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1. Executive summary:

The Wonderpan solar facility is located on portion 4 of farm Karabee 50, approximately 18 km SE of the town of Prieska in the Northern Cape Province (Figure 2). The site is accessed via the N10, south of Prieska. The Wonderpan solar development covers approximately 133 ha of nearly undisturbed natural karoo vegetation and includes a 13 km transmission line connecting the Wonderpan and Camel Thorn solar facilities.

The Wonderpan solar facility and a small portion of the proposed transmission line is located within the Bushmanland Arid Grassland (NKb 3) vegetation type (Figure 3) (SANBI, 2006-2018). The larger portion of the transmission line will be placed within the Northern Upper Karoo (NKu 3) vegetation type (Figure 3) (SANBI, 2006-2018).

Three relatively homogenous Vegetation Units (VUs) were identified within the Wonderpan Solar Facility's proposed development boundary. These units were delineated based on overall floral compositional homogeneity. On a broader scale, the site's vegetation resembles a semi-closed shrubland with a well-developed medium-low shrub stratum (Figure 5). The sub-shrub stratum was very well developed and featured an unexpected high species richness of shrubs, bulbs, and forbs. The high species diversity of the mentioned vegetative growth forms is assumed to be attributed to the ample rainfall received in the area this year.

Several provincially protected flora and one plant species of conservation concern (*Hoodia gordonii*) were recorded on site (Table 15). A literature study also revealed the possible occurrence of another floral SCC (*H. officinalis*); however, this species was not recorded on site. The Unit sensitivity analysis concluded that all VUs should be regarded as moderately sensitive units (Table 13). Mitigation measures, especially concerning the possible occurrence and known observations of floral SCCs should be strongly enforced and overseen by a suitable specialist.

The overall anticipated environmental impact evaluation has indicated that the development will generate a moderate and low environmental impact for the construction and operational phases respectively (Table 22). A moderate environmental impact is primarily attributed to the clearing nature of solar developments. PV solar developments usually result in clearing an entire area's vegetation and consequently habitat for flora and fauna. It's important to emphasise that the impact generated through the facility's operational phase was calculated at the higher threshold of the low impact category. Any deviation from the proposed development plan may 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. The possible occurrence of several provincially protected flora and possibly two flora SCCs significantly contributed to the anticipated impact scores. Development may still be favourably considered, but only if all mitigation measures are followed.

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 only provide these services as long as they are in a healthy state. Habitat fragmentation, pollution, erosion and unsustainable harvest are only a few anthropogenic activities threatening healthy ecosystems. These anthropogenic activities destabilise ecosystems and will ultimately result in an ecological breakdown. Poorly functioning ecosystems cannot provide these ecosystem services, which ultimately raise 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. The presence of these red data species 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).

Prieska Power Reserve (PTY) Ltd. intends to develop a series of green energy production developments in Prieska, Northern Cape. This Ecological investigation is restricted to the proposed 60 MW photo voltaic (PV) Wonderpan solar facility and its associated 33KV powerline, which connects into the Camel thorn solar facility (Figure 2). 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.

Field surveys were conducted on the 14th and 15th of April 2022, in which the proposed development footprint and its immediate surroundings were surveyed. The survey was conducted in early autumn, which is generally not optimal for plant species

identification. Regardless, the field survey resulted in numerous plant species' identification, which is assumed to be sufficient for the purpose of this report.

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 on the receiving environment.

5.1. Vegetation:

Vegetation related topics to be investigated include:

- The 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]

5.2. Fauna:

Fauna related topics to be investigated include:

- A survey primarily concerned with visual observations of mammal species and supporting evidence of their presence in a given region, such as burrows, excavations, animal tracks, dung, etc.
- A species list including both observed and probable species occurrence.

5.3. Assumptions and limitations:

- Not all plants have the same flowering period, and thus it is likely that the survey could have occurred outside of the flowering period of a specific species.
- The field survey took place in early Autumn, which is not optimal for plant species identification. Regardless, the abundant recorded plant species (likely due to an excellent rainy season) are assumed to be sufficient to make sound ecological-based conclusions regarding the state of the receiving environment.
- Some geophytic and succulent plants might have been overlooked due to their cryptic nature.
- Some animal species exhibit a nocturnal and or shy habit and will most likely not be observed during the daytime.

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[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.

- 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.

6. Methodology:

6.1. Literature used for additional information:

Vegetation:

- Red Data List (Raimondo et al. 2009)
- Vegetation types (Mucina and Rutherford 2006; SANBI, 2006-2018)
- 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)

Terrestrial fauna:

- Field guides for species identification (Stuart and Stuart, 2000; Marais, 2004; Stuart and Stuart, 2015)
- Red List of Mammals of South Africa, Swaziland and Lesotho (Child et al., 2016)

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

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 100 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

[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.

species. Observed animal species and evidence of their existence (dung, habitat requirements, excavations, animal tracks, burrows, and nests) were recorded.

6.3. Assessment criteria:

The environmental status and unit sensitivity analysis involve qualitative assessments of the natural process that govern the ecology of the environment. A healthy functioning ecosystem comprises many intricately connected environmental units and would therefore deserve a high conservation value whilst poorly functioning ecosystems do not. Unit sensitivity is quantified as the sum of various *in situ* environmental aspects, where a higher score corresponds to a higher sensitivity and a lower score corresponds to a lower sensitivity.

Table 1 Unit sensitivity categories quantified as the sum of multiple environmental aspects. Each environmental aspect and its corresponding evaluation criteria are described in the following paragraphs.

