PB CONSULT
ENVIRONMENTAL MANAGEMENT SERVICES

BOTANICAL ASSESSMENT

TRIPLE D FARMS AGRICULTURAL DEVELOPMENT

PROPOSED DEVELOPMENT OF A FURTHER 60 HA OF VINEYARDS, ERF 1178, 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. 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 NCCBA maps were used to guide the identification of potential significant sites.

VEGETATION ENCOUNTERED

The vegetation on site conforms to a slightly disturbed version of Bushmanland Arid Grassland, with the most significant feature the denser riparian zones associated with the larger water courses (Refer Figure 8). The proposed development will result in the transformation of approximately 60 ha of this vegetation within a proposed CBA area.

CONSERVATION PRIORITY AREAS

According to the Northern Cape Critical Biodiversity Areas (2016), the proposed site will impact on a CBA area, but it is also located within an area that is characterised by intensive farming, with little connectivity remaining to the northern parts of the site.

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

CONNECTIVITY

The proposed activity will have a long term impact on 60 ha of land within a CBA. The vegetation of the larger footprint is still partially connected to the south, west and east. However the northern parts of the footprint are surrounded by existing vineyards to the west, north and east. Connectivity will be impacted but it is already compromised towards the Orange River. Corridors along the most significant water courses would help to retain some connectivity (Figure 8).

LAND-USE

At present the land seems to be fallow land (not currently used for grazing). 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:

- **One red-listed species** (*Aloidendron dichotomum*) (Heading 4.6.1).
- No NEM: BA protected plant species (Heading 4.6.2).
- **One NFA protected tree** (*Boscia albitrunca*) (Heading 4.6.3)
- **Ten NCNCA protected plant species** (Heading 4.6.4).

WATER COURSES AND WETLANDS

As with almost all areas in the Northern Cape the site is criss-crossed by the normal ephemeral drainage lines, but some larger water courses, with well-established riparian zones, were also encountered. They have an important ecological and drainage function. Protection of the most significant water courses and its riparian vegetation will ensure protection of the majority of larger trees, observed on site (Refer to Figure 8).

MAIN CONCLUSION

The proposed development will result in the transformation of approximately 60 ha of natural vegetation (Least Threatened) within a proposed CBA area. It will also potentially impact on a number of significant water courses and its associated riparian vegetation, as well as 2 *Boscia albitrunca* (Protected in terms of the NFA) and 2 *Aloidendron dichotomum* trees (a red listed plant, and protected in terms of the NCNCA). In addition it is also likely to impact on a number of other NCNCA plant species (Refer to Table 5).

According to the impact assessment given in Table 8 the development could have a medium/high impact on the environment, but with mitigation it can be reduced significantly to medium/low. **It is thus very important that the mitigation actions described below are implemented.**

With the correct mitigation it is likely that the development will then not contribute significantly to any of the following:

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

WITH THE AVAILABLE INFORMATION IT IS RECOMMENDED THAT PROJECT BE APPROVED, BUT ONLY IF THE PROPOSED MITIGATION ACTIONS ARE IMPLEMENTED (IN ORDER TO MINIMISE THE ENVIRONMENTAL IMPACT.

NO-GO OPTION

The development may result in potential significant 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, environmental compliance audits and environmental control work (ECO) as well as more than 70 biodiversity or botanical studies.

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

Kakamas is a small town founded in 1898 and located in the Kai !Garib Municipality of the Northern Cape province of South Africa, on the banks of the Orange River. It originated as at a place where the Orange River could be relatively easily crossed (and was first known as Bassonsdrif). In 1898 a proper settlement was established and under the auspices of the Dutch Reformed Church the area was developed as an agricultural spot. It became a municipality in 1954. The name Kakamas was originally given to a drift that was known as Takemas or T'Kakamas since 1779. The name means "place of the raging cow". The economy of this town is based on farming, and thanks to irrigation from the Orange River farmers from the Kakamas area are now prime exporters of table grapes peaches, dried fruit, raisins, oranges and dates (https://en.wikipedia.org/wiki/Kakamas).

Triple D Farms is a large agricultural farm just west of Kakamas (just off the N14) focusing on the production of table grapes and raisins. The owners would like to develop a further 60 ha on Erf 1178, Kakamas South Settlement. An area of approximately 120 ha was evaluated in the larger footprint. The development will also the construction of a new pump station on the banks of the Orange River, pipelines from the Orange River to the property, an off-stream storage dam (reservoir) on the property, a packing shed and labour housing. The proposed pump station and pipelines will be located within registered servitudes.

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 new development will be located in veld still supporting natural veld and PB Consult was appointed to conduct a botanical assessment of the larger property.

Only one vegetation type is expected, namely Bushmanland Arid Grassland (considered "Least Threatened" in terms of the National list of ecosystems that are threatened and in need of protection). As with almost all areas in the Northern Cape the site is criss-crossed by the normal ephemeral drainage lines, but some larger water courses were also encountered. These drainage lines are often associated with slightly larger shrubs and small trees that are only found near such water ways.

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 town of Kakamas is located along the N14, on the banks of the Orange River along the, between Pofadder and Upington (Kai !Garib Local Municipality, ZF Mgcawu District Municipality) in the Northern Cape Province (Figure 1). Triple D is located just west of Kakamas (approximately 2.5 km), just off the N14 (Figure 2).

