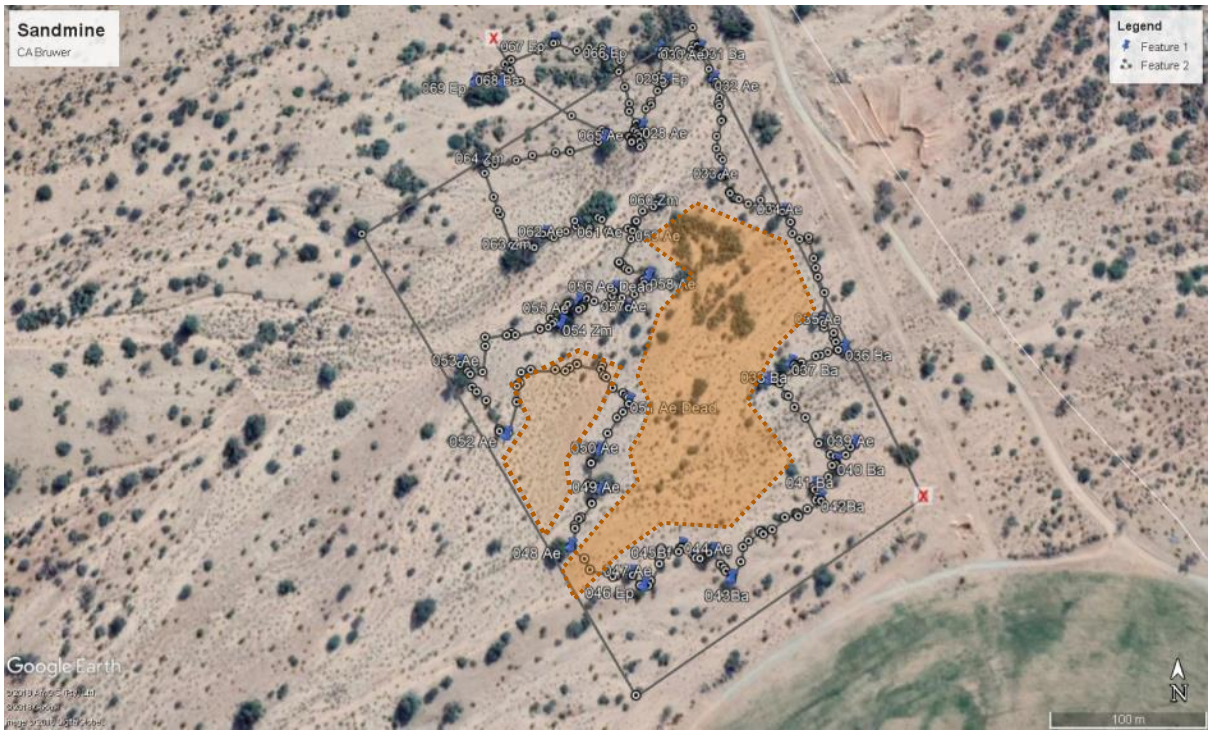


Figure 8: Proposed potential areas for sand mining, which will avoid the stream and protected tree species

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