Unit sensitivity:	Scores	Development preference
Low	9-13	This unit is ideal for development. Some mitigation measures might be recommended.
Low-medium	14-18	This unit is preferred for development. Mitigation measures might be recommended.
Medium	19-23	This unit is acceptable for development. Mitigation measures should be implemented.
Medium-high	24-28	This unit is not preferred for development. A great deal of mitigation will be required.
High	29-34	This unit is not suitable for development.

Rare, threatened and or protected floral species:

The presence or potential presence of rare, threatened and or protected plant species within the site's receiving environment has an ever-important role in the feasibility of the development. These species are usually sensitive and deserve a high conservation value. Before fieldwork, a thorough review of habitat requirements and the potential occurrence of red data species was performed.

Protected species are defined as any species listed as protected in terms of *Section 56 (1)(d)* of the National Environmental Management Biodiversity Act. Protected species include those listed in the Threatened or Protected Species lists (TOPS), and the South African Red List of Plants. The conservation status categories defined by

the South African Red List of Plants (Figure 1) represent species of conservation concern (SCC). Particular emphasis was placed on identifying such species during the floral survey.

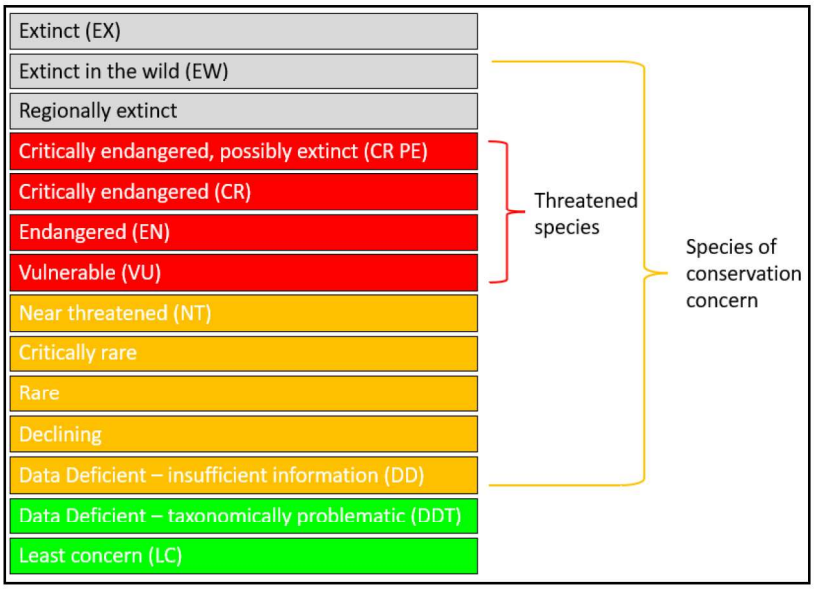

Figure 1 Illustration depicting the categories of plant species of conservation concern.

SANBI was consulted prior to the field survey to attain the names of any rare, threatened and or protected floral species. The names of these species may not be mentioned in this report and will be referred to by each species' specific sensitive species number.

Table 2 Rare- threatened and or protected floral species evaluation score sheet.

Criteria:	Score
Presence of or high likelihood of presence	(3)
Possible occurrence	(2)
Presence is highly unlikely	(1)

Ecological function:

An ecosystem functions as an intimately interconnected system consisting of various environmental units. The overall health and persistence of an ecosystem rely heavily on the functioning of all its parts. These parts can be viewed as the various communities that persist within the ecosystem. However, it remains important to note that some parts within the ecosystem carry a critical sustaining role, and the removal of these parts will lead to rapid ecological destabilisation. Therefore, it is recommended that development avoid sensitive habitats and implement adequate mitigation to ensure ecological function remains.

Table 3 Ecological function evaluation score sheet.

Criteria:	Score
The environment acts as a critical ecological unit and therefore regarded as highly sensitive.	(3)
The environment is of medium ecological importance and regarded as moderately sensitive.	(2)
The environment is of low ecological importance and is considered to be low sensitivity.	(1)

Formal conservation rating:

Formal conservation threat status as indicated in the National Biodiversity Assessment of 2018 (Skowno et al., 2019). The ecosystem threat status provides an indication of the remaining intact extent of a vegetation type and therefore its conservation priority.

Table 4 Formal conservation rating score sheet.

Criteria: NBA 2018 Threat status	Score
Critically endangered	(3)
Endangered	(2)
Vulnerable	(1)
Least concern	(0)

Biodiversity planning:

Provincial spatial biodiversity plans aim to amongst others identify areas which are critical for the management of natural resources (SANBI, 2018). Spatial biodiversity planning resources are usually represented in CBA maps. CBA maps typically identify five main categories: protected areas, CBAs, ESAs, Other Natural Areas (ONA), and areas with no natural habitat remaining. Each of these categories has a different desired land use state and consequently conservation priority.

Table 5 Biodiversity planning rating score sheet.

CBA Map category	Description	Desired state	Score
Protected area	Areas that are formally protected in terms of the Protected Areas Act. Each protected area has a management plan.	As per each protected area's management plan.	(4)

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CBA 1	Areas that are irreplaceable for meeting biodiversity targets. There are no other options for conserving the ecosystems, species, or ecological processes in these areas.	Maintain in natural or near natural ecological condition.	(3)
CBA 2	Areas that are the best option for meeting biodiversity targets, in the smallest area, while avoiding conflict with other land uses.		
ESA 1	Areas that support the ecological functioning of protected areas or CBAs or provide important ecological infrastructure.	Maintain in at least semi-natural ecological condition.	(2)
ESA 2		No further intensification of land use.	
ONA	Natural or semi-natural areas that are not required to meet biodiversity targets or support natural ecological processes.	Best determined through multi-sectoral planning processes.	(1)
No natural areas remaining	Areas in which no natural habitat remains		(0)

Percentage ground cover:

Ground cover is influenced by climate and biophysical conditions such as overgrazing, frequent fires and anthropogenic activities. Poor ground cover is generally attributed to a disturbed habitat. However, it should always be interpreted in terms of the environment's natural condition. For example, arid ecosystems tend to display a poor ground cover, whilst mesic ecosystems are more productive and present a higher ground cover.