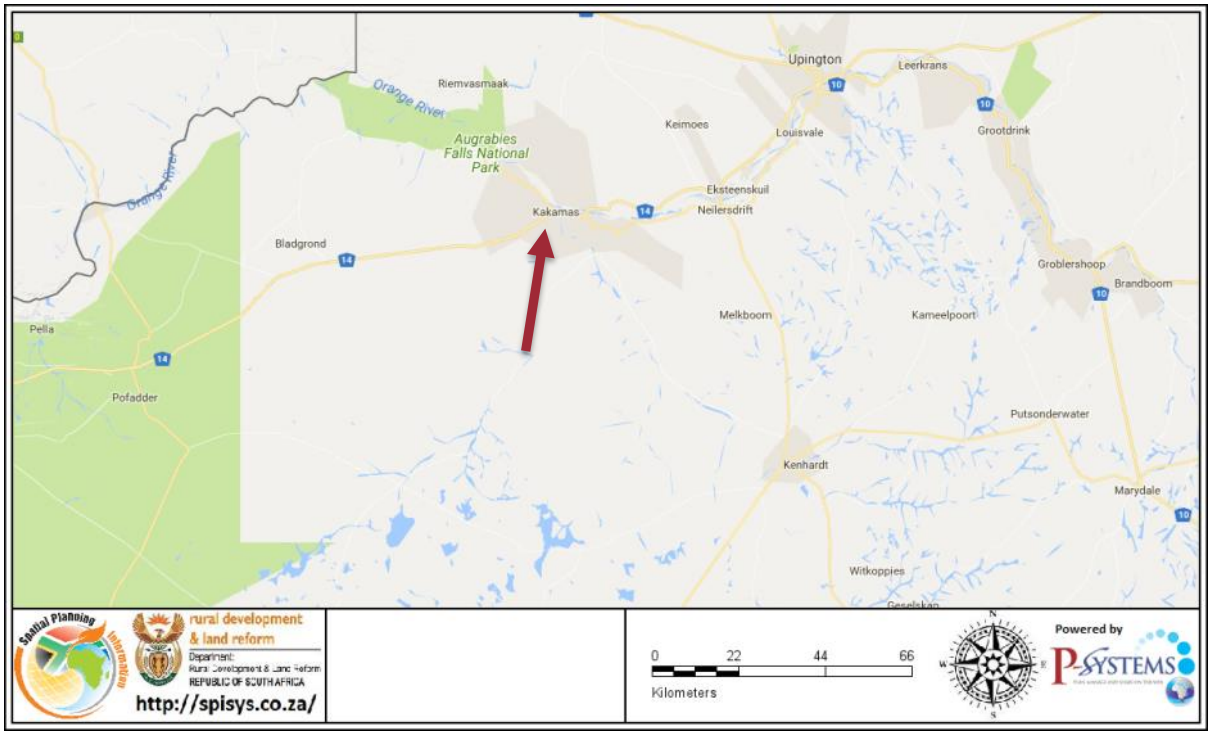

Figure 1: Map showing the location of Kakamas in the Northern Cape Province

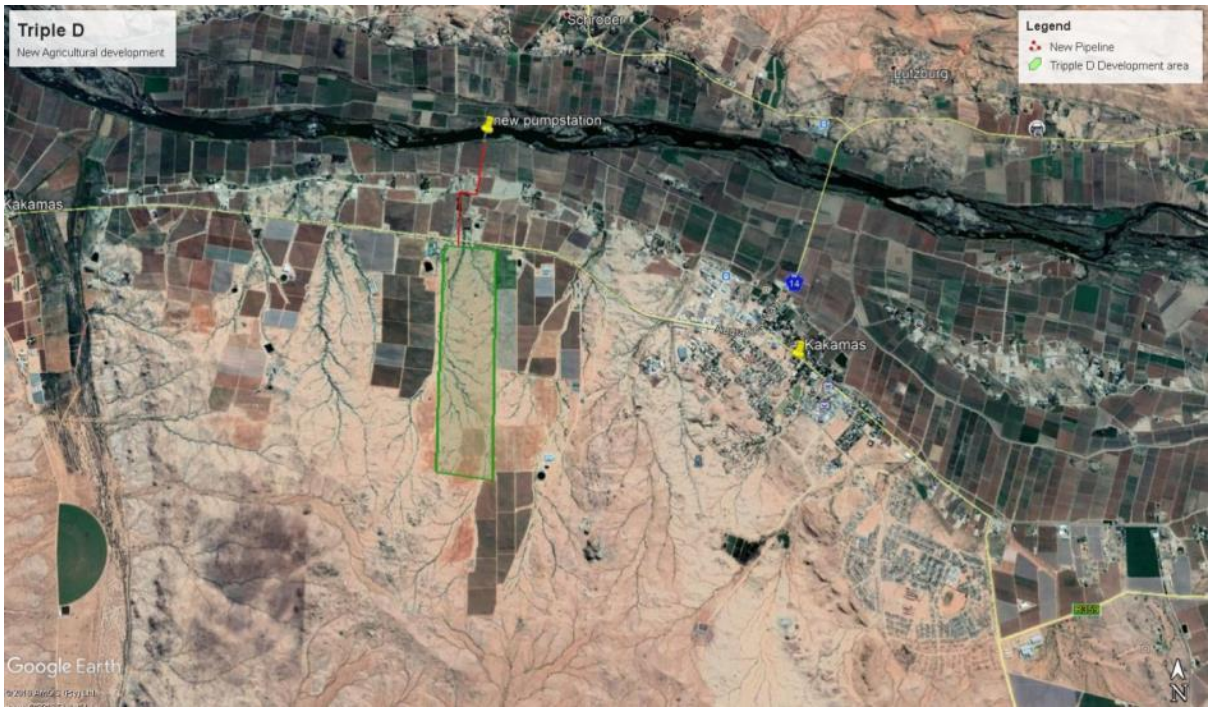

Figure 2: The location of the proposed development footprint in relation to Kakamas

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/location/911655/)

	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/location/911655/).

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.

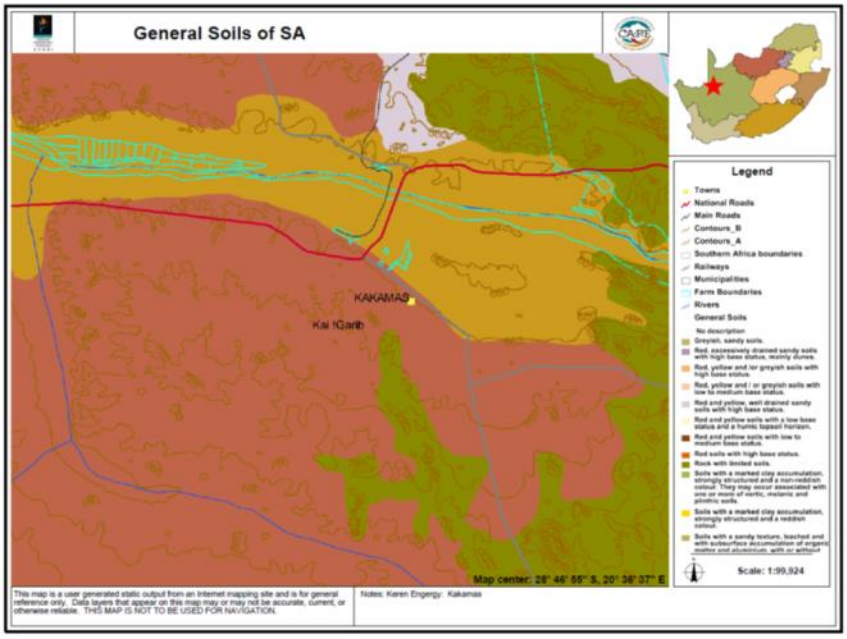

Figure 3: General soils map for the area (SANBI BGIS)

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).

Please note that Agrimotion did a detailed soil and development potential report for the proposed development (Agrimotion, 2017).

2.4. TOPOGRAPHY

The larger footprint (approximately 120 ha in size) is mostly located on a level to slightly undulating plain, sloping slightly from south to north (towards the Orange River). The proposed site is about 1 km away from (to the south) of the Orange River with the N14 between the Orange River and the site. However, the northern parts of the proposed site (next to the N14) is traversed by a number of more pronounced seasonal water courses cutting through the landscape and resulting in a number of deeper runnels (coupled with a number of rocky outcrops). The rocky outcrops are mostly very small and did not support any specialised vegetation, but will make development more costly. Elevation drops from south to north approximately 687 m to 664 m (above sea level) over a distance of approximately 2.2 km with an average slope of 0.3% (very gentle slope). In general aspect is not expected to have any significant influence on the vegetation, but differences in geographical features such as the seasonal watercourses results in differences in vegetation combination. In terms of vegetation, the smaller ephemeral streams is not seen as significant features, but the larger watercourses have an important function in terms of drainage and also supports the most significant riparian vegetation (associated with larger trees).

3. EVALUATION METHOD

Desktop studies coupled with a site visit were performed. The site visit was conducted during August of 2018. The timing of the site visit was reasonable in that essentially all perennial plants were identifiable. Bulb and annual herbs were mostly absent (the possibility remains that some of these species may have been missed).

