DRAFT ECOLOGICAL ASSESSMENT FOR THE 132KV TRANSMISSION LINE DEVELOPMENT, GROBLERSHOOP

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Declaration of independence:

I, the above-mentioned specialist investigator responsible for conducting this particular specialist ecological study, declare that

- I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- At the time of conducting the study and compiling this report, I did not have any interest, hidden or otherwise, in the proposed development, except for financial compensation for work done in a professional capacity;
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part of;
- I declare that there are no circumstances that may compromise my objectivity in performing this specialist investigation. I do not necessarily object to or endorse the proposed development, but aim to present facts, findings and recommendations based on relevant professional experience, and scientific data;
- I do not have any influence over decisions made by the governing authorities;
- I have the necessary qualifications and guidance from professional experts (registered Pr. Nat. Sci.) in conducting specialist reports relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity
- This document and all information contained herein are and will remain the intellectual property of Environmental Management Group. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the respective specialist investigator.

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Report prepared for: Orange River Solar Facility

Locality: Groblershoop, Northern Cape, South Africa

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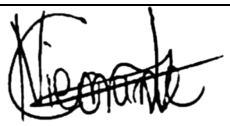
Corné Niemandt	MSc Plant Science	SACNASP Ecological Science 116598	

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1. Executive summary:

The proposed transmission line is 7.85 km long and runs from the proposed solar facility to the Eskom high voltage substation North West of Groblershoop. Regional vegetation in which the proposed transmission line is located is the Bushmanland Arid Grassland (NKb3) vegetation type of the Nama Karoo biome and Lower Gariep Alluvial vegetation (Aza3) of the Inland azonal vegetation regions. AZa3 is associated with the Orange river.

An ecological survey was performed as part of a Botanical Impact Assessment. The topography of the study area varies, from gentle riverine terraces to steep hillsides. Outcrops are prominent features of the landscape, with quartz and quartz schists veins. Gravel-sized to large quartz-muscovite schist and quartz-amphibole schist stones decorate most of the landscape. Dune, riparian and viticulture areas of the study area have no to very little small quartz gravel stones.

The vegetation on the orange river's eastern side has experienced some moderate anthropogenic disturbances in the southern areas. In contrast, the Northern regions on the eastern side of the orange river have experienced little to no anthropogenic disturbances. The vegetation on the western side of the orange river has experienced no to extreme levels of anthropogenic disturbances. Riverine reed beds and islands are pristine to near pristine. Vegetation adjacent to the riverine reed beds has experienced extreme anthropogenic disturbances and has been completely transformed. The remaining vegetation on the eastern side of the orange river has experienced little to some anthropogenic disturbances.

The site consists of multiple vegetation units with varying overall vegetation layer characteristics. Within the study area, nine homogeneous vegetation units were identified. Overall, the tree layer is moderately to well-developed in certain areas while absent in others. The shrub layer is moderately developed throughout the site. The tall shrub layer is absent in some vegetation units while moderately developed in others. On the other hand, the dwarf shrub layer is moderately to well-developed consistently throughout the site. Poor to moderately developed graminoid and herbaceous layers are consistent throughout the study area.

Located within the remaining extent of NKb3 and AZa3 vegetation types, the development area is also located within a CBA 2 area and borders a CBA 1 area. Thus, the study area falls in an area that requires conservative management (SANBI, 2017).

Overall anticipated environmental impact evaluation has indicated that the development would have a low anticipated environmental impact. A low environmental impact was quantified by the proposed transmission lines' few direct impacts within the study area.

2. List of figures:

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3. List of tables:

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4. Introduction:

Ecological infrastructure refers to the natural functioning ecosystems which provide essential services to people. An ecosystem functions as a collective of components, living and non-living, interacting with one another (Wohlitz, 2016). Humans benefit from healthy functioning ecosystems in the utilisation of the services they provide. Ecosystem services include provisioning services (food, raw materials, freshwater), regulating services (climate and air quality, carbon sequestration, water purification), supporting services (habitats and genetic diversity), and cultural services (recreation, tourism and spiritual) (Costanza et al., 1997; Fy et al., 2015; Wohlitz, 2016). Ecosystems can't provide these services when in a poorly functioning, unhealthy state. An ecosystem's health is largely threatened by anthropogenic influences such as habitat fragmentation, pollution and unsustainable harvesting. These anthropogenic activities destabilise ecosystems and will ultimately result in an ecological breakdown, which ultimately raises the costs of living. In terms of biological diversity, South Africa ranks third globally with a high level of endemism (found only in South Africa) (Hoveka et al., 2020). Because of this, South Africa's vegetation is highly localised and experiences a greater threat of extinction. Thus, it is our responsibility to protect South Africa's rich biodiversity.

Despite the seeming homogeneity and low diversity of vegetation, an area may contain endangered and rare species. Red data species presence may make the development unfeasible at that specific location. If this occurs, the project should be moved to an alternative location or cease immediately. Development is a necessity, especially for a developing country such as South Africa. New developments create job opportunities, increase capital growth, and overall create a better country. However, these developments should not come at the cost of pristine ecosystems as they produce invaluable services humans reap for free. For this reason, sustainable development practices should balance the need for development and the conservation of natural resources (Wohlitz, 2016). In a developing country, development is closely linked to electricity generation, transmission and utilization (Akinbami et al., 2021). Renewable energy generation provides the same benefits of sustainable development to the economy (Lekavicius et al., 2019; Akinbami et al., 2021).

The proposed 132 kV transmission line forms part of a larger development project that is located just North of Groblershoop in the ! Kheis Local Municipality of the Northern Cape. Part of the larger proposed development project involves the proposed development of a 50 MW photovoltaic solar facility on the North-eastern side of the Orange river. This proposed solar facility needs to be connected to the national electricity supply grid through ESKOM's Groblershoop high voltage sub-station located on the southwestern side of the Orange river. In order to do this, a transmission line to connect the proposed solar facility to the high-voltage substation is required. Thus, the proposed 132 kV transmission line will act as the required connection.

According to the proposed transmission line's surveyor, the recommended route for the proposed transmission line will cover a distance of about 7.85 km. Transmission

line pylons are expected to be placed approximately 80 m from one another, depending on the distance between changes in the direction of the recommended route and accounting for the distance over the Orange river.

A previous ecological assessment performed in August of 2018 by van Rooyen and van Rooyen for the site was available for reference and was largely influential in this study.

Surveying took place in early spring, before the first good rains of the season. As a result, the majority of species observed on site are perennial. The diversity of perennial species observed underrepresents the potential diversity of annual and geophytic species which could occur on site. Thus, the number of species observed is an underestimate of the potential number of species that could occur on site.

This report forms part of the Environmental Authorisation Process for the proposed development and will discuss the various potential impacts that could arise given the approved authorisation of the development. The recommendations and mitigation measures generated in this report should be used to minimise the impact of the proposed development.

5. Scope and limitations of the study:

- Evaluating the present ecological functioning of the area within which the proposed development will take place.
- Identifying and assessing possible environmental impacts that the proposed development could generate.

5.1. Scope:

Vegetation-related topics to be investigated include:

- Vegetation type within which the proposed development lies and the importance thereof.
- Assessing the overall ecosystem health in terms of its vegetation with emphasis on the level of disturbance (grazing- and anthropological impacts).
- Identification of the area's species composition with emphasis on dominant-, rare-, threatened[1]- and protected species[2]
- Environmental impacts on terrestrial plant species assessment in terms of site sensitivity verification and terrestrial plant species specialist assessment.

5.2. Assumptions and limitations:

[1] Any species classified as Critically Endangered, Possibly Extinct (CR PE), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), indicated by the South African Red List categories.
[2] Protected species is any species listed as protected in terms of *Section 56 (1)(d)* of the Biodiversity Act.

- Not all plants have the same growth and/or flowering period, and thus it is likely that the survey could have occurred outside of the growth and/or flowering period of a specific species.
    - Thus, species diversity and growth form may be skewed towards perennial species.
    - Thus, true species diversity and richness are assumed to be underestimated.
- Some geophytic and succulent plants have specialised in mimicking their surrounding habitat. Thus, some of these plants might have been overlooked due to their cryptic nature.
- Species of conservation concern (SCC) are generally uncommon and/or localised.
    - Thus, locating such species can be challenging when attempts to locate such species occur outside the SCC's flowering season.
- With ecology being vast, dynamic, and highly complex, some aspects may have been overlooked. However, most floral communities have been accurately assessed and considered. Therefore the information within this report is considered sufficient to allow informed decision-making to take place.
- Most plant species found in central South Africa experience summer rainfall, which allows for summer growth periods and summer-spring flowering season.
    - Thus, late winter or early spring is not an optimal season in which to perform vegetation surveying for this study region.

6. Methodology:

6.1. Literature used for additional information:

- Red Data List (Raimondo et al. 2009).
- Vegetation types (Mucina and Rutherford, 2006; SANBI, 2006-2018).
- Botanical Assessment of the Destination Rock Inn Resort Development, Groblershoop Portion 18 of Farm 387) (van Rooyen and van Rooyen, 2018).
- Field guides used for species identification (van Wyk and Malan, 1998; Botha, 2001; van Rooyen et al., 2001; Bromilow, 2010; van Wyk and van Wyk, 2013; van Oudtshoorn, 2014; Manning, 2019).

6.2. Survey:

Before visiting the site, a desktop study commenced where the following information was determined:

- Vegetation type.
- Climatic conditions.
- Probable rare- endemic- and protected species[3].
- Relatively homogenous vegetation units in which surveying will commence.

[3] SANBI was consulted prior to the site visit to attain the species names of Rare, threatened and or protected floral species as identified through the DFFE Screening Tool.

- Probable environmental impacts of the proposed development.
- The iNaturalist website was also consulted to obtain probable species presence as identified by the general public and other specialists.

The survey was performed by means of transects traversed on foot. The use of an unmanned aerial vehicle (UAV) flying at a maximum altitude of 80 m was used to aid the delineation of relatively homogenous vegetation units. Plant species observed were recorded with particular emphasis on rare-, endemic-, protected- and dominant species. Attention was given to the current state of the environment regarding grazing impacts, anthropogenic disturbances, erosion and the presence of alien or invasive species. Observed animal species and evidence of their existence (dung, habitat requirements, excavations, animal tracks, burrows, and nests) were recorded.

6.3. Assessment criteria:

6.3.1. Unit sensitivity assessment

As per the SANBI (2020) Species Environmental Assessment Guidelines, site ecological importance (SEI) was calculated. The fulfilling criteria of the conservation importance, functional integrity and resilience is not an exhaustive list, and the guidelines allow for adding additional, conditional aspects which were not included in the fulfilling criteria. Where the addition of additional, conditional aspects was required, the reasoning for the applicable addition was required to be stipulated.

Conservation importance (CI) concerns the sites' ability to support biodiversity features or species of conservation concern through largely natural processes. CI was calculated using internationally acceptable, recognized and established biodiversity value determination principles and criteria utilized in evaluating conservation importance (IUCN KBA, 2016; SANBI, 2020), as shown in the table below.

Table 1: Criteria that fulfil the requirements for the ratings of conservation importance (CI)

Conservation importance (CI) rating	**Fulfilling criteria**
Very high	Confirmed or high likelihood of occurrence of SCC with an EOO of <10km^2. and/or Any environment featuring characteristics of a natural habitat of a CR vegetation type or a large area (>0.1% of total vegetation type extent) of natural habitat of an EN vegetation type. and/or Natural habitat featuring a unique combination of biophysical characteristics rarely seen in the surrounding environment. and/or

	Unusually high occurrence frequency of protected/ endemic species.
High	Confirmed or highly likely occurrence of SCC species with an EOO of >10km^2. SCC must be listed under any criterion other than A. Species with reported occurrences of <10 localities or < 10 000 individuals and/or Small area (>0.01% but <0.1% of total vegetation type extent) of natural habitat of an EN vegetation type or a large area of natural habitat of a VU vegetation type. and/or Natural habitat featuring a unique combination of biophysical characteristics and may also occur in the surrounding environment. and/or Any area hosting a unique combination of protected species not occurring in the surrounding environment.
Medium	Confirmed or high likely occurrence of SCC which have been observed in more than 10 locations or more than 10 000 reported mature individuals. and/or Any area of natural habitat of a VU vegetation type. and/or Confirmed species which exhibits a restricted range. and/or >50% of the unit contains natural habitat with potential to support SCC. and/or A fairly high species richness of naturally occurring species. Some protected species may also occur.
Low	No confirmed observations of, or low probability of SCC occurrence. and/or No confirmed observations of, or low probability of species with a restricted range.

	and/or <50% of unit contains natural habitat with a limited potential to support SCC. and/or Poor to moderate species richness. Some alien and invasive species may occur.
Very low	No confirmed observations of, or very low probability of SCC occurrence. and/or No confirmed observations of, or very low probability of species with a restricted range. and/or Very little to no natural habitat remaining.

Functional integrity refers to the site's ecological condition, where it's able to maintain its structure and functionality with regard to habitat connectivity and pristineness. The ecological condition of the vegetation units was determined by considering the remaining functional area, habitat connectivity and level of disturbance which influences the ecological processes of the site.

The ecological functioning of a large, uninterrupted, undisturbed natural area is considered intact and functional with high functional integrity. On the other hand, a small, fragmented, poorly connected, very disturbed site is inhibited and has a very low functional integrity.

Site functional integrity was determined using the fulfilling criteria as tabulated below in Table 2.

Table 2: Criteria that fulfil the requirements for the ratings of functional integrity (FI)

Functional integrity (FI)	**Fulfilling criteria**
Very high	Very large (>100 ha) intact habitat and/or High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. and/or No or minimal current negative ecological impacts with no signs of major past disturbance

High	Large (>20 ha but <100 ha) intact area for any conservation status of vegetation type or > 10 ha for EN vegetation type. and/or Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches and/or Only minor current negative ecological impacts (e.g., few livestock utilising area) with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential.
Medium	Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of vegetation type or > 20 ha for VU vegetation type. and/or Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. and/or Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	Small (> 1 ha but < 5 ha) area and/or Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. and/or Several minor and major current negative ecological impacts.
Very low	Very small (< 1 ha) area. and/or No habitat connectivity except for flying species or flora with wind-dispersed seeds. and/or Several major current negative ecological impacts.

Biodiversity importance concerns the site's ability to support biodiversity features or species of conservation concern with its current ecological condition in terms of functional size, connectivity and level of disturbance. Using the determined conservation importance and functional integrity of the vegetation units, biodiversity importance was determined using the following simple matrix (SANBI, 2020), as seen in table 3 below.

Table 3: Matrix in calculating biodiversity importance (BI) using conservation importance and functional integrity.