Table 6 Percentage ground cover evaluation score sheet.

Criteria:	Score
Good ground cover.	(3)
Moderate ground cover (few patches of exposed soil).	(2)
Very poor ground cover (large areas of barren soil).	(1)

Vegetation structure and composition:

A comparison of the naturally occurring vegetation strata, I.e., the ratio between the top (trees/ tall shrubs), middle (shrubs) and lower (herbaceous/dwarf shrub) strata whilst considering the floral composition. It is important to note that the observed vegetation structure and composition is compared to a hypothetical pristine habitat corresponding to the specific vegetation type.

Table 7 Vegetation structure evaluation score sheet.

Criteria:	Score
Vegetation structure and composition is a good representation of the specific vegetation type	(3)
Moderate structural and compositional representation of the specific vegetation type	(2)
Vegetation structure and or composition is not a good representation of the specific habitat type.	(1)

Infestation of exotic and invasive plants:

The lack of natural predators usually stimulates the proliferation of exotic species. In many instances, these exotics outcompete native plant species and become invasive species. Exotic species are categorised according to NEMBA (Act no. 10 of 2004) and CARA (Act no. 43 of 1983).

CARA (Act no. 43 of 1983) identifies three categories for the management of invasive and alien species:

- **Category 1:** Declared weeds that are prohibited on any land or water surface in South Africa. These species must be controlled or eradicated where possible.
- **Category 2:** Declared invader species only allowed in demarcated areas under controlled conditions and prohibited within 30m of the 1:50 year flood line of any watercourse or wetland.
- **Category 3:** Declared invader species that may remain but must be prevented from spreading. No further planting of these species is allowed.

NEMBA (Act no. 10 of 2004) identifies four categories for managing invasive and alien species:

- **Category 1a:** Invasive species requiring compulsory control. Remove and destroy. Any specimens listed in this category need, by law, to be eradicated from the environment. No permits will be issued.
- **Category 1b:** Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to

be placed under a government-sponsored invasive species management programme. No permits will be issued.

- **Category 2:** Invasive species regulated by area. A demarcation permit is required for restricted activities involving these species. No permits will be issued for Category 2 plants to exist in riparian zones.
- **Category 3:** Invasive species regulated by activity. An individual plant permit is required to undertake certain restricted activities. No permits will be issued for Category 3 plants to exist in riparian zones.

The receiving environment's level of infestation by exotic plant species greatly influences that area's conservation value. An area with a high invasive species count will have a lower conservation value than environments without such species.

Table 8 Infestation of exotic and invasive plant species evaluation score sheet.

Criteria:	Score
No or a small presence of alien/invasive species	(3)
Moderate infestation by one or more alien/invasive species	(2)
Area with a very high presence of many alien/invasive species	(1)

Impact of grazing/ browsing:

The intensity and type of grazing and browsing greatly influence the overall vegetation structure and vegetation condition. For example, extensive grazing usually leads to the selective removal of palatable species that changes the environment's floral composition over time.

Table 9 Impact of grazing/ browsing evaluation score sheet.

Criteria:	Score
Very little or no signs of grazing/browsing	(3)
Some signs of grazing/browsing (browse lines, shrubs/trees with signs of browsing and grass with signs of grazing)	(2)
Very clear browse level in trees, shrubs heavily pruned and grass layer heavily grazed.	(1)

Erosion:

Soil erosion is a natural process that involves the removal of fertile topsoil from the environment. The issues concerning soil erosion are instead focused on the rapid displacement of fertile topsoil due to mismanaged land and consequently habitat degradation.

Table 10 Erosion evaluation score sheet.

Criteria:	Score
No or very little signs of erosion	(3)
Small erosion gullies or the presence of slight sheet erosion	(2)
High degree of gully erosion and/ or high degree of sheet erosion	(1)

Connectivity:

The connection between habitats is of critical importance for the long-term resilience and functioning of ecosystems. At its core, connectivity between habitats dictates the potential of energy exchange between biotic components. Areas with a greater proportion of unobstructed connectivity to prominent green nodes/ corridors deserve a higher conservation value. Key factors being assessed include habitat fragmentation, level of anthropogenic exposure, proximity to conservation areas and indirectly urban centres, unobstructed passage to other habitats etc.

Table 11 Connectivity evaluation score sheet.

Criteria:	Score
Clear, unobstructed connectivity to other prominent green nodes/corridors	(3)
Limited connectivity to other prominent green nodes/ corridors	(2)
Very poor connectivity	(1)

Rare, threatened and or protected faunal species:[4]

The presence or potential presence of rare, threatened and or protected faunal species within the site's receiving environment has an ever-important role in the feasibility of the development. These species are usually sensitive and deserve a high conservation value. Before fieldwork, a thorough review of habitat requirements and the potential occurrence of red data species was performed.

Table 12 Rare and endangered faunal species evaluation score sheet.

Criteria:	Score
Presence of or high likelihood of presence	(3)
Possible occurrence	(2)

[4] This report primarily focuses on the floral component of the environment and will briefly touch on topics related to the faunal component. In the event of a suspected occurrence of a rare, threatened, and or protected faunal species, a relevant specialist, will be consulted to fully address the potential impacts on this component.