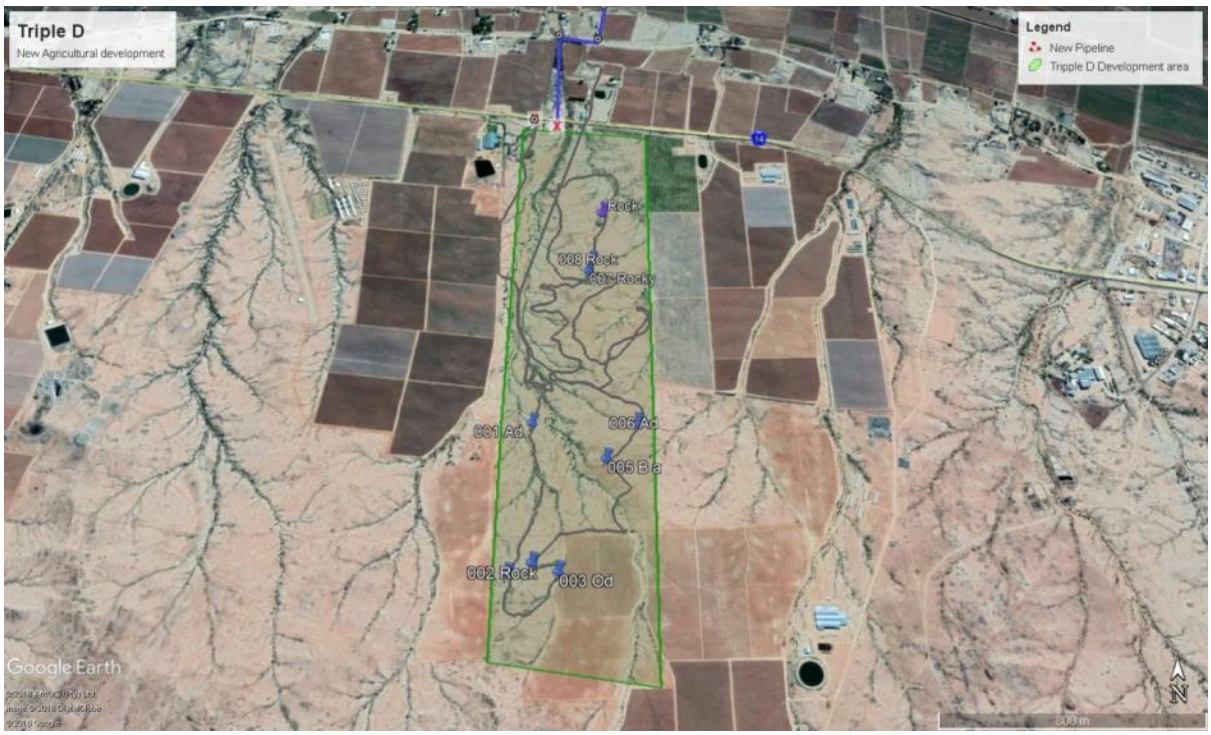

Figure 4: The proposed larger footprint (green) that was studied during the site visit

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

4. THE VEGETATION

The Northern Cape contains about 3500 plant species in 135 families and 724 genera, with about 25% of this flora endemic to the region. It is also home to an exceptionally high level of insect and reptile endemism, with new species still being discovered. However, it must be noted that this remarkable diversity is not distributed evenly throughout the region, but is concentrated in many local centres of endemism (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.

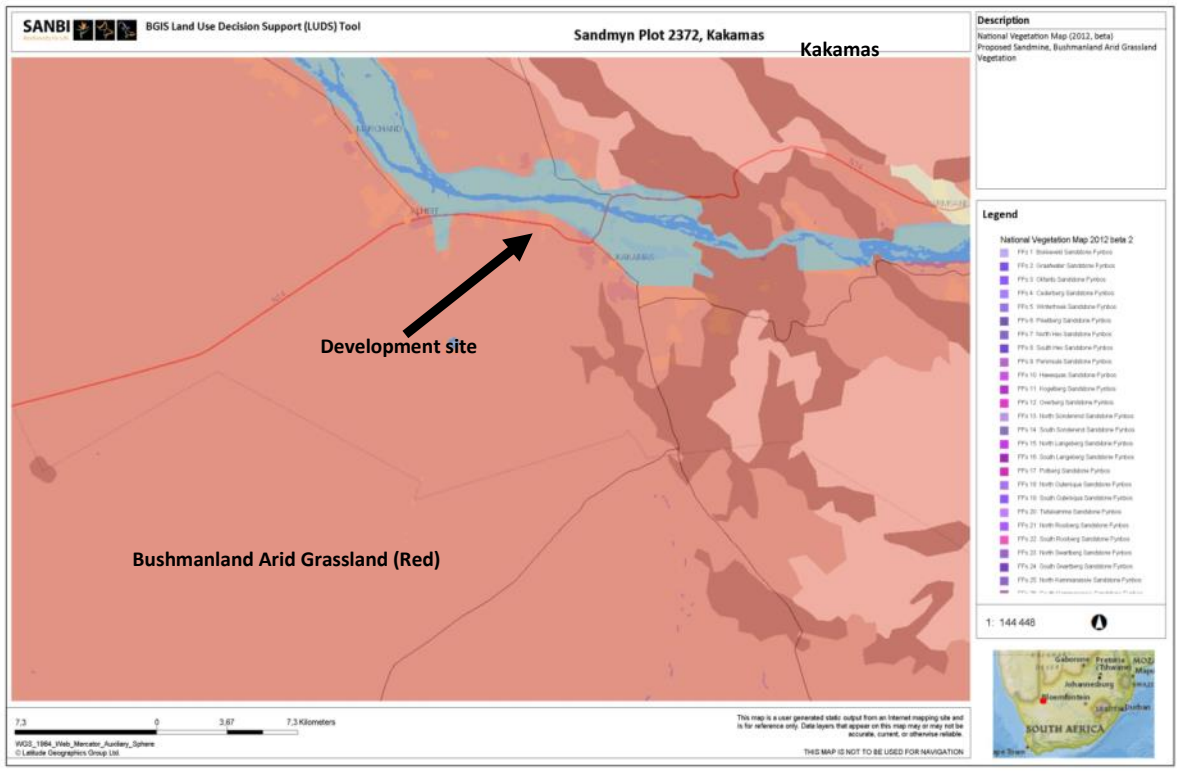

Figure 5: Vegetation map of South Africa (2012 beta 2 version), showing the larger area and expected vegetation

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 plant species and does not contain any centre of endemism. Local endemism is very low, which might indicate a relative youthful biome linked to the remarkable geological and environmental homogeneity of the Nama-Karoo. Rainfall seasonality and frequency are too unpredictable and winter temperatures too low to enable leaf succulent dominance (as in the Succulent Karoo). It is also too dry in summer for dominance by perennial grasses alone and the soils generally 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

Approximately 120ha of veld was evaluated, of which the land owner would like to develop 60 ha. The vegetation encountered conforms to Bushmanland Arid Grassland. Two definite communities were encountered namely a sparse (semi-desert type) low shrubland with grasses sometimes present (expected to be more prominent after rain) on the open undulating plains, while a denser and higher riparian vegetation was encountered next to the watercourses. The more pronounce these water courses the more established

the riparian zone became. Because of the arid nature of the region (and the unpredictability of rainfall) the carrying capacity of the veld is very low and much of the natural veld is expected to have suffered from incorrect grazing or overgrazing practices since the early 19th century (after farms became fenced).