Biodiversity importance		**Conservation importance (CI)**				
		Very high	High	Medium	Low	Very low
Functional integrity	Very high	Very high	Very high	High	Medium	Low
	High	Very high	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very low
	Low	Medium	Medium	Low	Low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

Site resilience is the site's natural ability to overcome or recover from negative influences of disturbance without human intervention. A site's recovery to a specified level of restoration with respect to the site's original ecological functionality in an estimated time is the baseline evaluation criteria. Justification of the resilience rating with respect to estimated recovery time was required. Particular disturbances and impacts, as well as the time of year these impacts are expected to occur, are often associated with resilience and were considered (SANBI, 2020).

Site resilience was determined using the fulfilling criteria as indicated below (Table 4).

Table 4: Criteria that fulfil the requirements for the ratings for resilience (R)

Resilience category	**Fulfilling criteria**
Very high	Habitat that can recover rapidly (~ less than five years) to restore > 75% of the original species composition and functionality of the receptor functionality or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.

Medium	Will recover slowly (~ more than 1ten years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

Site ecological importance (SEI) concerns the site's biodiversity importance in its ability to support biodiversity features or SCC and its natural resilience ability to recover from negative influences.

SEI for each vegetation unit was determined through the simple matrix (SANBI, 2020) below (Table 5) by using the vegetation units' biodiversity importance (CI x FI) and resilience. SEI was determined for each relatively homogenous vegetation unit (VU) and should be used to inform sustainable development practices.

Table 5: Matrix for determining site ecological importance (SEI) using biodiversity importance and resilience

Site ecological importance		**Biodiversity importance**				
		Very high	High	Medium	Low	Very low
Receptor resilience	Very high	Very high	Very high	High	Medium	Low
	High	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	Low	High	Medium	Low	Very low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

Site ecological importance is specific to the proposed development activities and is not comparable to different proposed development activities (SANBI, 2020).

Interpretation of the ratings of site ecological importance in relation to the activities associated with the proposed development is indicated in Table 6 below.

Table 6: Interpretation of the ratings of site ecological importance in relation to proposed development activities

Site ecological importance	Interpretation in relation to proposed development activities
Very high	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation is not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/ unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high-impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact are acceptable, followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact are acceptable, followed by appropriate restoration activities.
Very low	Minimisation mitigation – development activities of medium to high impact are acceptable, and restoration activities may not be required.

6.3.2. 6.5.2. Anticipated environmental impact assessment

Anticipated impacts (section 10) of the proposed development on the receiving environment at the proposed location were determined using the impact assessment and significance evaluation forms which are available in Appendix 1 and 2.

Anticipated environmental impacts of the proposed development on each SCC (section 10.1) were determined as above. Anticipated environmental impacts of the proposed development on the receiving environment were determined for the following components: habitat, indigenous floral and faunal, floral SCC and provincially protected flora.

7. Study area:

The proposed 123kV sub-transmission line from the proposed 50 MW photovoltaic solar facility development to the Eskom high voltage sub-station is located North West of Groblershoop in the ! Kheis local municipality (Northern Cape Province).

Roughly 7.85 km long, the proposed transmission line will connect the proposed photovoltaic solar facility to the national grid through the selected Eskom sub-station. Rooisand Farm 387/18, on which the Destination River Resort and proposed solar facility are located, is approximately 2.6 km North of Groblershoop to the west of the N8.

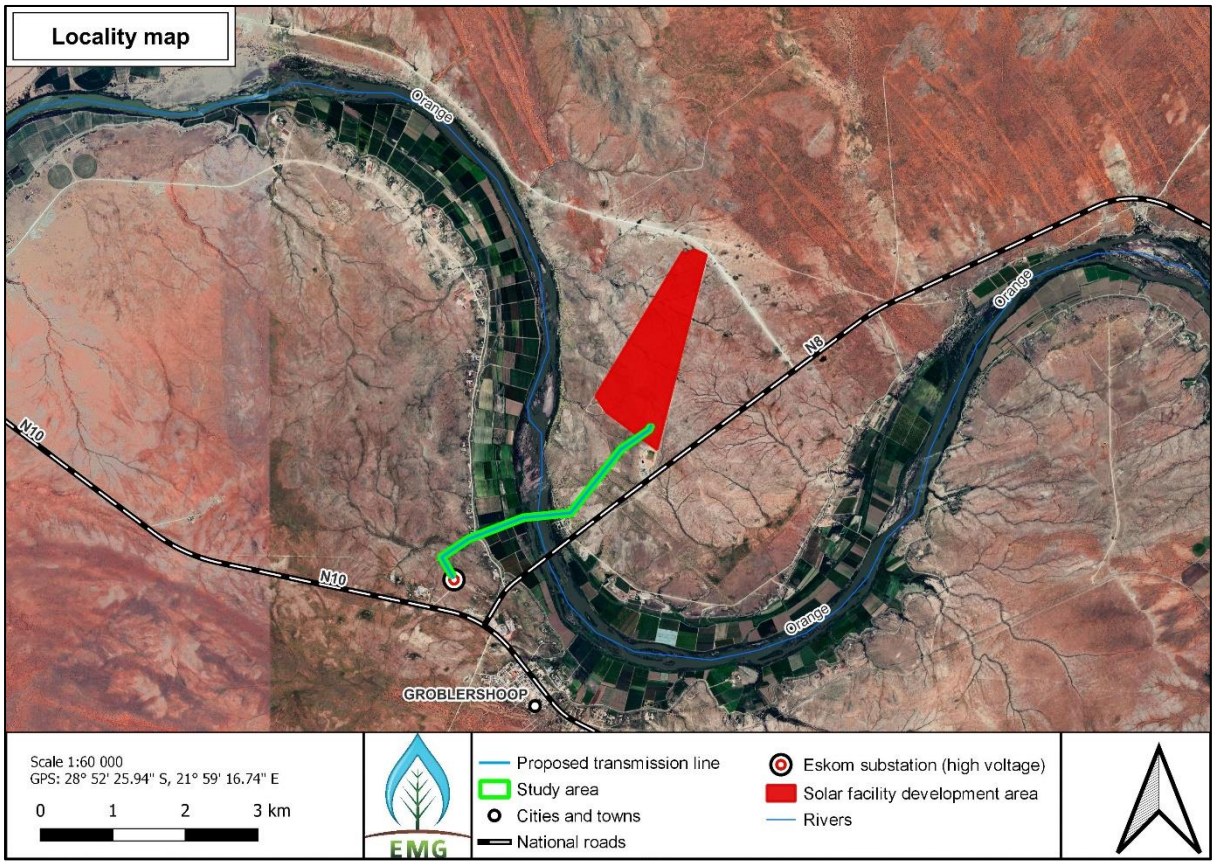

Figure 1: Map indicating the proposed solar development site locality which is situated just North of Groblershoop.

Development of the proposed transmission line will affect the vegetation of a roughly 30 m wide servitude footprint area underneath the transmission line (15m on either side of the transmission line pylons). Thus, the total area potentially influenced by the proposed transmission line will be about 23.55 ha. Despite the total area that may potentially be influenced by the proposed transmission line, the actual area that will be influenced will be much less than the potential 23.55 ha. This is due to the development requiring pylons that will be placed roughly 80 m apart, depending on the distances between changes of direction and clearance over the orange river. Thus, physical vegetation clearance will be largely restricted to pylon placement. Transmission lines require service roads, which would increase the actual area that would be influenced by the proposed development. However, the presence of an

existing high-voltage transmission line running near parallel to the proposed transmission line has an existing service road. Thus, the development of a service road is not required, which lowers the actual area that will be influenced by the proposed development.

The northern sections of the transmission line will occur on steeply to gently undulating hillsides. Gently inclining floodplains along the orange river mark the southern areas of the transmission line, which experiences less undulating topography.

7.1. The physical environment:

The topography of the study area varies from gentle flat alluvial terraces to gently and steeply undulating hillsides. Over most of the study area, the geology and vegetation are the most prominent feature of the landscape. Lowest points of the study area are along the orange river and associated tributaries. Generally, the altitude of the study area increases from the lowest point at the orange river to the study area's highest points on either side of the Orange river. These highest points are where the proposed transmission line meets the proposed solar development (to the east of the Orange river) and where the proposed transmission line meets the high-voltage substation (to the west of the Orange river).

7.2. Regional vegetation:

The proposed development area is located within the Nama Karoo biome and Alluvial vegetation of the Succulent Karoo.

At the Biome scale, the Nama-Karoo biome is dominated by dwarf shrubs, grasses, succulents, geophytes and annual forbs, with small trees only occurring along drainage lines. The Nama-Karoo biome covers 19.6% of southern Africa. Three bioregions distinguish the vegetation of the Nama-Karoo. These are the (1). Bushmanland and West Griqualand, (2) Upper Karoo and (3). Lower Karoo bioregions. Bushmanland Arid Grassland is described under the Bushmanland and West Griqualand bioregion (Mucina and Rutherford, 2006). Average annual precipitation for the NKb3 is 133 mm, with the majority of rainfall occurring in late summer-autumn (January to May). Rainfall is variable from year to year. This bioregion is dominated by arid grasslands and shrublands. A slightly sloping plateau with extensive, sometimes undulating, plains is a characteristic landscape feature of the NKb3 vegetation type. NKb3's sparse vegetation is dominated by *Stipagrostis* species. Other dominant graminoids include *Aristida adscensionis, A. congesta, Enneapogon desvauxii, Eragrostis nindensis, Schmidtia kalahariensis* and *Cenchrus cilliaris*. The dwarf shrub layer is dominated by *Aptosimum spinescens, Hermannia spinosa* and *Pentzia spinescens*. Dominant medium/ tall shrubs include *Lycium cinereum, Rhigozum trichotomum* and *Cadaba aphylla*. NKb3 vegetation type has a conservation status of least concern (LC). The protected area extent covers 191.7819km², a mere 0.5% of the original vegetation-type area (Skowno et al., 2018).

Alluvial vegetation is vastly diverse across the biomes of South Africa, but common floristic and ecological features unite the vegetation type.

In the Succulent Karoo biome, alluvial vegetation consists of plant species that are capable of surviving or even thriving in waterlogged, nutrient-rich soils which experience occasional disturbance. This vegetation type is susceptible to change as habitat disturbance allows for the rapid spread of indigenous species as well as alien and invasive species. Average annual precipitation for the AZa3 is 131 mm, with the majority of rainfall occurring in late summer to mid-autumn (Mucina and Rutherford, 2006). Flat alluvial terraces, riverine islands and flooded grasslands are characteristic landscape features of the Aza3 vegetation type (Mucina and Rutherford, 2006). Riparian thickets dominated by *Euclea pseudebenus, Tamarix usneoides* and *Ziziphus mucronata* and reed beds with *Phragmites australis* are typical of Aza3 (Mucina and Rutherford, 2006). AZa3 vegetation type has a conservation status of least concern. AZa3 is poorly protected, with a protected area extent covering 66.0411 km², which is 7.6% of the original vegetation type area (Skowno et al., 2018).

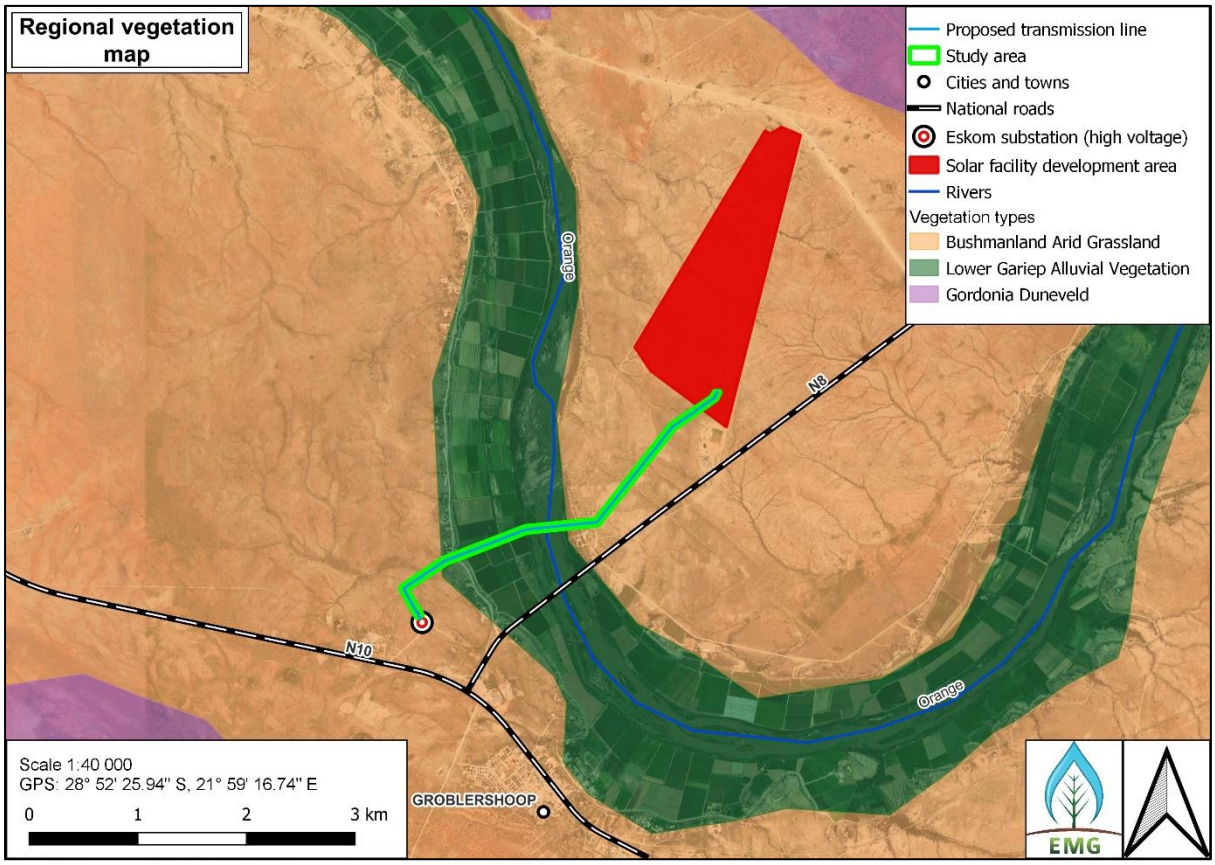

Figure 2: Regional vegetation indicating the site's locality within the Bushmanland Arid Grassland (NKb 3) and Lower Gariep Alluvial Vegetation (AZa3) (SANBI, 2006-2018).

The proposed transmission line development area is located within critical biodiversity areas one and two.

Critical biodiversity areas are pristine to near pristine natural areas that must remain in good ecological condition. CBA 1 areas are considered to be irreplaceable, while CBA 2 areas are considered optimal or best-design sites. These areas require a conservative approach to land use changes (SANBI,2017).