Presence is highly unlikely	(1)

7. Study area:

The Wonderpan solar facility is located on portion 4 of farm Karabee 50, approximately 18 km SE of the town of Prieska in the Northern Cape Province (Figure 2). The site is accessed via the N10, south of Prieska. The Wonderpan solar development covers approximately 133 ha of nearly undisturbed natural karoo vegetation and includes a 13 km transmission line connecting the Wonderpan and Camel Thorn solar facilities.

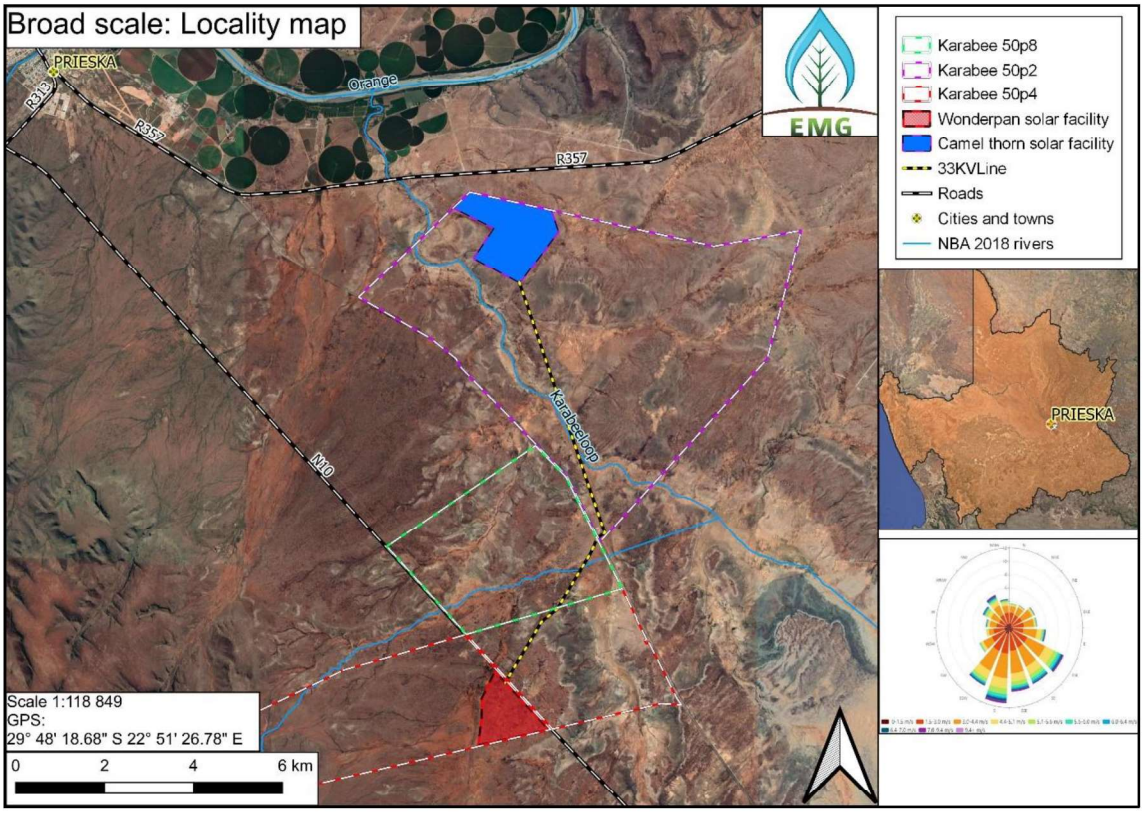

Figure 2 Locality map indicating the Wonderpan solar facility's location along with the 33KV transmission connecting the Wonderpan and Camel Thorn solar facilities. The Wonderpan solar facility is clearly indicated within portion 4 of farm Karabee 50 located southeast of Prieska. Various important river systems as indicated by the NBA 2018 data set is also depicted. A windrose chart depicting the prevailing wind direction is also provided.

7.1. The physical environment:

The Wonderpan solar facility's topography features an almost flat plane which gently loses elevation towards the southern and western boundaries. Here altitude remains relatively even, varying from around 1005 m a.s.l. to 998 m a.s.l. Numerous small (some difficult to clearly delineate) calcrete banks protrude through the generally flat landscape within and around the Wonderpan solar facility.

Topographical variation along the powerline varies considerably as it traverses the landscape along the Karabeeloop towards the connection point at Camel Thorn. The

overall landscape of the area features a relatively flat plain irregularly interspersed with low hills and ridges. These landscape variations become more prominent near the Karabeeloop. The Karabeeloop system is fed by an intricate network of ephemeral drainage lines and small watercourses.

Prieska's climate [5]profile is classified according to the Köppen Geiger climate classification as a hot desert climate (BWh). The average maximum and minimum for the hottest and coldest months around Prieska are 40°C(December-January) and -3°C (July), respectively. Rainfall in this region is highly variable, but with precipitation maxima around early Autumn (±38 mm) and minima around mid winter (<5 mm). This region's mean annual precipitation calculated over a 20-year period is 223 mm.

7.2. Regional vegetation:

The Wonderpan solar facility is located near Prieska, Northern Cape Province, primarily dominated by Nama-Karoo associated vegetation. The Nama-Karoo Biome is an arid Biome emerging on the central plateau of the western half of South Africa. It occurs at altitudes ranging between 500 and 2000 m a.s.l., with the majority lying between 1000 and 1400 m a.s.l. The Nama-Karoo Biome is further subdivided into three bioregional classifications: (1) the Lower Karoo bioregion, (2) the Upper Karoo bioregion, and (3) the Bushmanland bioregion (Mucina and Rutherford, 2006).