4.2.1. The Open plains

The vegetation encountered on the open gravelly plains can be described as a sparse low shrubland (sometimes even a dwarf shrub layer) (Photo 1 & 2), with surface rocks and sometimes even small/low rocky outcrops (Photo 3) showing above ground (to the north of the site, larger rocky outcrops were also encountered). The vegetation varied from a sparse low shrubland dominated by *Tetraena decumbens (=Zygophyllum)* (Photo 1) to a very sparse open low shrubland (Photo 2) either dominated by either *Tetraena decumbens* or by *Justicia australis (=Monechma)*, in the calcrete patches (Photo 2).

Photo 1: Sparse shrubland dominated by *Tetraena decumbens* with *Aloe claviflora* present in the foreground.

The following plant species were observed scattered throughout the site (never dominating, but sometimes encountered in patches); the small *Acanthopsis disperma*, the common *Aloe claviflora*, two individuals of *Aloidendron dichotomum* (a third was observed outside of the proposed footprint)*, Aptosimum spinescens, Asparagus* cf. *cooperi, Avonia* cf. *papyracea*, *Berkheya fruticosa*, *Blepharis mitrata*, two individuals of *Boscia albitrunca* (one in poor and one in fairly good condition), scattered individuals of *Boscia foetida*, patches of *Cynanchum viminale, Euphorbia gariepina,* and occasionally the smaller *Euphorbia* cf. *rhombifolia*, *Forsskaolea candida*, the common *Galenia africana, Geigeria filifolia, Justicia spartioides, Kleinia longiflora, Leucosphaera bainesii, Limeum aethiopicum, Lycium cinereum,* the succulent *Mesembryanthemum coriarium* (=*Psilocaulon coriarium*), *Monsonia* cf. *patersonii*, *Ptycholobium biflorum*, *Rhigozum trichotomum,* the common *Rogeria longiflora*, *Salsola aphylla*, *Sericocoma avolans, Senegalia mellifera* and *Tapinanthus oleifolius.*

Photo 2: Very sparse open low shrubland with *Justicia australis* prominent.

The vegetation encountered at the small rocky outcrops (Photo 3) did not differ in species from that of its surroundings (although vegetation cover was sometimes slightly denser, as a result of the shelter given by the outcrops). The only plant that was not observed elsewhere and that was only found near one of the rocky outcrops to the north was *Berkheya glabrata.* Other species commonly associated with these outcrops were *Aloe dichotoma*, *Boscia foetida*, *Forsskaolea candida, Galenia africana* and *Tetraena decumbens.*

Photo 3: One of the small rocky outcrops towards the south of the site.

Please refer to Appendix 1 for a collage of pictures of the open plains area.

4.2.2. The riparian vegetation

The vegetation along the small ephemeral drainage lines and small seasonal water courses did not varied much, apart from becoming denser and larger, the more pronounce the water course becomes (e.g. Photo 4). Agrimotion, 2017 did a very good job of mapping the most prominent of these water courses on their soil potential map for the Triple D farm (Figure 6). The following plants were commonly observed in association with these seasonal water courses: *Asparagus* cf. *cooperi*, *Boscia foetida*, the herb *Chascanum garipense*, *Hermannia stricta, Jamesbrittenia glutinosa*, *Justicia spartioides*, *Montinia caryophyllacea*, *Osteospermum scariosum*, *Ozoroa dispar*, *Parkinsonia africana*, *Rhigozum trichotomum Senegalia mellifera, Tapinanthus oleifolius, Tetragonia reduplicata* and *Ziziphus mucronata.*

Photo 4: One of the larger seasonal water courses to the north of the site.

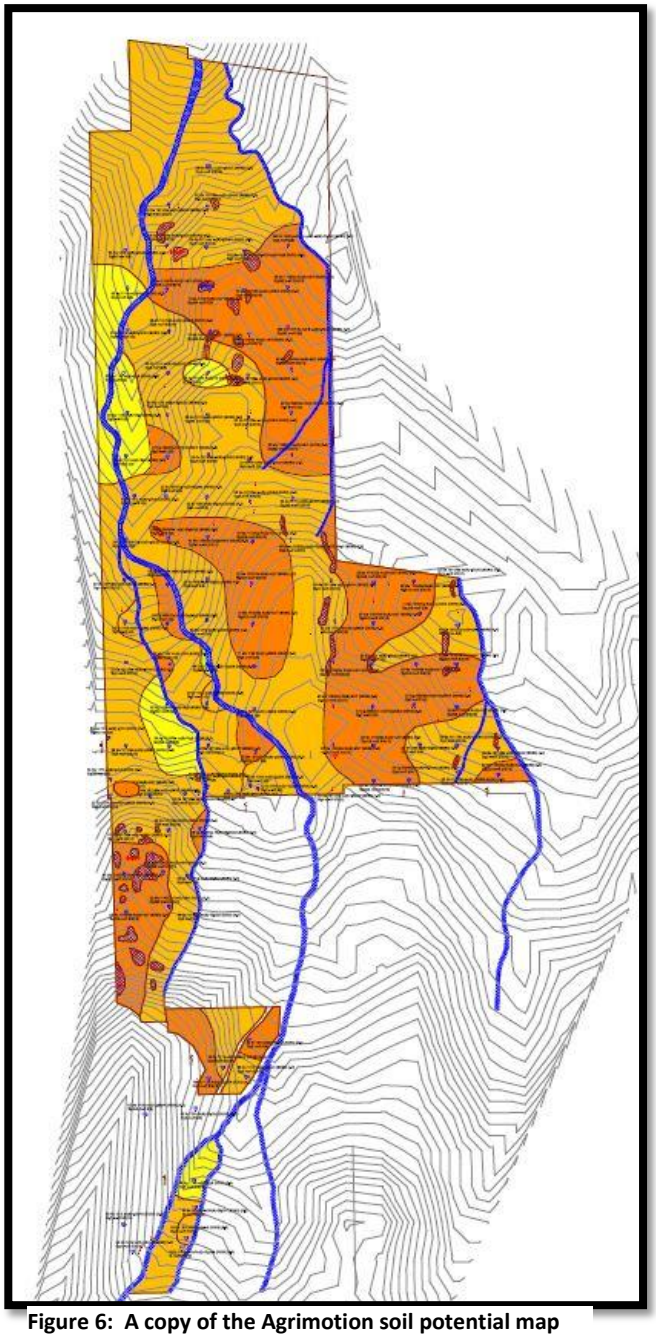

Figure 6: A copy of the Agrimotion soil potential map

Figure 6, was taken from the soil potential report done by Agrimotion (2017) for the same project. On the soil potential map (a copy of which is shown), the seasonal water courses are clearly indicated. The protection of these features is fully supported by this report. However, it is also recommended that a buffer zone of at least 3 – 5 m is established next to these main water courses (as indicated in Figure 6), measured from the edge of the water course (not the centre of the water course) in order to protect the existing riparian vegetation.

Farm/crop access roads may not be established or intrude into these buffer zones. In other words the access road may not form the buffer zone, but must be placed away from the water course and outside of this buffer zone.