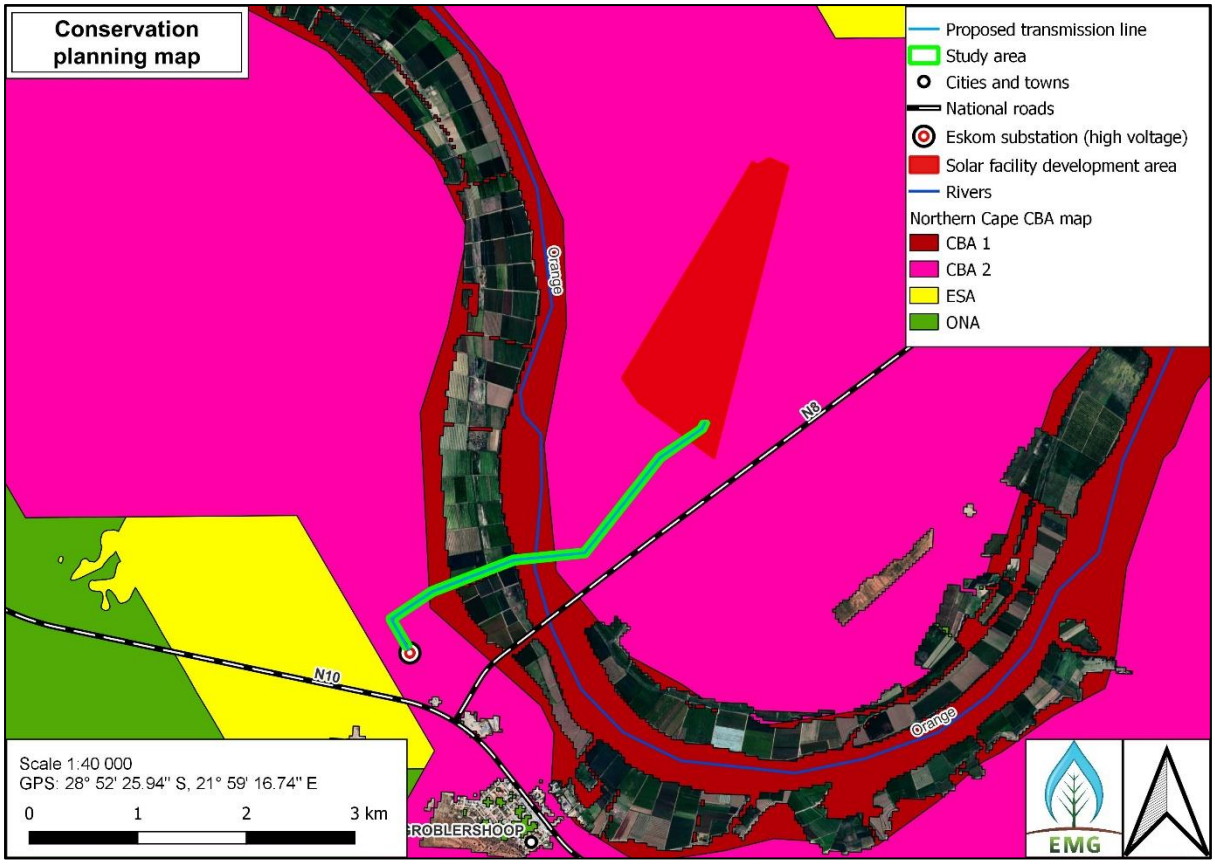

Figure 3: The study area is majorly found in a CBA 2 area but also crosses over a CBA 1 area according to the Northern Cape spatial biodiversity plan (SANBI, 2017).

8. Results:

A comprehensive floral species list is available in Table 15.

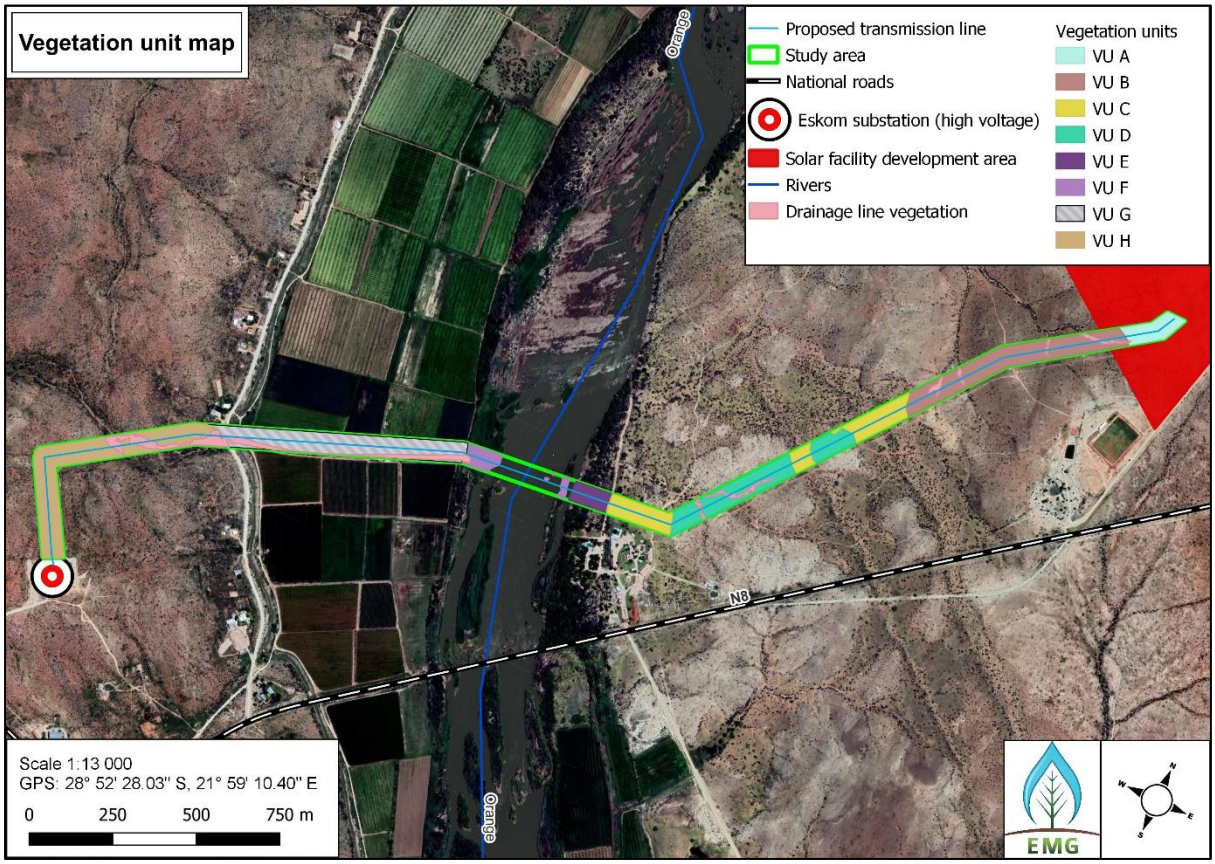

Figure 4 Map indicating the spatial distribution of the homogenous vegetation units (VU's) within the study area. A total of nine vegetation units can be found along the transmission line. Three homogeneous vegetation units can be found on the western side of the orange river, while five homogeneous vegetation units can be found on the eastern side of the Orange River. The ninth vegetation unit is associated with ephemeral drainage lines and can be found on either side of the Orange river.

8.1. Floral survey:

Nine homogeneous vegetation units were identified within the study area. The vegetation unit delimitation was based on floral homogeneity, vegetation composition distinctiveness and influences of anthropogenic disturbances. Broadly, the study area's vegetation resembles that of an open Nama-Karoo dwarf shrubland with semi-open to closed riparian vegetation.

Bare ground, rocky outcrops and loose stones are prominent, patchy features in various areas of the study area. For the majority of the study area, vegetation is sparse, with vegetation coverage low in some areas, while in others, vegetation coverage is high with almost complete canopy cover.

On the western side of the Orange river, the study area contains three vegetation units that vary from flooded riparian grassland to vineyards to an open Nama Karoo shrubland. Vegetation on the eastern side of the Orange river is more variable, with five vegetation units being found in the study area. One vegetation unit, the drainage vegetation, which is associated with ephemeral drainage lines, was found on both sides of the Orange river.

See a complete species list of observed species in Appendix 3.

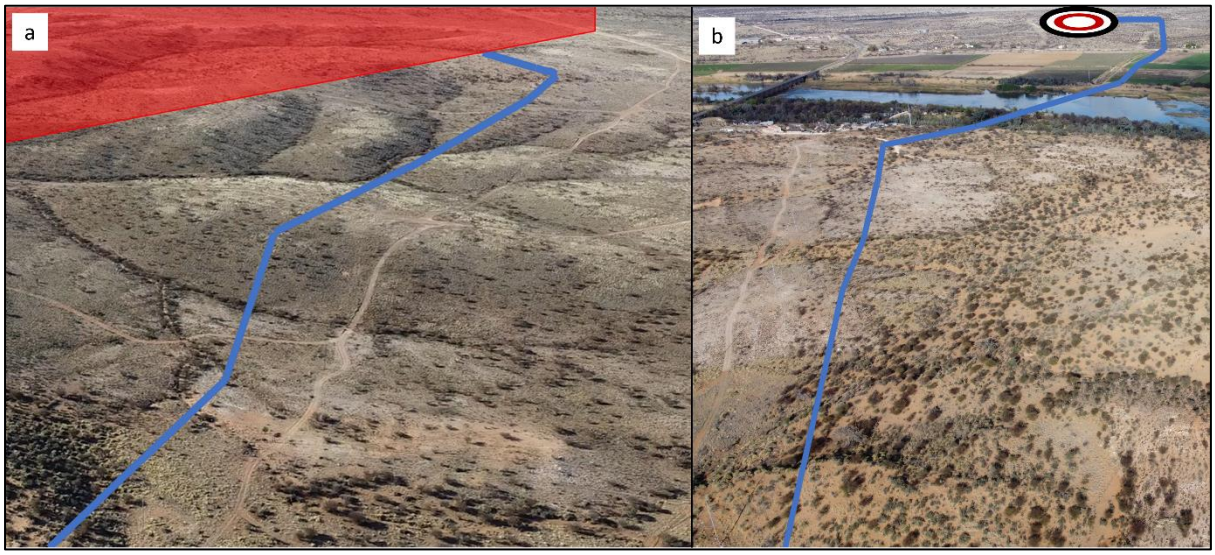

Figure 5: Aerial views of the overall characteristic vegetation structure of the study area's vegetation. The blue line indicates the rough path the proposed transmission line will follow. a). A North facing aerial view of the study area taken from the central parts of the study area. The red indicates the proposed development area for the proposed solar facility. b). A South facing aerial view of the study area taken from the central parts of the study area. The black, red and white target symbol represent the ESKOM Groblershoop high-voltage substation.

Types of disturbance observed throughout the study area include informal infrastructure development, habitat loss and soil compaction associated with informal and formal road development, viticulture activities (agricultural activities specific to vineyards), overgrazing and poor open space management allowing for alien invasions. Northern areas of the study area are near pristine, with current disturbance

in the form of road laying and existing powerlines. While the mid-central to southern areas of the study area exhibit ranging levels of varying types of disturbances.

8.1.1. Vegetation Unit A:

Vegetation Unit A was found on the slightly undulating hillsides within the most Northern parts of the study area. This vegetation unit is approximately 0.9 ha within the study area. Vegetation is sparsely distributed, with areas of rocky ground between individual plants (Figure 5. c). This vegetation unit showed minimal localised heterogeneity in vegetation structure in areas where linear ridge formations with large outcrops were observed. Disturbance within this vegetation unit is minimal, with disturbance in the form of a road. Quartz-muscovite schist and quartz-amphibole schist outcrops and various sized gravel to large boulders scatter the landscape (Figure 5.d). Vegetation unit A has a high likelihood of occurrence of two SCC (Vulnerable and Near Threatened), which were confirmed to occur within the larger habitat of which this vegetation unit forms a part. The SCC are Sensitive species 930 (Vulnerable) as well as *Hoodia officinalis* (Near Threatened).

The low tree layer is open or denuded, with few and sparsely distributed individuals of *Boscia albitrunca* (A protected tree under the National Forest Act and Provincial Ordinance) and *Senegalia mellifera.* A single *Searsia burchellii* individual was observed on a linear ridge formation within the southern parts of the quartz dwarf shrubland (Figure 5.a). For all provincially and nationally protected species, the appropriate authority must be contacted with regard to the feasibility of obtaining removal permits for any protected species which would require such a permit should the development be approved. Removal permits for all protected species which will be affected by the development must be obtained before development commences.

The shrub layer is sparsely to moderately covered, with most individuals being classified as dwarf shrubs. *Roepera lichtensteiniana, Monechma incanum, Tetraena rigida, Aptosimum spinescens and Rhigozum trichotomum* dominate the dwarf shrub layer. Other dwarf shrubs found in this vegetation unit include *Eriocephalus ambiguus and Aptosimum albomarginatum.*

The herbaceous layer is moderately developed, dominated by dwarf succulents, dwarf graminoids and forbs that are sparsely distributed. Graminoids that were dominant were *Enneapogon desvauxii, E. scaber, Oropetium capense* (Dwarf graminoid) and *Stipagrostis ciliata*. Other graminoids in this vegetation unit include *Schmidtia kalahariensis, Eragrostis annulata* and *Stipagrostis obtusa*. Succulents were a dominant growth form in this vegetation unit (Figure 5. b). Dominant succulents were *Aloe claviflora* (provincially protected), *Euphorbia spinea* (provincially protected), *Euphorbia gariepina* subsp. *Gariepina* (provincially protected), *Euphorbia gregaria* (provincially protected) and *Kleinia longiflora.* Other succulents found in this vegetation unit include *Titanopsis calcarea* (provincially protected), *Monsonia crassicaulis* and various *Anacampseros* species (provincially protected). Dominant forbs included *Acanthopsis hoffmannseggiana*, *Barleria lichtensteiniana* and *Blepharis mitrata.* Other forbs found in this vegetation unit include *Geigaria ornativa,* and *Peliostomum leucorrhizum.*

Alien and invasive species were not observed within this vegetation unit, which is a good indicator of the ecosystem's functionality and health. VU A is in good ecological condition as it is in a natural state.