The proposed development traverses two broad-scaled bioregional vegetation classifications *viz.*, Bushmanland (NKb) and Upper Karoo (NKu) Bioregions. A distinction between the Bushmanland bioregion and the other two bioregions in the region is based on climatic disparity, in which NKb features the highest annual rainfall variability, highest annual temperature and the overall lowest mean annual rainfall (Mucina and Rutherford, 2006). In contrast, the NKu features a more reliable annual rainfall predictability, higher mean annual rainfall, and the lowest mean annual temperature.

The Wonderpan solar facility and a small portion of the proposed transmission line is located within the Bushmanland Arid Grassland (NKb 3) vegetation type (Figure 3). The larger portion of the transmission line will be placed within the Northern Upper Karoo (NKu 3) vegetation type (Figure 3).

[5] Climatic data was obtained from the NASA power access portal using the MERRA-2 data assimilation model for a 20 year period.

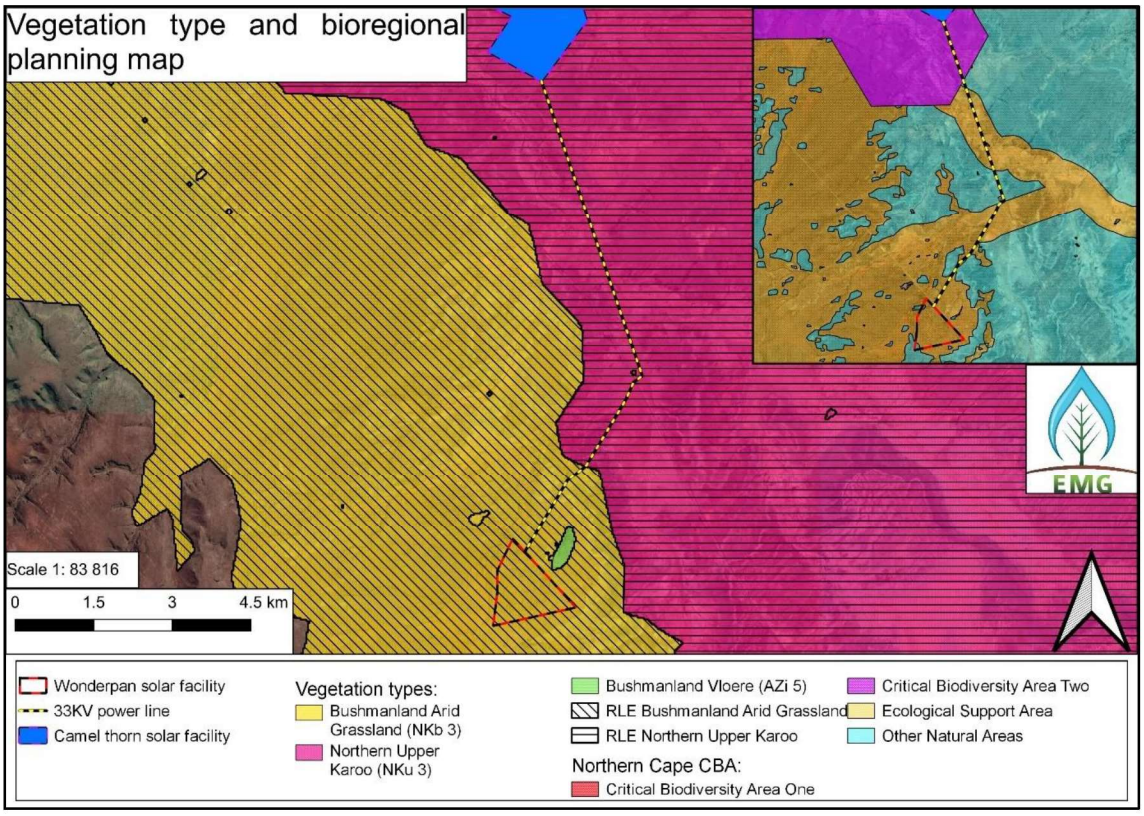

Figure 3 Broad scaled map depicting the proposed development's relationship relative to various vegetation types and in the context of the Northern Cape CBA bioregional planning zones (small map~right). The map clearly depicts the Wonderpan solar facility and its transmission line transecting natural distributions of the illustrated vegetation types (Remaining Natural Extent).

The Bushmanland Arid Grassland (NKb 3) is primarily distributed in the Northern Cape, where it spans the area around Aggenys and Springbok (west) and over to Prieska in the east (Mucina and Rutherford, 2006). The southern boundary of NKb 3's distribution is formed by intrusions of the Bushmanland Basin, whilst its northern distribution is somewhat fragmented and irregularly interrupted by Lower Gariep Broken Veld, Kalahari Karoid Shrubland and Gordonia Duenveld. NKb 3's landscape features vast open to irregular plains on a slightly sloping plateau supporting sparsely vegetated arid grasslands dominated by *Stipagrostis* species. In some areas, dwarf shrubs of *Caroxylon spp.* alters the overall landscape's physiognomy to resemble a grassy shrubland. In good rainfall years, the Bushmanland Arid Grassland often features a rich collection of annual herbs and forbs (Mucina and Rutherford, 2006). Important plant taxa, often associated with NKb 3 are listed in Appendix 3B. The Bushmanland Arid Grassland is a poorly protected vegetation type (0.5% of its natural distribution is protected) and is listed in the National Biodiversity Assessment (NBA) 2018 as a vegetation type of least conservation concern (Skowno et al., 2019).