4.2.3. The pipeline route

The proposed pipeline route includes the establishment of a new pump station at the banks of the Orange River. From there it will be placed in or next to existing farm roads through transformed agricultural area (as is the case along most of the banks of the Orange River in this area), with only the last section passing along an area with some very disturbed natural veld next to a seasonal water course.

The proposed location for the placement of the extraction pump (Photo 5- 7) is located on a disturbed portion of the Orange River, already used as an access point / jetty for the small boats. As long as the pipeline is located within the existing disturbance footprint, the impact on vegetation will be minimal (Please note that a Freshwater specialist report was commissioned, who will address the impact on the river system). Next to the disturbance footprint, disturbance indicator plants, alien invasive species (Prosopis species) and some remaining natural vegetation was encountered, the most important of which was *Phragmites australis* stands stabilizing the river banks and the small indigenous trees, *Vachellia karroo* (=*Acacia karroo*) and *Tamarix*

usneoides. Other species included disturbance indicators like *Mesembryanthemum guerichianum*, *Mesembryanthemum coriarium* and the herb *Jamesbrittenia glutinosa*.

Photo 5: The proposed pump station location looking from south onto the Orange River. Note the disturbance footprint.

S28° 45' 07.3" E20° 35' 15.8"

Photo 6: The banks of the Orange River at the proposed pump station location (looking from the disturbed area eastwards).

Photo 7: The banks of the Orange River at the proposed pump station location (looking from the disturbed area westwards).

From the banks of the Orange River the pipeline will follow existing roads for the next 1.7 km through areas under intensive cultivation (mostly vineyards) (Refer to Photo 8-10). Through this section the impact there

should be no impact on any natural veld (transformed land) and as long as the pipeline stays next to or within the existing roads, impact on agriculture should be minimal.

Photo 8: The proposed pipeline route will follow existing roads. This picture depicts the last section of agricultural land towards the banks of the Orange River, looking from south to north (towards the Orange River in the background).

Photo 9: This picture depicts the proposed pipeline route from south to north through agricultural land going towards Picture 8. Note the alien *Prosopis* trees to the left.

Photo 10: This picture depicts the pipeline route following a section of the road (from west to east) before it turns south towards the Orange River (Picture 9). Note the alien Beefwood windbreaks to the left and right of the road.

The final section of the pipeline will be located next to a badly disturbed area, but with some natural plants still remaining, next to a seasonal stream. Unfortunately, this area is very disturbed and degraded, and the riparian vegetation is mostly replaced by the alien *Prosopis* trees, Beefwood (*Casuarina* species), with the occasional indigenous *Vachellia karroo,* patches of *Phragmites australis* and some disturbance indicator species remaining (e.g. *Mesembryanthemum guerichianum*, *Mesembryanthemum coriarium, Lycium species, Rhigozum trichotomum* and *Senegalia mellifera).*

Photo 11: The section of the pipeline next to the water course from the N14 towards Picture 10.

Photo 12: The section of the proposed pipeline, crossing underneath the N14 (through an existing culvert) and then running next to the seasonal stream towards Picture 11).

Since this area is very disturbed with very little remaining natural veld and running next to a seasonal stream, the exact location of the pipeline should be advised by the Freshwater Specialist report. Impact on any significant vegetation or species should be minimal, especially if the pipeline route is placed as near to or within the existing farm roads to the west of the stream.

4.3. CRITICAL BIODIVERSITY AREAS MAPS

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

Critical biodiversity areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI 2007). The primary purpose of CBA's is to inform land-use planning in order to promote sustainable development and protection

of important natural habitat and landscapes. CBA's can also be used to inform protected area expansion and development plans.

- **Critical biodiversity areas (CBA's)** are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.

- **Ecological support areas (ESA's)** are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.

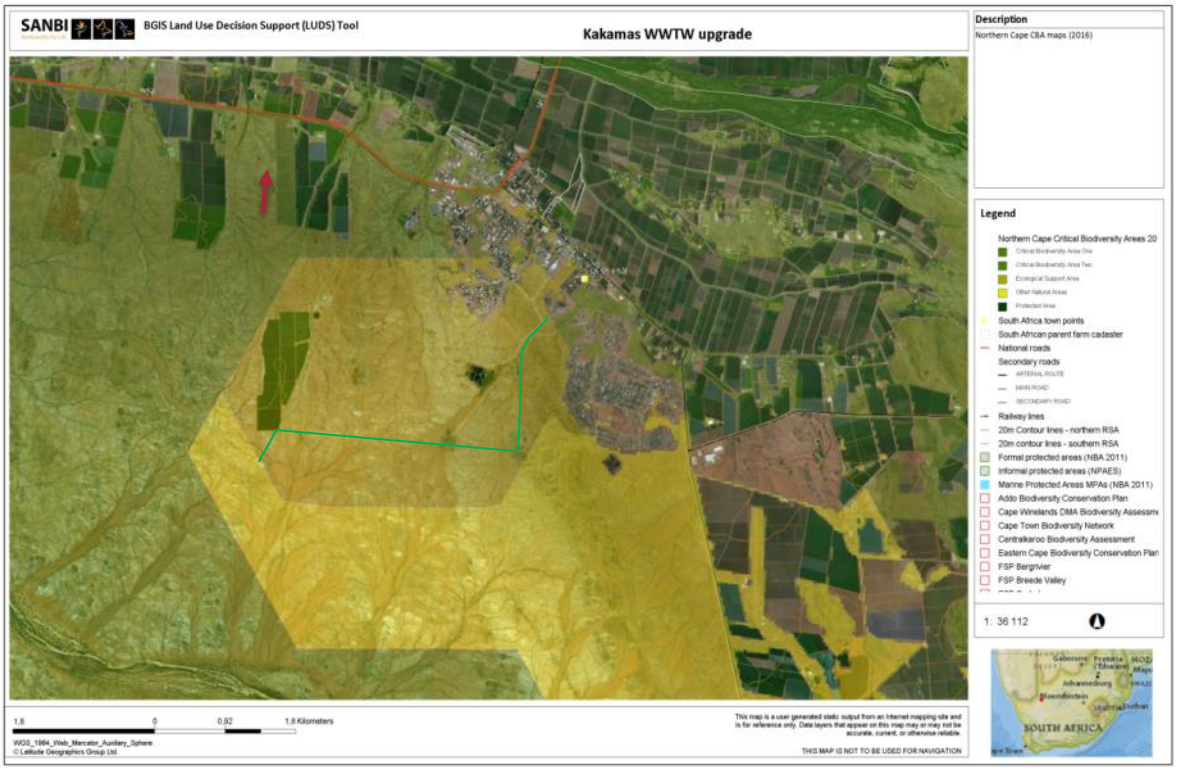

Figure 7: The Northern Cape Critical Biodiversity Areas (2016) showing the location of the proposed development

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

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

- For ESA's a change from the desired ecological state is most significant elsewhere in the landscape through the indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway (e.g. removing a corridor results in a population going extinct elsewhere or a new

plantation locally results in a reduction in stream flow at the exit to the catchment which affects downstream biodiversity).

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 7), the proposed development will be located within a CBA.