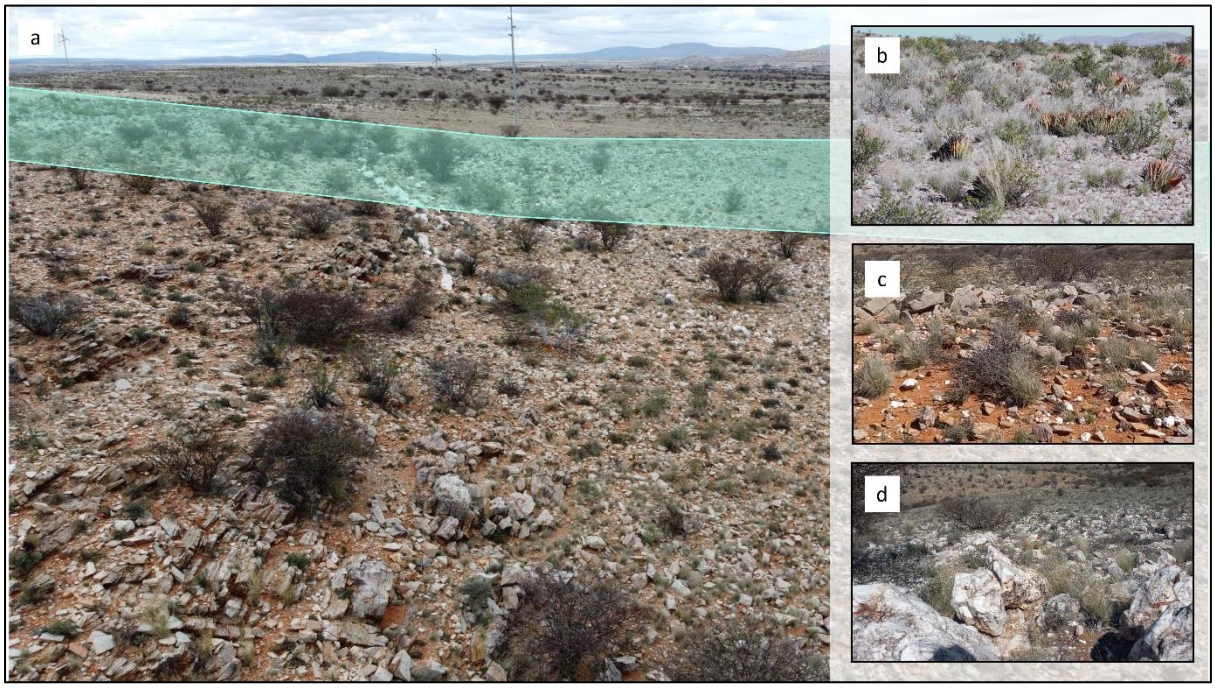

Figure 6: Typical vegetation of the quartz dwarf shrubland a). ground view of the quartz dwarf shrubland. b). *Aloe claviflora* dominates the landscape. c). Somewhat vegetatively denuded areas of small to large quartz schists stones are prominent features of the landscape. d). Vegetation is sparsely distributed and has a patchy appearance.

8.1.2. Vegetation Unit B

Vegetation Unit B resembles a rocky, dwarf shrubland (Figure 6. a) and is located south of VU A in the study area. This vegetation unit covers the third largest area within the study area, which is roughly 4.1 ha. Moderate vegetation ground cover and moderate to high coverage of gravel, stones and large granite outcrops were observed. Vegetation is patchy in some areas, particularly in areas where large outcrops are found. Disturbance was observed in this vegetation unit in the form of roads. This vegetation unit is frequently interrupted by drainage vegetation.

Boscia albitrunca is a sparsely distributed small tree in this vegetation unit. *Senegalia mellifera* dominates the poorly developed tall shrub layer. For all provincially and nationally protected species, the appropriate authority must be contacted with regard to the feasibility of obtaining removal permits for any protected species which would require such a permit should the development be approved. Removal permits for all protected species which will be affected by the development must be obtained before development commences.

The shrub layer is moderately developed, with *Rhigozum trichotomum* (Dwarf shrub), *Phaeoptilum spinosum, Hermannia spinosa* (Dwarf shrub) and *Nymania capensis* (provincially protected) being the dominant (dwarf) shrubs. *Aloe claviflora* (provincially

protected), *Aloe hereroensis* subsp. *hereroensis* (provincially protected), *Euphorbia spinea* (provincially protected) and *Euphorbia gariepina* subsp. *gariepina* (provincially protected) are the dominant succulents. Other succulents found in this vegetation unit include *Lithops hookeri* (provincially protected), *Euphorbia braunsii* (provincially protected), *Kleinia longiflora* and various *Anacampseros* species (provincially protected). *Hoodia gordonii* (nationally protected) is an SCC with a high likelihood of occurrence within this vegetation unit as it was observed within the broader habitat of which this vegetation unit forms a part. Prominent forbs include *Acanthopsis hoffmanseggiana, Hermannia abrotanoides, Barleria lichtensteiniana* and *Blepharis mitrata*. *Peliostomum leucorrhizum* and *Helichrysum leontonyx* are rarely found in this vegetation unit.

The grass layer was well developed, with moderate ground coverage (Figure 6. b). Dominant grasses include *Stipagrostis uniplumis*, *Enneapogon cenchroides* and *Eragrostis echinochloidea*. In areas where rocky outcrops and gravel are large and more common (Figure 6. c), *Enneapogon desvauxii* and *Oropetium capense* dominate. Two geophytic species were frequently found in this vegetation unit, namely *Ledebouria apertiflora* and an *Albuca* species. VU B is in good ecological condition as it is in a near-natural state.

Figure 7: Characteristic landscape and vegetation features of VU B. a). Aerial view of the rocky dwarf shrubland. b). Ground view of the grassy areas of VU B. c). View of areas where medium to large rocks are a prominent feature of the vegetation unit. d). View depicting the shrubby and grassy element of the vegetation unit.

8.1.3. Vegetation Unit C

Vegetation unit C equals roughly 2.7 ha in the study area. However, within the study area, this vegetation unit is fragmented by vegetation unit D. It resembles duneveld vegetation of the Gordonia Duneveld vegetation type (Figure 7. a) (Mucina and

Rutherford, 2006). Vegetation and bare soils are prominent landscape features of this vegetation unit. Soils are sandy and uncompacted (Figure 7.d), with vegetation sparsely distributed.

Tall trees, tall shrubs and grasses dominate the vegetation. *Vachellia erioloba* (protected species) (Figure 7. c) *is* the dominant tall tree, while *Senegalia mellifera* is the dominant tall shrub. Other shrubs include *Crotalaria orientalis, Calobota linearifolia* and *Roepera lichtensteiniana*.

For all provincially and nationally protected species, the appropriate authority must be contacted with regard to the feasibility of obtaining removal permits for any protected species which would require such a permit should the development be approved. Removal permits for all protected species which will be affected by the development must be obtained before development commences.

The grass layer is moderately developed, with *Stipagrostis amabilis* being the dominant graminoid (Figure 7.b). Other prominent graminoids include *Cenchrus ciliaris, Stipagrostis uniplumis, S. obtusa, S. ciliata and Schmidtia kalahariensis*. VU C is in good ecological condition as it is in a natural state.

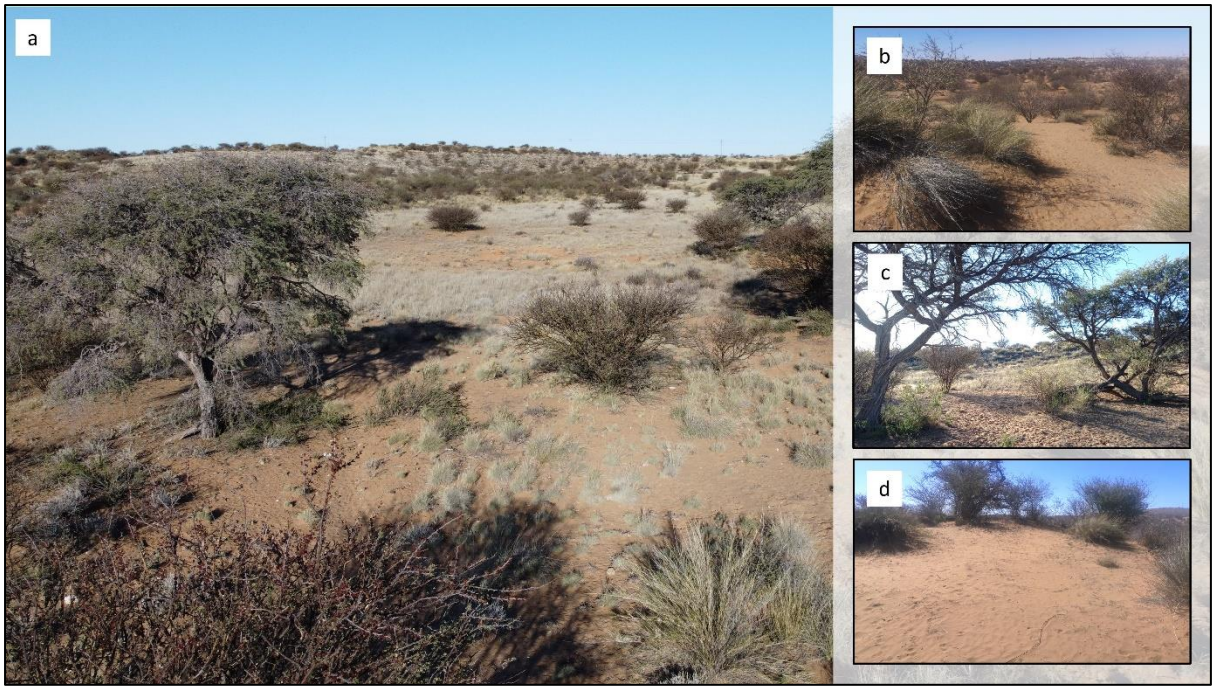

Figure 8: Typical vegetation of the duneveld in the Southeast of the study area. a). Aerial view of the duneveld vegetation. b). view from on top of a dune showing the dominant grass species, *Stipagrostis amabilis*. c). Dominant tree species of the duneveld, *Vachellia erioloba*. d). view from the bottom of a dune showing the sand and sparse vegetation.

8.1.4. Vegetation Unit D

Vegetation Unit D covers an area of approximately 3.2 ha, which is fragmented into two fragments of unequal area. Vegetation unit D interrupts and fragments vegetation unit C.

Steeply undulating hillsides scattered with small to large gravel, stones and outcropping boulders of quartz-muscovite schist and quartz-amphibole schist (Figure 8. b) resemble that of vegetation unit A. In fact, vegetation unit D is a disturbed form of vegetation unit A. Previous and current agricultural-related disturbances have drastically influenced the vegetation (Figure 8. a). Trees, shrubs, dwarf shrubs, graminoids and forbs show signs of overgrazing and browsing through species composition and remaining foliage damage (Figure 8. c and d).

The tree layer is well-developed in some areas of this vegetation unit. *Senegalia mellifera* is the dominant tree and shrub species. *Boscia albitrunca* (protected species) can also be found sparsely distributed in the tree layer. Dominant dwarf shrub species include *Aptosimum spinsecens, Caroxylon tubercalatum* and *Rhigozum trichotomum*. Other dwarf shrub species include *Monechma spartioides* and *Roepera lichtensteiniana. Senegalia mellifera* and *Rhigozum trichotomum* are known bush encroacher elements (Turpie et al., 2019), which with their dominance within this vegetation unit is indicative thereof. Dominant succulents are *Euphorbia spinea* (provincially protected)*, Euphorbia gregaria* (provincially protected) and *Kleinia longiflora*. Other succulents found in this area includes *Euphorbia braunsii* (provincially protected), which has a locally high species density in one particular area of the disturbed quartz dwarf shrubland, which was in the vicinity of a drainage line.

For all provincially and nationally protected species, the appropriate authority must be contacted with regard to the feasibility of obtaining removal permits for any protected species which would require such a permit should the development be approved. Removal permits for all protected species which will be affected by the development must be obtained before development commences.

The herbaceous layer is poorly developed, with the dominant forbs being *Blepharis mitrata*, *Acanthopsis hoffmannseggiana* and *Barleria lichtensteiniana*. Graminoid presence and cover were low due to the overgrazing observed. Graminoids observed include *Enneapogon desvauxii*, *Schmidtia kalahariensis, Oropetium capense, Tragus racemosus* and *Stipagrostis ciliata*. VU D is in fair ecological condition, as it is in a semi-natural state.

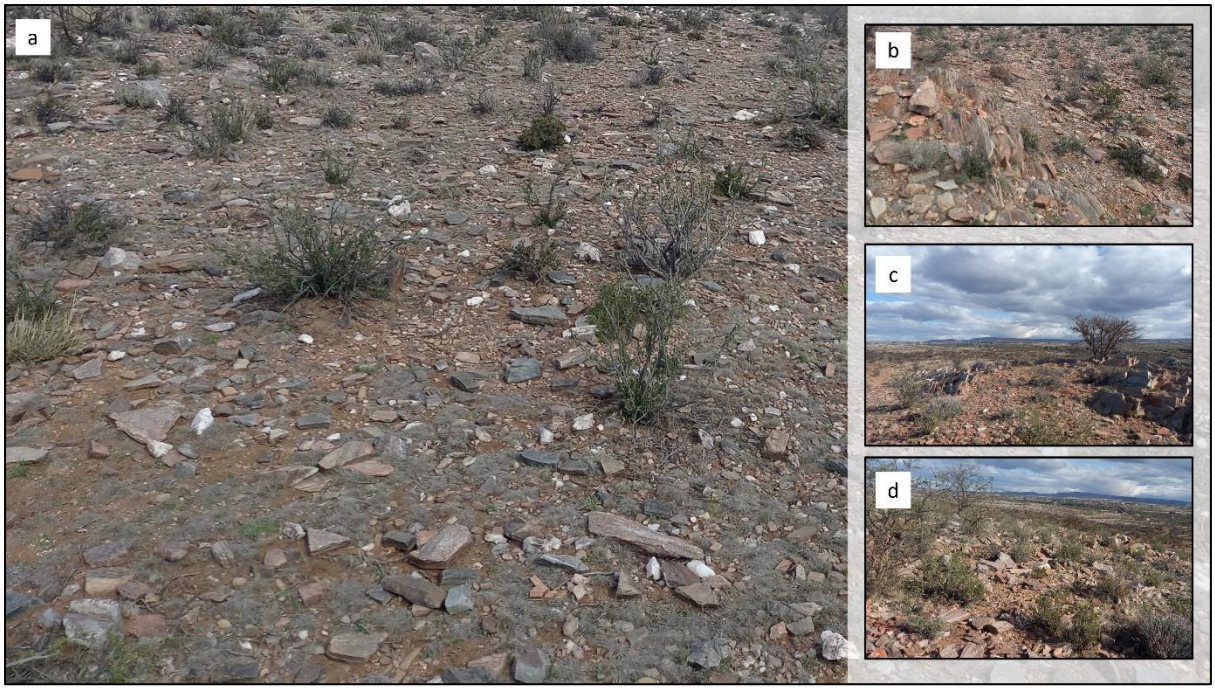

Figure 9: Typical vegetation of the Disturbed quartz shrubland. a). Aerial view of the vegetation unit showing areas of bare ground. b). View of denuded or sparse ground cover. c). Little to no herbaceous layer remaining. d). Remaining shrubs and dwarf shrubs show signs of overgrazing or have mechanical or chemical defences in the form of spines, thorns, prickles and milk latex.