Northern Upper Karoo (NKu 3) is primarily distributed in the Northern Cape and Free State Provinces (Mucina and Rutherford, 2006). NKu 3 stretches around the area of Swartkoppies and Meruche (north) down to Driefontein in the south. Its western distribution covers the area around Carnarvon and Vanwyksvlei, while its eastern

distribution stretches as far east as Petrusburg. The Northern Upper Karoo primarily features a shrubland landscape dominated by dwarf karoo shrubs, grasses and stands of *Senegalia mellifera subsp. detinens*. The southern distribution of NKu 3 is often associated with flat to gently sloping terrain with isolated hills sustaining Upper Karoo Hardeveld, whilst the northeastern distribution contains many interspersed pans often interrupted by Vaalbos Rocky Shrubland. Important plant taxa often associated with the Northern Upper Karoo is listed in Appendix 3B. Only 0.5% of the entire natural distribution of NKu 3 is protected in statutorily conserved areas. The NBA 2018 listed this vegetation type as least concern (Skowno et al., 2019).

The Wonderpan solar facility's overall vegetation composition and structure do not adequately represent the Bushmanland Arid Grassland in which it is mapped. Instead, the site's general shrubland associated vegetation structure and a composition dominated by *Senegalia mellifera* better represent the Northern Upper Karoo which is prevalent immediately north of the site (Figure 3).

8. Results:

A comprehensive floral species list is available in Appendix 3A

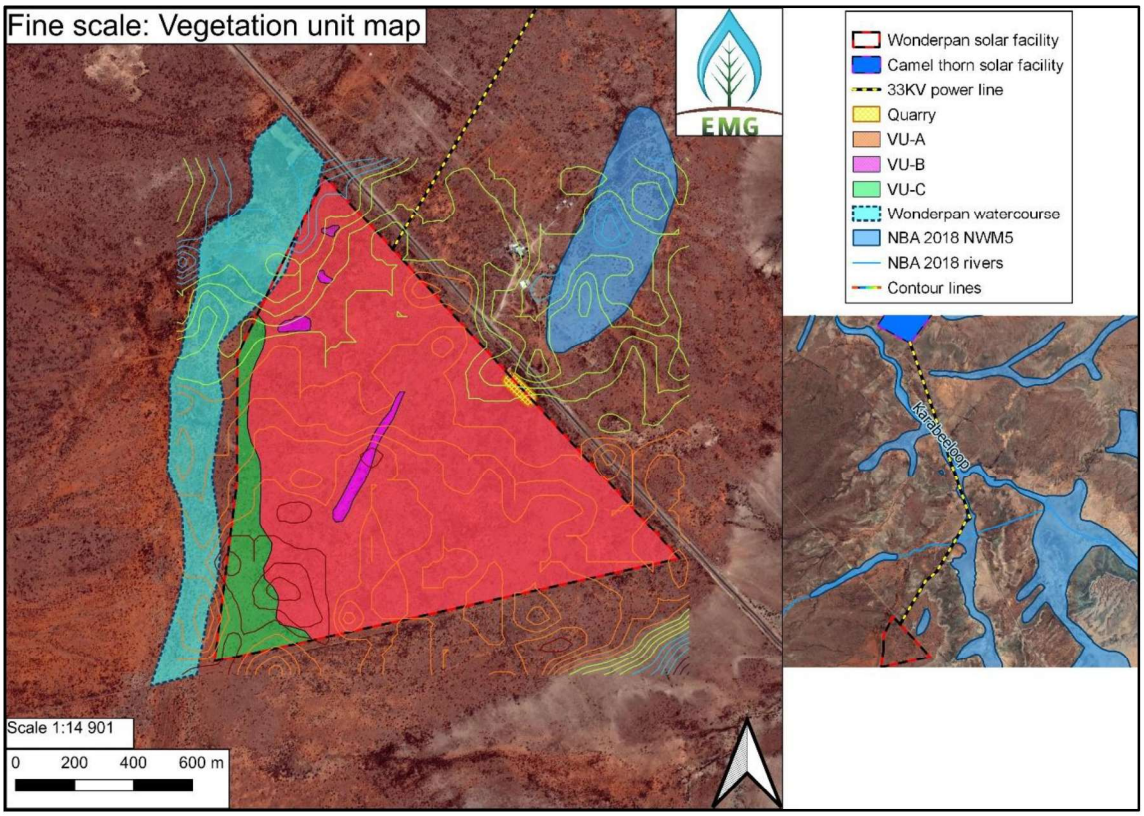

Figure 4 Fine scaled map indicating the three vegetation units identified on-site. The proposed transmission line is also indicated along with the NBA 2018 NWM5. Site topography is indicated with contour lines. Refer to Van Rensburg's (2022) wetland delineation report for details concerning the large watercourse along the site's western boundary and any other aquatic ecosystem possibly affected by the development.

8.1. Floral survey:

Three relatively homogenous Vegetation Units (VUs) were identified within the Wonderpan Solar Facility's proposed development boundary. These units were delineated based on overall floral compositional homogeneity. On a broader scale, the site's vegetation resembles a semi-closed shrubland with a well-developed medium-low shrub stratum (Figure 5). The sub-shrub stratum was very well developed and featured an unexpected high species richness of shrubs, bulbs, and forbs. The high species diversity of the mentioned vegetative growth forms is assumed to be attributed to the ample rainfall received in the area this year.