4.4. 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). **The proposed site does not fall within any recognised centre of endemism.**

4.5. FLORA ENCOUNTERED

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

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*	ASPHODELACEAE	NCNCA, Schedule 2 Protected (all species in this Family)	**Apply for a NCNCA Flora permit (DENC)**
3.	*Aloidendron dichotomum*	ASPHODELACEAE	VU NCNCA, Schedule 1 Protected	**Apply for a NCNCA Flora permit (DENC)**
4.	*Aptosimum spinescens*	SCROPHULARIACEAE	LC	
5.	*Aristida adscensionis*	POACEAE	LC	
6.	*Aristida congesta*	POACEAE	LC	
7.	*Asparagus* cf. *cooperi* (no flowers)	ASPARAGACEAE	LC	
8.	*Avonia* cf. *papyracea*	ANACAMPSEROTACEAE	LC	
9.	*Berkheya fruticosa*	ASTERACEAE	LC	
10.	*Berkheya glabrata*	ASTERACEAE	LC	
11.	*Blepharis mitrata*	ACANTHACEAE	LC	
12.	*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)**
13.	*Boscia foetida*	BRASSICACEAE (CAPPARACEAE)	LC NCNCA, Schedule 2 Protected (all species in this Genus)	**Apply for a NCNCA Flora permit (DENC)**
14.	*Casuarina* species	CASUARINACEAE	**Alien invasive plant species**	
15.	*Chascanum garipense*	VERBENACEAE	LC	
16.	*Cynanchum viminale (=Sarcostemma viminale)*	APOCYNACEAE	NCNCA, Schedule 2 Protected (all species in this Family)	**Apply for a NCNCA Flora permit (DENC)**
17.	*Euphorbia gariepina*	EUPHORBIACEAE	NCNCA, Schedule 2 Protected	**Apply for a NCNCA**

No.	Species name	FAMILY	Status	Alien & invader species (AIS)
			(all species in this Genus)	**Flora permit (DENC)**
18.	*Euphorbia rhombifolia*	EUPHORBIACEAE	NCNCA, Schedule 2 Protected (all species in this Genus)	**Apply for a NCNCA Flora permit (DENC)**
19.	*Forsskaolea candida*	URTICACEAE	LC	
20.	*Galenia africana*	AIZOACEAE	NCNCA, Schedule 2 Protected (all species in this Family)	**Apply for a NCNCA Flora permit (DENC)**
21.	*Geigeria filifolia*	ASTERACEAE	LC	
22.	*Hermannia stricta*	STERCULIACEAE	LC	
23.	*Jamesbrittenia glutinosa*	SCROPHULACEAE	LC	
24.	*Justicia australis (=Monechma genistifolium)*	ACANTHACEAE	LC	
25.	*Justicia spartioides*	ACANTHACEAE	LC	
26.	*Kleinia longiflora*	ASTERACEAE	LC	
27.	*Leucosphaera bainesii*	AMARANTHACEAE	LC	
28.	*Limeum aethiopicum*	LIMEACEAE	LC	
29.	*Lycium cinereum*	SOLANACEAE	LC	
30.	*Mesembryanthemum coriarium* *(=Psilocaulon coriarium)*	AIZOACEAE	LC Protected in terms of schedule 2 of the NCNCA	**Apply for a NCNCA Flora permit (DENC)**
31.	*Monsonia* cf. *patersonii*	GERANIACEAE	LC	
32.	*Montinia caryophyllacea*	MONTINIACEAE	LC	
33.	*Osteospermum scariosum*	ASTERACEAE	LC	
34.	*Ozoroa dispar*	ANACARDIACEAE	LC	
35.	*Parkinsonia africana*	FABACEAE	LC	
36.	*Phragmites australis*	POACEAE	LC	
37.	*Prosopis* species	FABACEAE	**Alien invasive plant species**	
38.	*Ptycholobium biflorum*	FABACEAE	LC	
39.	*Rhigozum trichotomum*	BIGONACEAE	LC	
40.	*Rogeria longiflora*	PEDALIACEAE	LC	
41.	*Salsola aphylla*	AMARANTHACEAE	LC	
42.	*Senegalia mellifera (=Acacia mellifera)*	FABACEAE	LC	
43.	*Sericocoma avolans*	AMARANTHACEAE	LC	
44.	*Stipagrostis uniplumis*	POACEAE	LC	
45.	*Tamarix usneoides*	TAMARICACEAE	LC	
46.	*Tapinanthus oleifolius*	LORANTHACEAE	LC	
47.	*Tetraena decumbens (=Zygophyllum decumbens)*	ZYGOPHYLLACEAE	LC	
48.	*Tetragonia reduplicata*	AIZOACEAE	LC Protected in terms of schedule 2 of the NCNCA	**Apply for a NCNCA Flora permit (DENC)**
49.	*Vachellia karroo*	FABACEAE	LC	
50.	*Ziziphus mucronata*	RHAMNACEAE	LC	

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).

- **One red-listed species** was observed, namely *Aloidendron dichotomum* (Vulnerable) (Refer to Table 2 & 3).

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

NO.	SPECIES NAME	COMMENTS	RECOMMENDATIONS
1.	*Aloidendron dichotomum* **Quiver tree**	Two Quiver trees were observed within the footprint	Refer to Table 5

4.6.2. NEM:BA protected plant species

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

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

4.6.3. NFA Protected plant species

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

- **One species protected in terms of the NFA** was observed (Refer to Table 2 & 4).

Table 4: Plant species protected in terms of the NFA encountered within the study area

NO.	SPECIES NAME	COMMENTS	RECOMMENDATIONS
1.	*Boscia albitrunca* **Sheppard's tree**	Two Sheppard's trees were observed	Refer to Table 5.

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 are 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	RECOMMENDATIONS
1.	*Aloe claviflora* **Schedule 2 protected**	Occasionally observed, but should be easy to avoid.	**Search & rescue**: Individuals within footprint to be transplanted to surrounding areas.
2.	*Aloidendron dichotomum* **Schedule 1 protected**	Two individuals observed at the following locations: S28° 46' 27.4" E20° 35' 05.5" S28° 46' 27.5" E20° 35' 18.9"	**Do not disturb**: Plants can be transplanted, but site layout should be adjusted if possible. Otherwise they must be transplanted outside of the footprint and a watering program must be implemented until they have established themselves. A NCNCA permit will be required.
3.	*Boscia albitrunca* **Schedule 2 protected**	Two individuals observed at the following locations: S28° 46' 43.7" E20° 35' 06.1" S28° 46' 31.8" E20° 35' 14.9"	**Do not disturb**: Plants transplant poorly. Development should avoid coming nearer than 1 m of the canopy cover (or drip line) of any of these trees. If they have to be removed, a NFA permit will be required as well as a NCNCA permit.
4.	*Boscia foetida* **Schedule 2 protected**	Occasionally observed within the footprint. However, they were mostly stumped or small species or associated with water courses.	**Search & rescue**: Individuals within footprint to be transplanted to surrounding area and a buffer zone to be established next to significant water courses (which will ensure the protection of the majority of these plants).
5.	*Cynanchum viminale* **Schedule 2 protected**	Occasionally observed within the footprint.	Larger *Cynanchum* plants are expected to transplant poorly. Species protection through topsoil conservation.
6.	*Euphorbia gariepina* **Schedule 2 protected**	All species in the genus *Euphorbia* protected by default. Locally common.	Larger *Euphorbia* transplant poorly. Species protection through topsoil conservation.
7.	*Euphorbia rhombifolia* **Schedule 2 protected**	Occasionally observed. All species in the genus *Euphorbia* protected by default.	**Search & rescue**: Individuals within footprint to be transplanted to surrounding area.
8.	*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.
9.	*Mesembryanthemum coriarium* **Schedule 2 protected**	This plant is a weedy disturbance indicator and commonly found throughout.	No special measures needed, this is a weedy pioneer species.
10.	*Tetragonia reduplicata* **Schedule 2 protected**	Only observed in association with water courses.	A buffer zone to be established next to significant water courses (which will ensure the protection of the majority of these plants).