8.1.5. Vegetation Unit E

In the study area, vegetation unit E covers a small area of 0.674 ha East of the Orange river. Soil is sandy, with little to no gravel on the surface. This vegetation unit has been influenced by anthropogenic disturbance in the northern parts of the vegetation unit (Figure 9.d and f). Foliage and branches litter the ground (Figure 9. b). Remaining naturally indigenous vegetation (Figure 9. e) resembles the Lower Gariep Alluvial Vegetation (Mucina and Rutherford, 2006)

The tree layer is closed, with *Eucalyptus camaldulensis, Prosopis glandulosa, Searsia lancea* and *Salix mucronata* dominating the tree layer (Figure 9. a). *Vachellia karoo* and *Ziziphus mucronata* were infrequently observed within this vegetation unit. *Eucalyptus camaldulensis* forms dense stands within and surrounding an inland canal (Figure 9. c). *Eucalyptus camaldulensis* is listed as a NEM:BA category 1b alien and invasive species within riparian areas. *Prosopis glandulosa* is listed as a NEM:BA category 3 species in the Northern Cape province. However, in riparian areas, category 3 listed species must be treated as Category 1b species. Management and control of alien and invasive species are required for category 1b listed species.

The shrub layer is mostly absent, with saplings of the dominant trees covering the shrub layer. The herbaceous layer is well-developed, with graminoids and alien and invasive species dominating. No succulents were found in this vegetation unit. Graminoids dominated where *Cynodon dactylon* and *Phragmites australis*. Dominant forbs included *Verbesina encelioides* and *Sisymbrium irio*, which are both alien and invasive species that have not been categorised or listed by NEM:BA (NEM:BA AIS

List, 2020; SANBI, 2022). One other alien and invasive species found in this vegetation unit is *Argemone ochroleuca* subsp. *ochroleuca,* which is a NEM:BA category 1b listed species. An alien and invasive management plan for the alien and invasive species can be drawn up and provided by Environmental Management Group upon request. VU E is in fair ecological state as it is in a moderately modified state.

Figure 10: Vegetation and anthropogenic disturbance observed within the river vegetation unit. a). *Salix mucronata* dominate the tree layer. b). The shrub layer is mostly absent, with patches of branch and foliage litter present. c). *Eucalyptus camaldulensis* stands within an inland canal shows anthropogenic disturbances. d). Central areas are influenced by informal infrastructure development. e). An aerial photograph of the closed tree layer and overall vegetation characteristics. f). Informal infrastructure development, including paved areas and manicured lawns.

8.1.6. Vegetation Unit F

This vegetation unit is represented by the flat western, alluvial terrace or riverbank of the orange river as well as several riverine islands (Figure 10. a), totalling an area of 0.737 ha. The flat alluvial terrace and riverine islands support reed beds and riparian thickets (Mucina and Rutherford, 2006). This vegetation unit is dominated by the mega-graminoid *Phragmites australis* (Figure 10. b). The tree layer is denuded except for on one of the riverine islands, where *Salix mucronata* is a dominant tree (Figure 10. c). Poorly developed shrub and herbaceous layers on the western side of the orange river and on the riverine islands are dominated by tree saplings and mega-graminoids. Young *Eucalyptus camaldulensis,* a NEM:BA category 1b alien and invasive listed tree species, is also present within this vegetation unit on the far western riverbank edge (Figure 10.d). Note that management and control of alien and invasive species are required for category 1b listed species. VU F is in good ecological condition as it is in a natural state.

Figure 11: Typical vegetation of the riverine vegetation reed bed and riverine island vegetation unit. a). Aerial view of the riverine islands. b). Aerial view of the riverine islands with *Phragmites australis* dominating one island while *Salix mucronata* dominates another. c). *Salix mucronata* dominates an island to the east of the Orange river despite the open tree, shrub and herbaceous layers. d). the mega-graminoid *Phragmites australis* dominates this vegetation unit.

8.1.7. Vegetation Unit G

Vegetation Unit G consists primarily of transformed agricultural land in the form of vineyards (Figure 11.a). However, as an open space that still allows for some low-level ecological functioning through vinecology, it can still be identified as a vegetation unit. Consisting primarily of the Mediterranean winegrape, *Vitis vinifera*, vegetation unit G is largely a perennial monoculture agroecosystem. The vegetation unit has several crop age group stages, which include various stages of fallow periods (Figure 11. b). Disturbance in riparian vegetation allows for the rapid spread of responsive flora (Mucina and Rutherford, 2006), which is often alien and invasive species. Thus, this vegetation unit's agricultural disturbances and susceptibility to alien invasions have a very low ecological function.

Outlying areas affected by the land transformation (Figure 11. c) are dominated by small to medium *Senegalia mellifera*. Other dominant shrubs include *Berkheya annectans, Tetraena decumbens, Monechma incanum* and *Phaeoptilum spinosum*. Dominant forbs include *Argemone ochroleuca* subsp. *ochroleuca*, which is a NEM:BA category 1b listed alien and invasive species. Dominant graminoids include *Stipagrostis uniplumis, Setaria verticillata* and *Fingerhuthia africana*.

VU G is in a poor ecological condition as it is in a severely modified state.

Figure 12: Land transformed for agriculture. a). aerial view of the vineyard vegetation which falls within the study area. b). aerial view of the different crop age stages with an area of a fallow vineyard. c). ground view of the area affected by the land transformation.

8.1.8. Vegetation unit H

Vegetation unit H resembles a grassy shrubland (Figure 12. a). This vegetation unit is dominated by the dwarf shrub and graminoid layers. The typical vegetation structure of this vegetation unit includes a semi-closed tall shrub layer with a well-developed dwarf shrub component and moderately to well-developed herbaceous layer (Figure 12.d). Medium-sized outcrops are common in this vegetation unit, with few small gravel components. Bare ground cover is low and visibly shows sandy soils.

Ziziphus mucronata is the dominant small tree. Few *Boscia albitrunca* (a protected tree under the National Forest Act. 1998 and provincial ordinance) individuals lie directly within the proposed transmission line's surveyed path. For all provincially and nationally protected species, the appropriate authority must be contacted with regard to the feasibility of obtaining removal permits for any protected species which would require such a permit should the development be approved. Removal permits for all protected species which will be affected by the development must be obtained before development commences.

Senegalia mellifera, Rhigozum trichotomum and *Phaeoptilum spinosum* are the dominant tall shrubs (Figure 12.b). The dwarf shrub layer is moderately to well developed. Dominant dwarf shrubs include *Justicia divaricata, Tetraena decumbens, Roepera lichtensteiniana* and *Monechma incanum*. Other dwarf shrubs were *Nymania capensis* (provincially protected) and *Indigofera heterotricha*. The herbaceous layer is well-developed, with the dominant growth form being graminoids. Some areas of this vegetation unit show localised increased densities of graminoid species (Figure 12.c). Dominant grasses include *Stipagrostis uniplumis, Cenchrus ciliaris, Enneapogon*

cenchroides E. desvauxii, E. scaber, Eragrostis echinochloidea, E. lehmanniana and *E. trichophora*. Forbs that were dominant include *Geigeria ornativa, Lotononis platycarpa, Felicia hirsuta, Hermannia abrotanoides* and *Barleria lichtensteiniana*. Other forbs which were observed include *Chenopodium olukondae, Kohautia sp.* and *Blepharis mitrata*. Dominant succulents include *Aloe herroensis* (provincially protected)., *Aloe claviflora* (provincially protected). and *Euphorbia gariepina* subsp. *gariepina* (provincially protected). Other succulents present include *Albuca setosa, Kleinia longiflora*, and *Mesembryanthemum guerichianum* (provincially protected).

A NEM:BA category 1b listed alien and invasive species, *Opuntia ficus-indica*, was recorded in this vegetation unit. VU H is in good ecological condition as it is in a near-natural state.

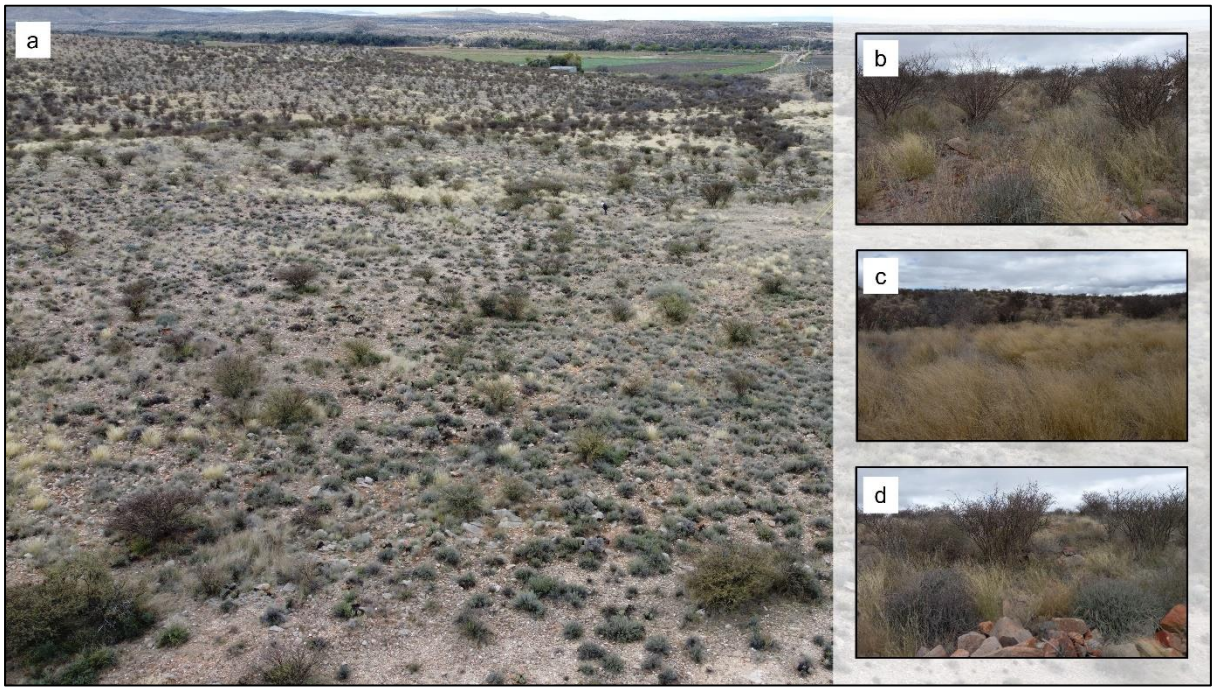

Figure 13: Typical vegetation unit of the grassy shrubland. a). Aerial view of the vegetation. b). Ground view of the vegetation's patchiness with *Senegalia mellifera,* the dominant tall shrub and overall grassy appearance. c). Ground view of localised areas of increased grassy components. d). Ground view of the typical vegetation cover structure.

8.1.9. Vegetation unit I - Drainage vegetation

Vegetation Unit I is represented by the Drainage vegetation on the map (Figure 3). Drainage vegetation is dominated by tall shrubs and trees, with few graminoids and low shrubs in the understory. Vegetation Unit I is a linear vegetation unit (Figure 13. a) that follows the sandy to rocky ephemeral drainage lines in the topography of the study area. The overall characteristic of this vegetation is an open tall shrubland. Bare ground cover and gravel cover are moderate to high (Figure 13. c). This vegetation unit has been severely interrupted by anthropogenic disturbances in the form of man-made dams (Figure 13.d).

Small tree to tall shrub layer is well developed while the dwarf shrub and forb layer are poorly-developed. Tall shrubs and small trees dominate the vegetation structure, with *Senegalia mellifera* the dominant tall shrub to small tree species. The vegetation canopy acts as a shelter for game (Figure 13.b). *Ziziphus mucronata* and *Boscia albitrunca* (a nationally and provincially protected species) were small tree species observed in this vegetation unit. For all provincially and nationally protected species, the appropriate authority must be contacted with regard to the feasibility of obtaining removal permits for any protected species which would require such a permit should the development be approved. Removal permits for all protected species which will be affected by the development must be obtained before development commences. *Boscia albitrunca* was less frequent in this vegetation unit than *Ziziphus mucronata*. *Phaeoptilum spinosum* is a commonly observed shrub in this vegetation unit. Dominant dwarf shrubs are *Justicia australis, Nymania capensis* (provincially protected)*, Hermannia spinosa* and *Aptosimum spinescens*. Few succulents were observed within or bordering this vegetation type. These succulents include *Euphorbia braunsii* (provincially protected) and *Euphorbia spinea* (provincially protected). An SCC, *Hoodia officinalis* (Near Threatened) is closely associated with flat areas of the larger habitat, which is represented in part by this vegetation unit. The graminoid layer is poorly developed in terms of ground cover. However, graminoid species composition was diverse, with *Setaria verticillata, Fingerhuthia africana, Enneapogon scaber, Enneapogon desvauxii, Stipagrostis obtusa, Stipagrostis uniplumis* and *Cenchrus ciliaris* being prominent. VU I is in good ecological condition as it is in a near-natural state.

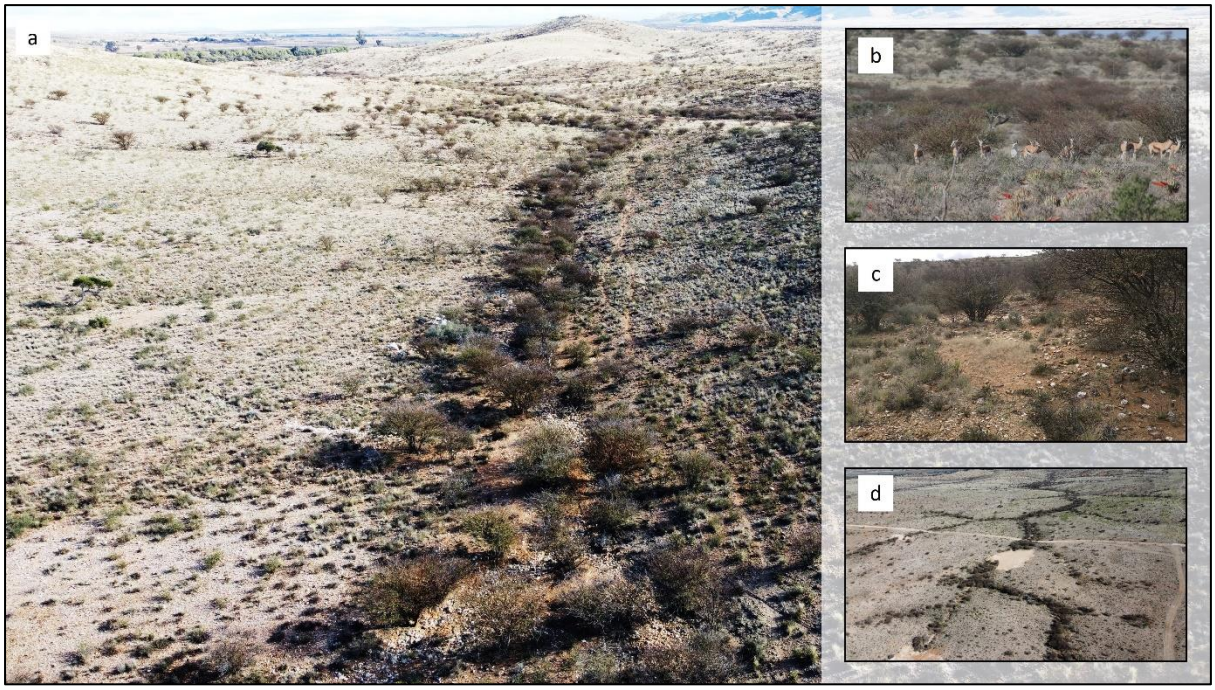

Figure 14: Vegetation of vegetation unit I (Drainage vegetation). a). Aerial photograph of the linear vegetation unit structure. b). Ground view of the vegetation unit acting as a shelter for springbuck. c). areas of bare ground and gravel are prominent in this vegetation unit. d). Many of the ephemeral drainage line's vegetation has been interrupted by artificial dam construction.