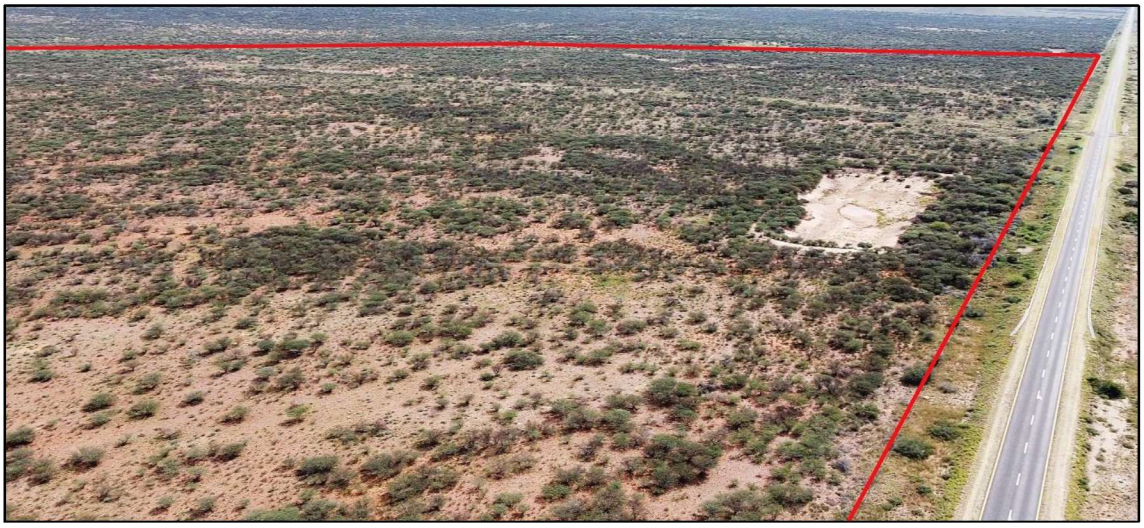

Figure 5 Drone perspective of the Wonderpan solar facility clearly showing the semi-closed shrubland dominated landscape on a relatively flat plane. The old quarry is also visible in this view.

8.1.1. VU-A:

VU-A covers the greater portion of the proposed PV site and is only interrupted by small, isolated patches where the soil becomes more calcrete-rich (VU-B). VU-A's distribution seems to be limited by the underlying geology and associated edaphic characteristics since the study area's southern and most western regions feature deeper alluvial deposited soils, supporting a greater herbaceous component (VU-C), which is not as pronounced in VU-A.

Figure 6 Ground view of the semi-closed shrubland habitat within VU-A. Note the overall dominance of *Senegalia mellifera* and a reasonably well developed herbaceous layer.

VU-A's vegetation presents associations with that of a semi-closed shrubland with a well-developed herbaceous layer (Figure 6). The shrub stratum is primarily dominated by *Senegalia mellifera,* a naturally occurring shrub/small tree species known to proliferate in overgrazed veld. The widespread distribution of this woody species is considered a natural element in this region (Mucina and Rutherford, 2006). Other woody components often recorded in VU-A include *Boscia albitrunca, Lycium cinerium, Lycium boscifolium* and *Rhigozum trichotomum.* The sub-shrub stratum also featured numerous dwarf karoo shrubs such as *Aizoon africanum, Eriocephalus cf. ericoides* and *Pentzia globosa*. Graminoids and other forbs often recorded in this unit include *Aristida adscensionis, A. congesta subsp. congesta, Enneapogon desvauxii, E. chenceroides, Eragrostis echinocloidea, E. lehmanniana, E. trichophora, Melenis repens, Oropetium capense, Schmidtia kalahariensis, Sporobolus ludwigii, Tragus berteronianus, Acanthopsis hoffmanseggiana, Barleria rigida, Geigeria filifolia, Aptosimum lineare* and *A. spinescens.* Geophytic herbs such as *Ammocharis coranica, Oxalis haedilupes, Oxalis obliquifolia* and *Nerine laticoma* were also frequently recorded. The numerous observations of *Hoodia Gordonii* (data deficient) should also be noted. No other SCCs were recorded within this VU.

VU-A's overall floral composition is primarily considered natural, with little signs of significant environmental disturbance. Localised elements of habitat disturbance include a small informal dumping area, old quarry and gravel roads running through the site.

A natural floral species composition, little signs of significant habitat disturbance, adequate connectivity to the surrounding natural open landscape and the numerous observations of provincially protected flora support a **medium** unit sensitivity rating. Furthermore, the numerous recorded individuals of *Hoodia gordonii* and *Boscia*

albitrunca significantly contributed to the medium sensitivity evaluation of VU-B. The removal of these species without a relevant permit is prohibited.

8.1.2. VU-B:

VU-B is the smallest and most irregularly distributed VU identified within the study area (Figure 4). This unit is restricted to the underlying geology. VU-B was only observed in areas where calcareous deposits protrude through the relatively flat topography. The calcareous-rich soils create a distinctive arid habitat in an already arid landscape. Here the vegetation structure is notably dwarfed and more open compared to the surrounding semi-closed shrubland associated landscape (Figure 7). VU-B's vegetation structure typically represents small islands of open dwarf shrubland with poor herbaceous ground cover.

Figure 7 Ground view of the rocky, calcrete-rich soils supporting the open shrubland habitat of VU-B. Note the distinct lower vegetation structure compared to the surrounding semi-closed shrubland habitats of VU-A and VU-C. The rocky soils depicted in this view make the perfect habitat for cryptic succulents to conceal their presence.