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 **Error! Reference source not found.**).

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. DISCUSSING BOTANICAL SENSITIVITY

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

- **Location**: The proposed development footprint is located on private property on slightly disturbed natural veld (stock grazing over a long period of time has likely altered the vegetation composition. As with almost all areas in the Northern Cape the site is criss-crossed by the normal ephemeral drainage lines, but some larger water courses were also observed.
- **Activity**: The proposed development is expected to result in a long term impact on approximately 60 ha of slightly disturbed Bushmanland Arid Grassland.
- **Geology & Soils**: The site is located on shallow gravelly soils, with surface rocks and sometimes even small/low rocky outcrops occasionally present. However, these rocky outcrops did not support any specialised vegetation. No other significant features such as 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).
- **Land use and cover**: At present the land seems to be fallow land (not currently used for grazing). 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). The vegetation on site conforms to a slightly disturbed version of this vegetation type, with the most significant feature the denser riparian zone associated with the larger water courses (Refer Figure 8).
- **Conservation priority areas:** According to the NCCBA the proposed site will impact on a CBA area, but it is also located within an area that is characterised by intensive farming, with little connectivity remaining to the northern parts of the site. The site will not impact on any recognised centre of endemism.
- **Connectivity**: The proposed activity will have a long term impact on 60 ha of land within a CBA. The vegetation of the larger footprint is still partially connected to the south, west and east. However the northern parts of the footprint are surrounded by existing vineyards to the west, north and east. Connectivity will be impacted but it is already compromised towards the Orange River. Corridors along the most significant water courses would help to retain some connectivity (Figure 8).
- **Watercourses and wetlands**: As with almost all areas in the Northern Cape the site is criss-crossed by the normal ephemeral drainage lines, but some larger water courses were also encountered, that will be important for drainage and erosion prevention. Protection of the most significant water courses and its riparian vegetation will ensure protection of the majority of larger trees, observed on site.
- **Protected or endangered plant species**: A number of NCNCA protected species as well as one NFA protected species and one vulnerable species was observed on the site. The most significant of these are two *Boscia albitrunca* and two *Aloidendron dichotomum* individuals. The Aloidendron can be transplanted, but *Boscia* does not transplant well. Protection of these plants should be the main focus. Recommendations on impact minimisations are given in Table 5.
- **Invasive alien species**: Occasional *Prosopis* and *Casuarina* trees were observed along the pipeline route. Special care must be taken with the *Prosopis* tree removal to prevent re-sprouting.
- **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.

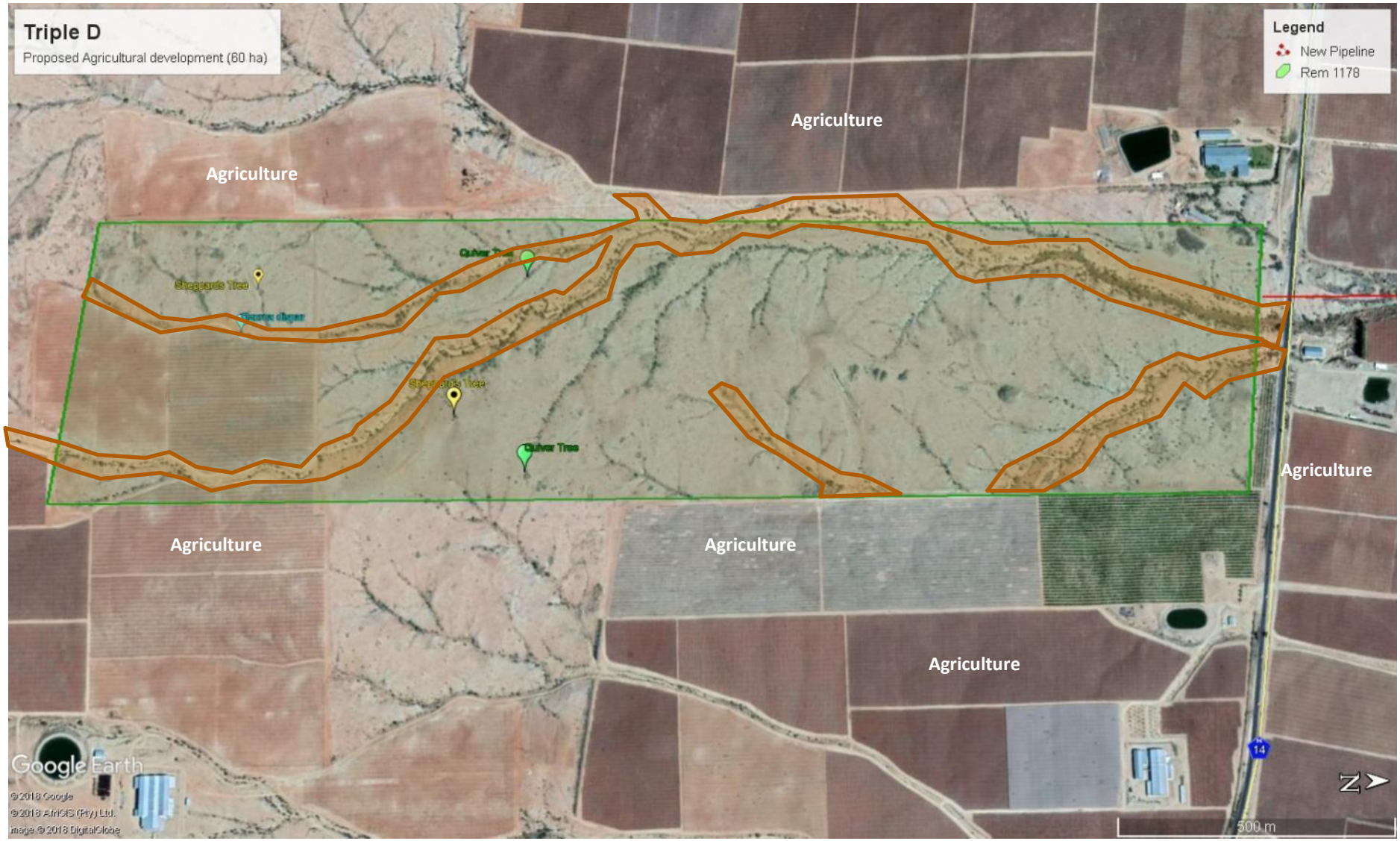

Figure 8: Botanical sensitivity Map based on the more significant water courses and its associated riparian vegetation