9. Sensitivity assessment

Unit sensitivity is calculated according to SANBI's (2020) Species Environmental Assessment Guidelines for site ecological importance (SEI). Unit sensitivity is calculated using resilience (R) and. biodiversity importance (BI), which is calculated as the sum of conservation importance (CI) and functional integrity (FI).

Table 7: Ratings determining the Unit sensitivities for the vegetation units found within the study areas

Vegetation unit	Conservation importance	Functional integrity	Biodiversity importance	Resilience category	UNIT SENSITIVITY
VU-A	High	Very High	Very high	Low	Very high
VU-B	Medium	High	Medium	Medium	Medium
VU-C	Medium	Medium	Medium	Medium	Medium
VU-D	Medium	Low	Low	Medium	Low
VU-E	Low	Very high	Medium	Medium	Medium
VU-F	Medium	Very high	High	Medium	High
VU-G	Very Low	Very Low	Very low	Medium	Very low
VU-H	Medium	Medium	Medium	Medium	Medium
VU-I	High	low	Medium	Medium	Medium

Vegetation Unit A

Was given a very high Conservation importance rating due to the high likelihood of occurrence of two SCC that were observed within the same habitat on Farm Rooisand 387/18. The SCC have national conservation statuses of Vulnerable and Near Threatened. A very high functional integrity rating was selected due to the minimal to no current ecological impacts with no signs of past disturbance. Thus, biodiversity importance is very high. Recovery of this habitat from major impacts is very low due to the aridity of the region and species relying on unpredictable seasonal rainfall. Thus, the resilience rating was very low. Together, the biodiversity importance rating of very high and resilience rating of very low for VU A results in a unit sensitivity rating of very high. The proposed transmission line development is expected to negatively influence a relatively small area of this vegetation unit.

Vegetation Unit B was given a medium conservation importance rating due to the high likelihood of occurrence of an SCC species which has been observed in more than 10 locations or more than 10 000 reported individuals which was observed within the same habitat on Farm Rooisand 387/18. The SCC has a national conservation status of data deficient due to insufficient information. A functional integrity rating of high was assigned due to the vegetation unit experiencing only minor current negative

ecological impacts with no signs of major past disturbance and having a good rehabilitation potential. Thus, the biodiversity importance rating is medium. Resilience of this unit to major impacts is medium as the species have a low likeliness of remaining at the site during and after the disturbance has occurred. Additionally, this habitat will take a long time to recover half of its current diversity. Together the Biodiversity importance and resilience ratings result in a unit sensitivity rating of medium. The proposed transmission line development is expected to negatively influence a relatively small area of this vegetation unit.

Vegetation Unit C had a fairly high species richness and confirmed occurrences of protected species. Thus, a medium conservation importance rating was selected. A medium functional integrity rating was selected as VU C is part of a larger area that has narrow corridors of good habitat connectivity, which has a busy road network between intact habitat patches. Thus, the biodiversity importance rating of VU C is medium. Dune ecosystems are known to be slow forming and slow recovering. However, there is a moderate likeliness that species will return to a site post-disturbance. Thus, the resilience rating of VU C was given a resilience rating of medium. Overall unit sensitivity is thus medium. The proposed transmission line development is expected to negatively influence a relatively small area of this vegetation unit.

Vegetation Unit D was given a medium conservation importance rating as it contains more than 50% of a natural habitat that could potentially support an SCC. As VU D is a degraded form of VU A, it still shares the potential to support the SCC observed in the same habitat as VU A. This vegetation unit (within the study area) is fragmented into less than 1 ha in size. It is experiencing several minor and major negative ecological impacts and has a low rehabilitation potential. The vegetation of this unit is dominated by unpalatable floral species resulting from selective grazing/browsing (overgrazing) by livestock which is also responsible for an underdeveloped herbaceous layer. Signs of bush encroachment are also present in the vegetation. A low rehabilitation potential of this vegetation unit is due to the vegetation unit being within a fenced in area which has been and will continue to be utilized as rangeland for livestock. Thus, a low functional integrity rating was assigned to VU C. The biodiversity importance rating was thus low. The unit resilience is estimated to recover to 75% of its current diversity slowly over ten years once the disturbance has been, which is a medium resilience rating. Unit sensitivity rating for VU C is low. The proposed transmission line development is expected to negatively influence a relatively small area of this vegetation unit.

Vegetation Unit E is a riparian area, which is a highly volatile habitat that is connected and highly influential to surrounding habitats. The Orange River system is a large, highly important and sensitive system that influences many different ecosystems. Thus, the significance of the Orange river system is not quantifiable in fulfilling requirements for conservation importance in this document. However, according to the fulfilling requirements for conservation importance, the appropriate CI rating for VU E is low. However, the functional integrity of VU E triggers the high habitat connectivity serving as functional ecological corridors with limited road networks between intact habitat patches criteria of the very high rating. Thus, the functional integrity of VU E is

very high. Resulting in a medium biodiversity importance rating. Slow recovery to 75% of the original species composition and functionality is expected from the habitat. Species are moderately likely to remain during and post disturbance. Thus, resilience is rated medium. Overall, the unit sensitivity rating is medium. The proposed solar development is expected to negatively influence a relatively small area of this vegetation unit.

Vegetation Unit F is a riparian area, which is a highly volatile habitat that is connected and highly influential to surrounding habitats. The Orange River system is a large, highly important and sensitive system that influences many different ecosystems. Thus, the significance of the Orange river system is not quantifiable in fulfilling requirements for conservation importance in this document. However, according to the fulfilling requirements for conservation importance, the appropriate CI rating for VU F is medium due to more than 50% of the vegetation unit containing natural habitat with no anthropogenic disturbance. However, the functional integrity of VU F triggers the high habitat connectivity serving as functional ecological corridors with limited road networks between intact habitat patches criteria of the very high rating. Thus, the functional integrity of VU F is very high. Resulting in a medium biodiversity importance rating. Slow recovery to 75% of the original species composition and functionality is expected from the habitat. Species are moderately likely to remain during and post disturbance. Thus, resilience is rated medium. Overall, the unit sensitivity rating is high. The proposed solar development is expected to negatively influence a relatively small area of this vegetation unit.

Vegetation Unit G was given very low Conservation importance due to the low to no probability of SCC occurrence, and there's very little to no natural habitat remaining. The functional integrity rating of VU G is very low due to the very small area that has several major current negative ecological impacts (complete habitat transformation). Thus, the biodiversity importance of VU G is Very Low. The vegetation of VU G is expected to recover relatively quickly to 75% of its original species composition due to species having a high likeliness of returning to the site post-disturbance. Overall, the unit sensitivity rating is very low. The proposed transmission line development is not expected to majorly influence this vegetation unit in a negative manner due to the complete transformation of the land.

Vegetation Unit H was given a medium conservation importance due to the confirmed occurrence of protected species in a vegetation unit that has more than 50% of its habitat intact as well as its fairly high species richness. A functional integrity rating of medium was selected due to the large area of greater than 5ha but smaller than 20 ha of a semi-intact vegetation type with mostly minor current ecological impacts with an established alien and invasive species population. Thus, the biodiversity importance rating is medium. A resilience rating of medium was selected due to the species having a moderate likeliness of returning to the site post-disturbance. Overall, the unit sensitivity rating is Medium. The proposed transmission line development is expected to negatively influence a relatively small area of this vegetation unit.

Vegetation Unit I – Drainage vegetation was given a conservation importance rating of high due to its flatter terrain areas' close association with an SCC species which

has been found in less than 10-15 localities and has fewer than 20 known mature individuals. Functional integrity of VU I is low as the area is more than 1 ha but smaller than 5 ha big and is experiencing several major negative ecological impacts. The high conservation importance rating and low functional integrity rating results in a medium biodiversity importance rating. Species of VU I are moderately likely to stay or return to the site during or post-disturbance. Thus, a medium resilience rating was given. Together the medium biodiversity importance rating and medium resilience rating results in a medium unit sensitivity rating. The proposed transmission line development is expected to negatively influence a relatively small area of this vegetation unit.

See the study area's ecological sensitivity map in Figure 14 below.

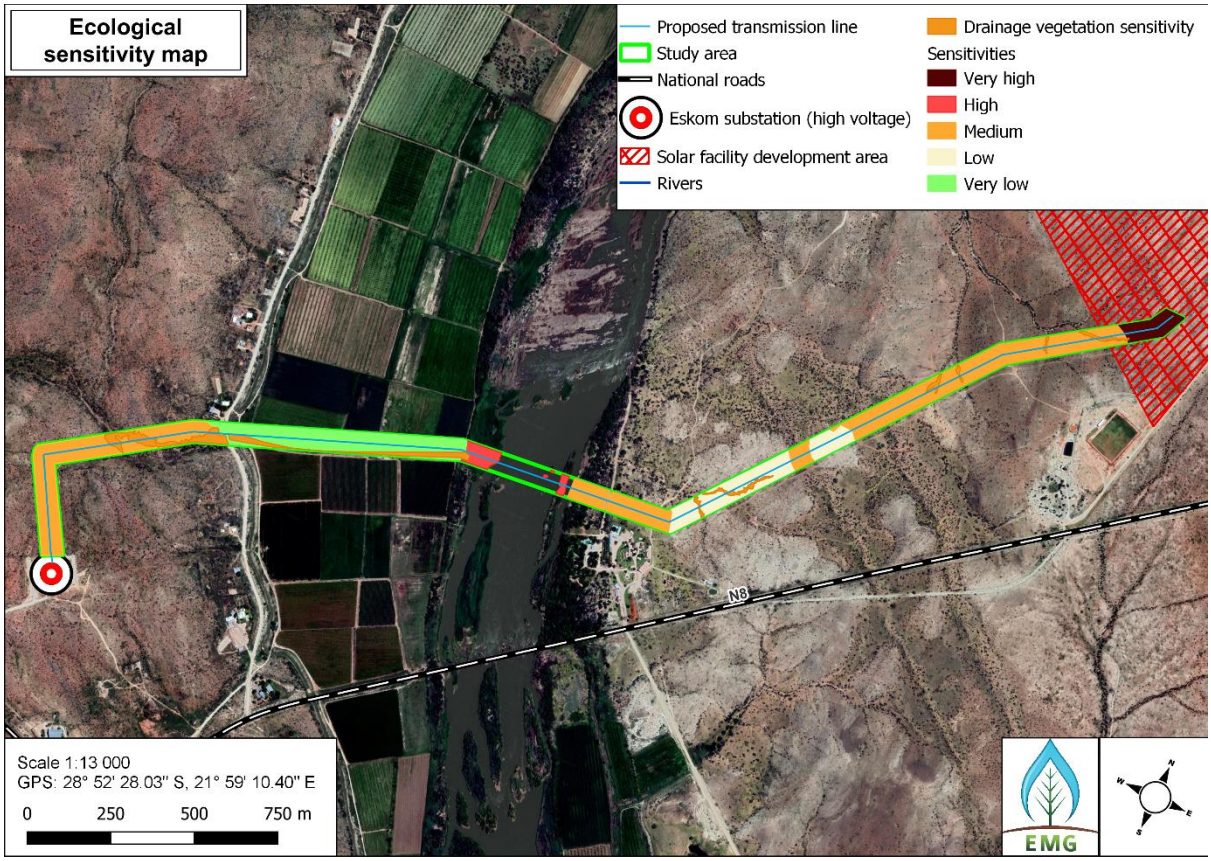

Figure 15: Map of the ecological sensitivity of the vegetation units identified within the study area.

10. Anticipated impacts:

Overall, the proposed transmission line development will directly impact small, fragmented areas over a larger, linear area. However, the transmission line development is expected to indirectly affect 23.55 ha of the study area, which varies in natural pristineness. Transmission line development indirectly affecting 23.55 ha is more than half of the direct impacts of 40ha for the proposed solar development. Of the 23.550 ha of the study area, 22.169 ha is terrestrial. The following section provides

a breakdown of the impacts imposed on the receiving environment due to the development and operation of the proposed solar facility.

Table 8 Summary of anticipated impacts associated with the proposed development. It's important to note that this table is not all-inclusive, but merely provides perspective concerning the types of activities that contribute to the deuteriation of concerned ecological aspects.

Concerned aspect	**Activities directly contributing to the concerned aspect**	**Secondary activities which may contribute to the concerned aspect**
Habitat loss	• Physical clearance of vegetation • Service roads • Habitat fragmentation leading to edge effects • Trampling • Accidental events such as fire • Loss of protected species	• Introduction of alien and invasive species • Soil compaction reducing re-establishment success • Soil erosion • Reduced biodiversity • Disrupted general animal behaviour
Loss of indigenous floral and faunal diversity	• Physical clearance of vegetation • Loss of protected species • Trampling • Habitat fragmentation • Accidental events such as fire, oil spills etc • Unlawful harvesting of plants • Unlawful hunting/ poaching of animals • Road mortalities • Electrocution (transmission lines)	• Introduction of unnatural competitors, i.e. alien and invasive species • Reduced fecundity through reduced reproductive ability and success • Reduced survivability • Disrupted general animal behaviour • Disrupted circadian rhythms • Noise pollution (construction phase) • Magnetic field pollution (operational phase)
Loss of floral and faunal species of conservation concern	• Clearance of vegetation • Loss of protected species • Habitat fragmentation • Poaching, unlawful hunting and gathering of plants and animals • Careless and reckless behaviour • Trampling • Accidental road mortalities • Accidental events such as fire	• Thinning of local genetic diversity • Reduced fecundity through reduced reproductive ability and success • Disrupted circadian rhythms • Interruption of lifecycle patterns due to noise and magnetic field pollution.

10.1. Concerned terrestrial ecological aspects:

Habitat loss and fragmentation is the leading cause of the global biodiversity crisis. The removal of crucial environmental units will lead to the destabilisation of the entire ecosystem and, eventually, ecological breakdown.

This project will result in an overall loss of biodiversity through habitat destruction and reduction of species diversity. Site location in the Bushmanland Arid Grassland (NKb3) and Lower Gariep Alluvial Vegetation (AZa3) vegetation types, both of least conservation concern (Mucina and Rutherford, 2006; Government Gazette no. 34809, 2011; Department of Environmental Affairs, 2016). The study area consists of multiple vegetation units with varying, sparse overall vegetation layer characteristics.

Within the study area, 22.2 ha is terrestrial. Of the 22.2 ha of terrestrial area, 17.8 ha has experienced little to no direct disturbance. An area of roughly 1 ha of 17.8 ha has experienced direct disturbances as a result of roads and informal infrastructure development. Only 4.588 ha has experienced extreme direct disturbances resulting from the complete transformation of land for viticulture. A large proportion of the proposed development area has experienced little to no disturbance, while a small area of the proposed development area has experienced very high levels of disturbance.

Overall, the expected disturbance is expected to influence a relatively small area considering pylon placement affected area being relatively small and the presence of existing service roads eliminating the need for developing new service roads. The expected level of disturbance caused by the proposed transmission line development is relatively low, resulting in slight vegetation and habitat transformation within the terrestrial area of the study area. This development will cause loss of habitat with the overall impact thereof on the receiving environment being low. However, the expected low levels of disturbance will only be for if all appropriate mitigation measures, which should consider avoiding areas with high densities of protected trees, are met. Additionally, where avoidance of areas with high densities of protected trees

The receiving environment's overall landscape is not considered unique regarding vegetation type and broadscale vegetation structure. It is, however, unique in broadscale supporting habitat having a high probability of occurrence of SCC. The proposed transmission line development site’s inclusion within CBA 2 and CBA 1 greatly promotes and stresses a conservative approach to land use change.

The impacts associated with habitat loss are evaluated to be of low significance since transmission line developments typically are restricted to pylon placement and service roads. Low-intensity developmental practices are necessary and should form a critical part of the Environmental Management Plan. The efficient implementation of the proposed mitigation measures will lower the impact significance on habitat loss.

Table 9 The anticipated impact on habitat loss for fauna and flora during the construction phase. Post-mitigation significance is also indicated.

Construction phase			
Concerned aspect:	**Impact characteristic**	**Pre mitigation**	**Post mitigation**
Habitat loss	Geographical extend	2	2
	Probability	3	2
	Duration	3	3
	Reversibility	2	2
	Cumulative impacts	2	1
	Intensity	2	1
	TOTAL	**24**	**10**
Significance rating		Low	Very low
General mitigation: • Removal of indigenous flora should be kept at a minimum. • Disturbance-related activities may only occur in the authorised area. • Vehicle movement should strictly be kept on designated dirt/gravel roads. • Soil erosion mitigation measures need to be implemented. • River bank stabilisation should be investigated. • Post-development open areas should be revegetated and kept free of exotic plant species. • Vehicles may only move within the demarcated space of the development area. • Any other relevant recommendations listed in this report should be implemented.			

Indigenous vegetation has a far greater conservation value compared to exotic species. Indigenous species have adapted to the surrounding environment and have established many stable networks of energy transfer. The removal of indigenous species disrupts this balance that has formed over many years.

Some alien and invasive species were recorded within the study area; however, their occurrences were restricted. The receiving environment's structure and species composition are primarily natural, with most areas showing few signs of significant habitat disturbance. Therefore, the construction phase of the transmission line development will result in the localized removal of mostly indigenous vegetation and the loss of local floral diversity. During the construction phase of the transmission line development, faunal elements will likely migrate to lesser disturbed spaces (broadly available in the area). Due to this, the anticipated impact on this aspect without mitigation is considered low. Mitigation is necessary and would be easily achieved. After mitigation measures are implemented, the anticipated impact on the loss of floral and faunal diversity is very low.

During the construction phase, the anticipated impact on the loss of indigenous floral and faunal diversity will be greater than during the operational phase, whether or not

mitigation measures are implemented. However, the implementation of mitigation measures during the construction phase will be significantly lower.

Table 10 The anticipated impact on the loss of indigenous floral and faunal diversity. The impacts were calculated for both the construction and operational phases. Post-mitigation significance is also indicated.

Construction phase			
Concerned aspect:	**Impact characteristic**	**Pre mitigation**	**Post mitigation**
Loss of indigenous floral and faunal diversity	Geographical extend	2	2
	Probability	3	2
	Duration	3	2
	Reversibility	3	2
	Cumulative impacts	2	1
	Intensity	2	1
	TOTAL	**24**	**9**
Significance rating		Low	Very low
General mitigation: • Development may only occur within the clearly demarked area. • Development in areas of very high sensitivity should be avoided (Avoidance mitigation). • No destructive developmental activities should be considered in areas of very high sensitivity. • Development in watercourses or within their buffer zone should be avoided. • Monitoring for the emergence of exotic species should be conducted. • An alien invasive species management plan must be drafted if the need for such management emerges. • Vehicle movement should remain within the authorised boundary. • A comprehensive fire management plan must be adhered to. • No unnecessary destruction or removal of vegetation is allowed. • Wildlife elements such as nests and burrows should be carefully inspected, and animals responsibly removed by a relevant specialist. • Post-development open areas should be revegetated and kept free of exotic plant species. • Any other relevant recommendations listed in this report should be implemented.			
Operational phase			
Concerned aspect:	**Impact characteristic**	**Pre mitigation**	**Post mitigation**
	Geographical extend	1	1

Loss of indigenous floral and faunal diversity	Probability	2	1
	Duration	4	4
	Reversibility	2	1
	Cumulative impacts	1	1
	Intensity	1	1
	TOTAL	**10**	**8**
Significance rating		Very low	Very low
General mitigation: • Ensure that all cables and connections are insulated to reduce the likelihood of accidental animal electrocution • Electric fencing near the ground should not be live to prevent the electrocution of small mammals. • Monthly inspections and recordings of all mortalities within the servitude area should be conducted and recorded. • An alien and invasive management plan (AIMP) should be developed to avoid the possibility of invasions and supply eradication techniques should they arise in the development area. • Quarterly alien and invasive species monitoring should take place according to the AIMP.			

The loss of rare, threatened and or protected species should always evoke a conservative approach regarding land use management. These species have been declared as species of conservation concern due to various population declining factors such as urban expansion, the loss of species-specific symbiotic relationships, innate small population sizes, habitat loss, etc. The further loss of these species should be prevented at all costs.

The transmission line development will affect numerous provincially protected flora and potentially two SCC (both with a very high likelihood of occurrence). The SCC was not recorded within the study area. Both SCC species were individuals whose population on site cannot be estimated due to the few known number of individuals of the species. As such, SCC flora are not permitted to be removed, transplanted, relocated or harmed in any way. However, certain provincially protected species can be granted a permit for removal or transplant. The DAERL should be consulted on the feasibility of transplanting protected flora. Based on the recommendations of the DAERL, removal or transplant permit applications for all provincially protected flora must be submitted to DAERL.

Boscia albitrunca and *Vachellia erioloba*, nationally and provincially protected trees listed as species of least conservation concern, are respectively sparsely distributed and localised in the development area. Removal of this species should be avoided in

areas where it has a high density. DFFE removal permits are necessary for the selective removal of this species.

Anticipated environmental impacts on the loss of floral SCC during the construction phase are expected to be moderate. After the efficient implementation of mitigation measures during the construction phase the anticipated impact on the loss of floral SCC is expected to be low. During the operational phase, the anticipated environmental impacts on the loss of floral SCC's will be low before the implementation of mitigation measures. However, after mitigation measures, the anticipated environmental impacts on the loss of floral SCC are expected to be very low. Strict mitigation measures are required to lower the overall impact.

Table 11 The anticipated impact on the loss of floral SCC. The impacts were calculated for both the construction and operational phases. Post-mitigation significance is also indicated.

Construction phase			
Concerned aspect:	**Impact characteristic**	**Pre mitigation**	**Post mitigation**
Loss of floral species of conservation concern	Geographical extend	2	2
	Probability	2	1
	Duration	3	3
	Reversibility	4	4
	Cumulative impacts	2	1
	Intensity	3	2
	TOTAL	**39**	**22**
Significance rating		Moderate	Low
General mitigation: Prior to development • A thorough walk-through of the study area by a qualified botanist should occur to locate any potential SCC. • All staff should be trained on SCC, observations of SCC and the reporting procedure. • On-site environmental and health and safety officers must report any observations of SCC to a qualified botanist and apply the recommended buffer area for that SCC. • Protected plant species should be located and demarcated. • Removal or relocation of the SCC are prohibited. • DAERL should be consulted with regard to the feasibility of transplanting or removing provincially protected species. • Removal or transplant permits from DAERL must be obtained for all provincially protected flora. • If DAERL indicates transplant or relocation of some of the provincially protected flora, a formal relocation management plan should be drafted and implemented. Construction • No new roads may be created within very highly sensitive areas.			

- The relocation plan should be strictly supervised by a qualified botanist.
- All construction staff should be informed on SCC and protected species or species of special conservation concern.
- A relevant specialist should be notified when any of the mentioned SCC and protected flora are observed during construction.
- All disturbance-related activities must be restricted to the authorised development boundary.
- No illegal harvesting of plant material is allowed.
- Any other relevant recommendations listed in this report should be implemented

Operational phase

Concerned aspect:	**Impact characteristic**	**Pre mitigation**	**Post mitigation**
Loss of floral species of conservation concern	Geographical extend	2	2
	Probability	1	1
	Duration	3	3
	Reversibility	4	3
	Cumulative impacts	2	1
	Intensity	2	1
	TOTAL	**24**	**10**
Significance rating		Low	Very low

General mitigation:

- Staff should immediately inform the on-site environmental representative and a relevant specialist if any SCC are observed.
- In the case of SCC observations, a GPS co-ordinate and photo must be recorded by the onsite environmental officer and supplied to the associated qualified botanist.
- Vehicle movement should strictly be contained on designated roads. No off-roading must be allowed.
- No harvesting of plant material allowed.
- All damage-causing activities should strictly be restricted to the authorised development area.
- An alien and invasive management plan (AIMP) needs to be developed to avoid the possibility of invasions in the supporting habitat of SCC and needs to be specific to the supporting habitat of SCC to prevent accidental harm to the SCC.
- The presence of alien and invasive species needs to be monitored quarterly.
- Emergence of alien and invasive species in the supporting habitat of SCC needs to be reported to the associated qualified botanist.
- Emergence of alien and invasive species in the supporting habitat of SCC needs to be swiftly eradicated in a method outlined by an AIMP.
- Any other relevant recommendations listed in this report should be implemented

The anticipated environmental impact evaluation indicated that the proposed transmission line development's construction phase would have an overall low impact on the receiving environment. The anticipated environmental impact generated through the facility's operational phase will have a very low impact. Any deviation from

the proposed development plan will significantly influence this score. The developer and the appointed contractor should remain mindful of low-impact developmental practices. The recommended mitigation measures should be strongly enforced.

Table 12 Overall anticipated environmental impact pre- and post-mitigation.

Concerned aspect	Score prior to mitigation	Rating prior to mitigation	Score post mitigation	Rating prior to mitigation
Construction phase				
Habitat loss	24	Low	10	Very low
Loss of indigenous floral and faunal diversity	24	Low	9	Very low
loss of floral species of conservation concern	39	Moderate	22	Low
Overall impact:	**29**		**14**	
Significance rating:	Low		Very low	
Operational phase				
Loss of indigenous floral and faunal diversity	10	Very low	8	Very low
loss of floral species of conservation concern	24	Low	10	Very low
Overall impact:	**17**		9	
Significance rating:	Very low		Very low	

11. Recommendations:

- Prior to development, a thorough walk-through of the study area by a qualified botanist should occur to locate any potential SCC.
- Protected plant species should be located and demarcated prior to development.
- Removal or relocation of the SCC are prohibited.
- No protected flora may be removed or harmed without the necessary permits.
  - Prior to development, DAERL should be consulted with regard to the feasibility of transplanting or removing provincially protected species.
  - Removal or transplant permits from DAERL must be obtained for all provincially protected flora prior to development.
  - If DAERL indicates transplant or relocation of some of the provincially protected flora, a formal relocation management plan should be drafted and implemented prior to development.
- Notice boards should be erected informing construction workers on floral special of conservation concern. A relevant specialist should be notified when

any of these species are observed during the construction and operational phases.

- All staff should be trained on SCC, observations of SCC and the reporting procedure.
- On-site environmental and health and safety officers must report any observations of SCC to a qualified botanist and apply the recommended buffer area for that SCC.
- During development, care should be taken to not unnecessarily clear or destroy indigenous vegetation.
- An alien invasive management plan is a recommended requirement for monitoring the invasion of alien and invasive species found in areas affected by disturbance. Early detection of alien invasion is recommended to lower the development's environmental impact as well as overall project costs.
    - The presence of alien and invasive species needs to be monitored quarterly.
- An alien and invasive management plan specific to the supporting habitat of SCC is required to ensure that no harm comes to the SCC if eradication of AIS occurs.
    - Emergence of alien and invasive species in the supporting habitat of SCC needs to be reported to the associated qualified botanist.
    - Emergence of alien and invasive species in the supporting habitat of SCC needs to be swiftly eradicated in a method outlined by an AIMP.
- Drip trays should be placed under stationary construction vehicles.
- Vehicle movement should be restricted to the authorised site boundary.
- Excavated topsoil should be kept clean of exotic vegetation.
- Should any fauna become trapped in excavations, a qualified individual must be responsible for their safe relocation and release.
- A designated construction waste/debris area should be placed on site and located as far as possible from sensitive habitats.
- Waste should be removed from the site on a regular basis and not allowed to pile up to start polluting the environment.
- All construction-related waste/material should be appropriately disposed of after the construction has ceased.
- A comprehensive fire management plan should be implemented to prevent any fire outbreaks.

12. Discussion and conclusion:

A previous ecological assessment performed in August of 2018 by van Rooyen and van Rooyen for the eastern part of the site (on the eastern side of the orange river) was available for reference and was largely influential in this study.