6.1. IMPACT ASSESSMENT

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

Table 8: Impact assessment associated with the proposed development

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Geology & soils: Potential impact on special habitats (e.g. true quartz or "heuweltjies")	Without mitigation	2	1	4	1	1	14	No significant features such as true quarts patches or heuweltjies, supporting specialised vegetation were observed.
	With mitigation	2	1	4	1	1	14	No mitigation proposed.
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	Potential positive impact.
Vegetation status: Loss of vulnerable or endangered vegetation and associated habitat.	Without mitigation	3	4	4	2	4	42	Permanent impact on 60Ha of slightly disturbed Bushmanland Arid Grassland (Least Threatened) located within a proposed CBA. The most significant feature being the denser riparian vegetation associated with larger water courses.
	With mitigation	3	3	3	1	2	27	Establish ecological corridors next to significant water courses. Protect the 4 protected trees. Apply for permits for other protected species.
Conservation priority: Potential impact on protected areas, CBA's, ESA's or Centre's of Endemism.	Without mitigation	3	4	4	2	4	42	Site overlaps a proposed CBA (proposed future protection area). But does not impact on any centre of endemism.
	With mitigation	3	3	3	1	2	27	Establish ecological corridors next to the most significant water courses.
Connectivity: Potential loss of ecological migration corridors.	Without mitigation	3	4	4	2	4	42	The larger site is still partially connected to the south, west and east, but connectivity in the northern part is already compromised.
	With mitigation	3	3	3	1	2	27	Establish ecological corridors next to the most significant water courses.
Watercourses and wetlands: Potential impact on natural water courses and it's ecological support areas.	Without mitigation	4	4	4	3	4	60	The proposed development will impact on small ephemeral drainage lines and potentially larger water courses with well-established riparian vegetation.
	With mitigation	4	3	3	1	2	36	Establish ecological corridors of at least 3-5m next to the most significant water courses, which will ensure drainage and protect riparian vegetation.
Protected & endangered plant species: Potential impact on threatened or protected plant species.	Without mitigation	3	4	4	3	4	45	A number of protected plants may potentially be impacted, the most significant being the 2 Sheppard and 2 Quiver trees and the riparian vegetation.
	With mitigation	3	2	3	1	2	24	Establish ecological corridors next to significant water courses. Protect the 4 protected trees. Apply for permits for other protected species.

Impact assessment								
Aspect	**Mitigation**	**CV**	**Lik**	**Dur**	**Ext**	**Sev**	**Significance**	Short discussion
Invasive alien plant species: Potential invasive plant infestation as a result of the activities.	Without mitigation	3	2	3	2	4	33	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	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	4	4	4	3	4	60	The most significant impacts are associated with protected tree species, the potential impact on riparian vegetation and the potential impact on a CBA.
	With mitigation	4	3	3	2	2	40	Establish ecological corridors next to significant water courses. Protect the 4 protected trees. Apply for permits for other protected 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 also no social economic gain.
	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 8, the main impacts associated with the proposed development will be on:

- Watercourses with its associated riparian zone;
- Protected plant species, one of which is vulnerable (Aloidendron dichotomum); while
- the fact that the development site falls within a CBA contribute to significance of vegetation status, conservation priority and connectivity.

Without mitigation the cumulative impact is expected to be Medium?/High, which should be unacceptable, especially since the impact can easily be reduced to Medium/Low through the implementation of mitigation measures (as explained under recommendations).

7. IMPACT MINIMISATION RECOMMENDATIONS

The proposed development will result in the transformation of approximately 60 ha of natural vegetation (Least Threatened) within a proposed CBA area. It will also potentially impact on a number of significant water courses and its associated riparian vegetation, as well as 2 *Boscia albitrunca* (Protected in terms of the NFA) and 2 *Aloidendron dichotomum* trees (a red listed plant, and protected in terms of the NCNCA). In addition it is also likely to impact on a number of other NCNCA plant species (Refer to Table 5).

According to the impact assessment given in Table 8 the development could have a medium/high impact on the environment, but with mitigation it can be reduced significantly to medium/low. **It is thus very important that the mitigation actions described below are implemented.**

With the correct mitigation it is likely that the development will then not contribute significantly to any of the following:

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

7.1. MITIGATION ACTIONS

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

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must include the recommendations made in this report.
- A suitably qualified Environmental Control Officer must be appointed to monitor the construction phase in terms of the EMP and any other conditions pertaining to specialist studies.
- The proposed 60 ha development must be located within the >100 ha area that was investigated in such a way that the impact on the more significant water courses (and its associated riparian vegetation) as depicted in Figure 8, and the 4 protected trees (Sheppard- and Quiver trees) are minimised.
- It is recommended that a **minimum buffer of at least 3 – 5 m is established next to these water courses** (Refer to Figure 8), measured from the edge of the water course (not the centre of the water course) in order to protect the existing riparian vegetation. Access road may not intrude into these buffer zones. In other words the access road may not form the buffer zone, but must be placed away from the water course and outside of this buffer zone.
- Ideally the development should be placed to minimise the impact on these water courses, while at the same time leaving a north-south migration corridor (for instance a 30m corridor associated with the main western water course).
- The two ***Boscia albitrunca* trees** (Refer to Figure 8) should be protected, in location, if at all possible. Since these trees transplant poorly, search & rescue is not considered a viable option. If they have to be removed, permits must be obtained in terms of the National Forest Act (NFA) and the Northern Cape Nature Conservation Act (NCNCA).
- The two ***Aloidendron dichotomum* trees** (Refer to Figure 8) should be protected, in location, if at all possible (First prize). However, these trees can be transplanted and search and rescue may be an option. However, if they are moved, a permit for their re-location must be obtained in terms of the NCNCA and they must be transplanted back within the immediate surroundings. The transplantation must be overseen by a botanist or suitably qualified person and a watering program must be implemented to support these trees until they have re-established themselves.

- The **Search & Rescue recommendations given in Table 5** must be implemented with regards to other protected species encountered and a DENC flora permit must be obtained in terms of the NCNCA.
- Future farm roads must be approved by the ECO and may not impact on the buffer zones next to the streams as proposed in Figure 8.
- **Before any work is done** the 60 ha development footprint, future roads and access routes must be clearly demarcated (to ensure the above mitigation measures are correctly interpreted) and approved by the ECO. 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.
    - This includes the removal of all excavated material, spoil and rocks, all construction related material and all waste material.
    - It also included replacing the topsoil back on top of the excavation as well as shaping the area to represent the original shape of the environment.
- An integrated waste management approach must be implemented during construction.
    - Construction related general and hazardous waste may only be disposed of at Municipal approved waste disposal sites.
    - All rubble and rubbish should be collected and removed from the site to a suitable registered waste disposal site.
- The pipeline route must be adjusted to minimise the impact on any large indigenous tree that might be encountered along its route and the construction footprint must be minimised as much as possible.

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APPENDIX 1: COLLAGE OF SITE PHOTOGRAPHS

Photo 13: A general view of the vegetation encountered at the southern part of the site (looking from north to south)

Photo 14: Typical vegetation associated with the more significant water courses (note the larger indigenous trees)

Photo 15: Riparian vegetation associated with smaller drainage lines (looking from north to south)

Photo 16: One of two the *Boscia albitrunca* trees encountered on site

Photo 17: *Ozoroa dispar* encountered (protected during the previous development)

Photo 18: A typical view of the north-eastern corner of the larger footprint (looking from east to west)

Photo 19: Typical vegetation encountered towards the middle of the site (looking from north to south)

Photo 20: Rocky outcrops encountered in the north-eastern corner of the larger footprint.

Photo 21: A view over the lower parts (northern parts) of the site, looking from north to south.

Photo 22: One of the significant water courses towards the lower (northern) part of the larger footprint.