The site consists of multiple vegetation units with varying overall vegetation layer characteristics. Overall, the tree layer is moderately developed in certain areas, while absent in others. The shrub layer is moderately developed throughout the site. Poor to moderately developed graminoid and herbaceous layers are consistent throughout the study area. The overall vegetation, excluding the dune and riparian areas, are a good representative of the Bushmanland Arid Grassland. Neighbouring vegetation types, Gordonia Duneveld vegetation, is represented by the dune areas within the study area, while the riverine and riverine island vegetation resembles the Lower Gariep Alluvial Vegetation (Mucina and Rutherford, 2006; SANBI, 2006-2018; Skowno et al., 2018).

The DFFE screening tool has indicated the floral theme to be of low sensitivity. The known occurrence of two floral SCC (sensitive species 930 and Hoodia officinalis) and numerous provincially protected flora in the surrounding vegetation is better associated with a high floral sensitivity theme. The supporting evidence for this has been supplied as per the specialist protocols in a separate specialist report. As these species were not directly found within this ecological report's study area the inclusion of this, the supporting evidence has been excluded.

Anticipated environmental impact evaluation has overall indicated that the development would have a low anticipated environmental impact. A low environmental impact was greatly influenced by the proposed transmission lines overall few direct impacts. As per the EIA species guidelines, avoidance mitigation alternatives should be investigated for very highly sensitive areas.

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14. Appendices:

14.1. Appendix 1: Impact assessment evaluation form

Table 13 description of the rating system used to evaluate the possible impacts concerned with the proposed development.

Geographical extent: This describes the spatial reach an impact might have.		
Score		
1	Site specific	The impacts will only affect the specific site.
2	Local	The impacts will affect the local area or district.
3	Provincial	The impacts will be recognised across most of the province.
4	International/ national	Will affect the entire country or other countries.
Probability: This describes the probability that a specific environmental impact will occur.		
1	Unlikely	Less than 25% chance of occurrence.
2	Possible	Between 25-50% chance of occurrence.
3	Most likely	50-75% chance of occurrence.
4	Definite	Greater than 75% chance of occurrence.
Duration: This describes the amount of time an environment will be affected by the impact.		
1	Short term	The impact will disappear very quickly, either through mitigation or through natural processes. The impact should have disappeared within 1 year.
2	Medium term	The impact will endure for a short while after the construction processes and will be mitigated by either human intervention or natural processes. The impact should have disappeared between 2-10 years. .
3	Long term	The impact will persist through the construction phase and disappear by either human intervention or natural processes in 10-30 years.
4	Permanent	Mitigation either by man or natural processes is highly unlikely. The impact will have permanently affected the environment.
Reversibility: Describes the potential of an impact to be entirely reversed after development.		
1	Entirely reversable	The impact is entirely reversible and can be achieved with minor mitigation measures.
2	Possibly reversable	The impact might be reversible. Suitable mitigation measures will increase the chances of reversibility and should be considered.
3	Barely reversible	It is unlikely that the impact will be reversed. Extreme mitigation measures might increase the chances of successful reversibility.
4	Irreversible	The impact is irreversible. No mitigation measures can reverse the effects on the environment.
Cumulative impacts: Describes the cumulative impacts of the proposed development, i.t.o. the development process and all activities emanating from the operation of the facility.		

1	Very low cumulative impact	The impact will result in no or minimal cumulative effects.
2	Low cumulative impact	The impact will result in an overall low cumulative effect.
3	Moderate cumulative impact	The cumulative impacts will have moderate levels of impact.
4	High cumulative impact	The cumulative impact will result in high to very high environmental effects.
Intensity: Describes the severity of the impact on the environment		
1	Low	The impact's effect on the system will be hardly noticeable, if at all. Rehabilitation measures have to be in place if required.
2	Medium	The impact will have a recognisable effect on the environment. However, system functionality will still be present with negligible effects on ecosystem integrity. Rehabilitation measures have to be in place.
3	High	The impact will severely affect ecosystem integrity and function. Rehabilitation will be costly, and extreme mitigation measures have to be in place.
4	Very high	The impact will result in the entire ecological breakdown of the system or components thereof. Rehabilitation will be costly with minimal chances of success. Extreme mitigation measures must be in place.

14.2. Appendix 2: Impact significance on the environment

14.2.1. Appendix 2A: Impact significance evaluation:

Impact significance describes the overall environmental impact resulting from the cumulation of impact characteristics. Significance gives a judgement of the effect a development will have on the environment. Significance is calculated as the total score for each criterion (geographical extend + probability + duration + reversibility + cumulative impacts) multiplied by the intensity. A greater significance score results in an overall greater environmental impact and should be avoided or allowed with extreme mitigation measures in place. A lower significance score results in an overall lesser environmental impact and may be allowed with very little or no mitigation measures needed.

Table 14 impact significance evaluation form

Score	Impact significance rating	Description
5-19	Very low	Impact significance is of a very low order. Development is acceptable
20-34	Low	Impact significance is of a low order, and development is acceptable.
35-49	Moderate	The impact will be recognisable and may pose a problem to the development.
50-64	High	The impact is substantial and will significantly affect the environment. Development is unacceptable.
65-80	Very high	The impact is of the highest possible order and will cause irrefutable damage to the environment. Development unacceptable.

Appendix 3: Species list

14.3. Appendix 3A: Plant species

Provincially protected species are coloured orange and species listed as nationally protected species are indicated in red. Specially protected species (NCCA schedule 1) are indicated in pink. The appropriate authority must be contacted with regards to the feasibility of obtaining removal or relocation permits for these species should they be influenced by the development. Based on the appropriate authorities' recommendations, the applicable permits for these species must be obtained prior to any developmental activity. Alien species are indicated in blue.

Table 15 Plant species recorded during the field survey

	Growth form	Family	Species name	Act	National conservation status (SANBI's red list of South African plants).
Acanthus's	Forb	Acanthaceae	*Acanthopsis disperma*		
	Forb	Acanthaceae	*Acanthopsis hoffmannseggiana*		DDT
	Forb	Acanthaceae	*Barleria lichtensteiniana*		
	Forb	Acanthaceae	*Blepharis mitrata*		
	Dwarf shrub	Acanthaceae	*Justicia australis*		
	Dwarf shrub	Acanthaceae	*Monechma incanum*		
	Dwarf shrub	Acanthaceae	*Monechma spartioides*		
	Succulent	Aizoaceae	*Lithops hookeri*	NCCA schedule 2	LC
	Succulent	Aizoaceae	*Mesembryanthemum guerichianum*	NCCA schedule 2	LC
	Succulent	Aizoaceae	*Ruschia intricata*	NCCA schedule 2	LC
	Succulent	Aizoaceae	*Titanopsis calcarea*	NCCA schedule 2	LC
Amaranths	Forb	Amaranthaceae	*Alternanthera pungens*	NEM:BA not listed	
	Dwarf shrub	Amaranthaceae	*Caroxylon tuberculatum*		
	Forb	Amaranthaceae	*Chenopodium olukondae*		
	Forb	Amaranthaceae	*Hermbstaedtia fleckii*		
	Geophyte	Amarylliaceae	*Nerine laticoma*	NCCA schedule 2	LC
	Succulent	Anacampserotaceae	*Anacampseros* sp. 1	NCCA schedule 2	

	Growth form	Family	Species name	Act	National conservation status (SANBI's red list of South African plants).
	Succulent	Anacampserotaceae	*Anacampseros* sp. 2	NCCA schedule 2	
	Succulent	Anacampserotaceae	*Anacampseros* sp. 3	NCCA schedule 2	
	Tree	Anacardiaceae	*Searsia burchellii*		
	Tree	Anacardiaceae	*Searsia lancea*		
Milkweeds	Succulent	Apocynaceae	*Cynanchum vimale*	NCCA schedule 2	LC
	Succulent	Apocynaceae	*Hoodia gordonii*	NCCA schedule 2	DDD
	Succulent	Apocynaceae	*Hoodia officinalis* subsp. *officinalis*	NCCA schedule 2	NT
	Succulent	Apocynaceae	*Larryleachia marlothii*	NCCA schedule 2	LC
Aloes	Succulent	Asphodeliaceae	*Aloe claviflora*	NCCA schedule 2	LC
	Succulent	Asphodeliaceae	*Aloe hereroensis* subsp. *hereroensis*	NCCA schedule 2	LC
	Succulent	Asphodeliaceae	*Haworthiopsis tessellata*	NCCA schedule 2	LC
Daisies	Dwarf shrub	Asteraceae	*Berkheya annectans*		
	Dwarf shrub	Asteraceae	*Eriocephalus ambiguus*		
	Forb	Asteraceae	*Felicia hirsuta*		
	Forb	Asteraceae	*Geigeria ornativa*		
	Forb	Asteraceae	*Helichrysum argyrosphaerum*		
	Forb	Asteraceae	*Helichysum leontonyx*		
	Forb	Asteraceae	*Helichrysum luteo-album*		
	Succulent	Asteraceae	*Kleinia longiflora*		
	Dwarf shrub	Asteraceae	*Ptreonia mucronata*		
	Forb	Asteraceae	*Senecio cf. angustifolius*		
	Forb	Asteraceae	*Verbesina enceloides*	NEM:BA not listed	
	Shrub	Bignoniaceae	*Rhigozum trichotomum*		
	Forb	Brassicaceae	*Sisymbrium irio*	NEM:BA not listed	
	Small tree	Capparaceae	*Boscia albitrunca*	Protected tree (NFA) NCCA schedule 2	LC
	Succulent	Cactaceae	*Opuntia ficus-indica*	NEM:BA category 1b	
	Forb	Cleomaceae	*Cleome Angustifolia*		

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	Growth form	Family	Species name	Act	National conservation status (SANBI's red list of South African plants).
	Geophyte	Colchicaceae	*Colchicum* sp.		
Gourd's	Forb	Cucurbitaceae	*Cucumis africanus*		
Spurges	Succulent	Euphorbiaceae	*Euphorbia braunsii*	NCCA schedule 2	LC
	Succulent	Euphorbiaceae	*Euphorbia gariepina* subsp. *gariepina*	NCCA schedule 2	LC
	Succulent	Euphorbiaceae	*Euphorbia gregaria*	NCCA schedule 2	LC
	Succulent	Euphorbiaceae	*Euphorbia spinea*	NCCA schedule 2	LC
Legumes	Shrub	Fabaceae	*Calobota linearifolia*		
	Shrub	Fabaceae	*Crotalaria orientalis*		
	Dwarf shrub	Fabaceae	*Indigofera heterotricha*		
	Forb	Fabaceae	*Lessertia cf pauciflora*	NCCA schedule 1	DDT
	Forb	Fabaceae	*Lotononis platycarpa*		
	Tree	Fabaceae	*Prosopis glandulosa*	NEM:BA category 1b	
	Tree/shrub	Fabaceae	*Senegalia mellifera*		
	Tree	Fabaceae	*Vachellia erioloba*	Protected tree (NFA)	LC
	Tree	Fabaceae	*Vachellia karroo*		
	Succulent	Geraniaceae	*Monsonia crassicaulis*		
Hyacinths	Geophyte	Hyacinthaceae	*Ledebouria apertiflora*		
	Geophyte	Hyacinthaceae	*Albuca setosa*		
	Geophyte	Hyacinthaceae	*Albuca sp.*		
Irises	Geophyte	Iridaceae	*Gladiolus permeabilis*	NCCA schedule 2	LC
	Geophyte	Iridaceae	*Moraea simulans*	NCCA schedule 2	LC
	Parasite	Loranthaceae	*Tapinanthus oleifolius*		
Malvas	Forb	Malvaceae	*Hermannia abrotanoides*		
	Dwarf shrub	Malvaceae	*Hermannia spinosa*		
	Shrub	Meliaceae	*Nymania capensis*	NCCA schedule 2	LC
	Tree	Myrtaceae	*Eucalyptus camaldulensis*	NEM:BA category 1b	

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	Growth form	Family	Species name	Act	National conservation status (SANBI's red list of South African plants).
	Shrub	Nyctaginaceae	*Phaeoptilum spinosum*		
Sorrel's	Forb	Oxalidaceae	*Oxalis* sp.	NCCA schedule 2	
Poppy's	NEM:BA 1b AIS	Papaveraceae	*Argemone ochroleuca* subsp. *ochroleuca*	NEM:BA category 1b	
Grasses	Graminoid	Poaceae	*Aristida congesta*		
	Graminoid	Poaceae	*Aristida diffusa*		
	Graminoid	Poaceae	*Cenchrus ciliaris*		
	Graminoid	Poaceae	*Chloris virgata*		
	Graminoid	Poaceae	*Cynodon dactylon*		
	Graminoid	Poaceae	*Enneapogon cencheroides*		
	Graminoid	Poaceae	*Enneapogon desvauxii*		
	Graminoid	Poaceae	*Enneapogon scaber*		
	Graminoid	Poaceae	*Eragrostis annulata*		
	Graminoid	Poaceae	*Eragrostis echinochloidea*		
	Graminoid	Poaceae	*Eragrostis lehmanniana*		
	Graminoid	Poaceae	*Eragrostis trichophora*		
	Graminoid	Poaceae	*Fingerhuthia africana*		
	Dwarf graminoid	Poaceae	*Oropetium Capense*		
	Mega graminoid	Poaceae	*Phragmites australis*		
	Graminoid	Poaceae	*Schmidtia kalahariensis*		
	Graminoid	Poaceae	*Setaria verticillata*		
	Graminoid	Poaceae	*Stipagrostis amabilis*		
	Graminoid	Poaceae	*Stipagrostis ciliata*		
	Graminoid	Poaceae	*Stipagrostis obtusa*		
	Graminoid	Poaceae	*Stipagrostis uniplumis*		
	Graminoid	Poaceae	*Tragus berteronianus*		
	Graminoid	Poaceae	*Tragus racemosus*		

	Growth form	Family	Species name	Act	National conservation status (SANBI's red list of South African plants).
	Tree	Rhamnaceae	*Ziziphus mucronata*		
	Forb	Rubiaceae	*Kohautia* sp.		
Willows	Tree	Saliaceae	*Salix mucronata*		
	Parasite	Santalaceae	*Lacomucinaea lineata*		
Figworts	Dwarf shrub	Scrophulariaceae	*Aptosimum albomarginatum*		
	Dwarf shrub	Scrophulariaceae	*Aptosimum marlothii*		
	Dwarf shrub	Scrophulariaceae	*Aptosimum spinescens*		
	Forb	Scrophulariaceae	*Peliostomum leucorrhizum*		
Grapes	Vine	Vitaceae	*Vitis vinifera*	Commercial crop	
Twinleaves	Forb	Zygophyllaceae	*Fagonia* sp.		
	Dwarf shrub	Zygophyllaceae	*Roepera lichtensteiniana*		
	Dwarf shrub	Zygophyllaceae	*Tetraena decumbens*		
	Dwarf shrub	Zygophyllaceae	*Tetraena rigida*		
	Forb	Zygophyllaceae	*Tribulus cristatus*		