The dwarf shrub stratum is primarily dominated by *Rhigozum trichotomum* and *Roepera lichtensteiniana*, whereas the herbaceous stratum is dominated by *Oropetium capense* and *Enneapogon desvauxii.* Other species frequently recorded in these areas include *Tribulus terrestris, Acanthopsis hoffmannseggiana, Barleria rigida, Aristida congesta subsp. Congesta* and *Aizoon africanum.*

VU-B's habitat is considered natural with no signs of significant environmental disturbance. No SCCs were identified within this unit. Cryptic flora such as *Titanopsis calcarea* would likely occur in this unit; however, none was recorded during the survey. It is important to note that *T. calcarea* was recorded in Van Rensburg's (2022) wetland delineation report, albeit not within the Wonderpan solar facility's proposed footprint. Some individuals of *Hoodia gordonii* were recorded in this unit; however, the occurrence frequency of this species is much less compared to VU-A. The lower

recorded occurrence frequencies of this species is likely attributed to the small size of this unit.

A natural floral composition, no signs of habitat disturbance, the unique habitat type and occurrence of protected flora such as *Hoodia gordonii* and possibly *Titanopsis calcarea* support a **medium** unit sensitivity evaluation. The removal of provincially protected flora without a relevant permit is prohibited.

8.1.3. VU-C:

VU-C is the second-largest VU identified in the study area and stretches along the site's western and south-western boundaries (Figure 4). VU-C presents structural and upper vegetation stratal compositional similarities to VU-A but differs in herbaceous composition (Figure 8). This unit features recently deposited alluvial fine red soils supporting a well-developed shrub stratum and a relatively diverse herbaceous stratum. This area's recently deposited alluvial soils are likely attributed to the ephemeral stream and its associated floodplain (Van Rensburg, 2022). The ephemeral stream originates due to a low point in the topography and flows south to west along the site boundary, eventually joining the Karabeeloop approximately 4 km east of the site(Figure 4).

Figure 8 Ground view of the semi-closed shrubland with a well-developed herbaceous stratum. Note a similar shrub compositional dominance of *Senegalia mellifera* as found in VU-A. This view clearly illustrates the greater herbaceous component within this unit compared to VU-A.

The shrub stratum's composition is quite similar to VU-A and is primarily dominated by *Senegalia mellifera.* Other tall woody elements frequently recorded in this unit include *Boscia albitrunca, Rhigozum trichotomum* and *Lycium boscifolium*. The herbaceous stratum is dominated by Enneapogon chenceroides and *Aristida adscensionis*. Other herbs and forbs frequently recorded include *Eragrostis rotifer*, *Eragrostis lehmanniana, E. biflora, E. bicolor, E. trichophora, Fingeruthia africana, Panicum coloratum, Schmidtia kalahariensis, Stipagrostis ciliata, Aptosimum spinescens, A. lineare* and *Felicia muricata.*

VU-C featured little signs of significant habitat disturbance. Minor sources of disturbance are restricted to gravel roads running through the site. Few exotic species were recorded in this unit, and the overall composition and vegetation structure is considered natural.

A unique feature of this unit are the numerous observations of provincially protected plants such as *Ammocharis coranica, Nerine laticoma, Oxalis lawsonii, O. haedulipes, Drosanthemum hispidum,* and *Boscia albitrunca.*

A **medium** sensitivity evaluation is supported by VU-C's natural floral composition, little signs of significant habitat disturbance, adequate connectivity to other open spaces, high species richness of provincially protected flora, and its association with the mentioned ephemeral stream. The removal of protected species is prohibited without the acquisition of a relevant removal/relocation permit.

8.2. Transmission line:

The landscape through which the 13 km transmission line traverses between Camel Thorn and Wonderpan is slightly more irregular compared to the reasonably flat terrain of the Wonderpan solar facility. Refer to (Figure 9) for an aerial perspective of the area. Here, impacts on the receiving environment's floral elements are considered insignificant as habitat transformation is restricted to pole placement. Therefore, this section only provides a brief overview of the environment and only reports on sensitivities which are believed to be impacted by the proposed powerline layout.

The greater portion of the powerline layout traverses through Northern Upper Karoo associated vegetation (SANBI, 2006-2018). Little to no significant habitat disturbance was noted along the powerline's layout.

When considering the southern half of the powerline, the landscape strongly resembles the overall floral composition and structure of VU-A. This portion is characterised by a semi-closed shrubland with a particular dominance *of Senegalia mellifera*. The sub-shrub layer is also well developed and hosts various graminoids and forbs. Protected species that might occur within this section include *Hoodia gordoni, Boscia albitrunca, H. officinalis, Euphorbia fusca, Piaranthus cornutus, Nerine laticoma, Ammocaharis coranica,* and *Titanopsis calcarean* (restricted to calcareous-rich soils).

The landscape through which the northern half of the powerline traverses is distinctly different in both floral composition and vegetation structure compared to the southern half. Here, large portions of the landscape resemble an arid grassland irregularly flanked by either shallow calcareous supported dwarf-open shrublands to dense thickets of *Senegalia mellifera*. Several graminoid stands emerge along the transmission line's layout, each dominated by different graminoid and shrub associations. Graminoids frequently recorded along the line include *Stipagrostis ciliata, S. obtusa, S. uniplumis, E. rotifer, E. lehmanniana, Enneapogon chenceroides, E. desvauxi,* and *Aristida adscensionis.* No floral SCC were recorded along the transmission line. Protected species that may occur along this route include

(*Ammocharis coranica, Nerine laticoma, Boscia albitrunca, Moraea polystachya, Oxalis spp* (Appendix 3A), *Hoodia gordonii,* and *Titanopsis calcarean* (restricted to calcareous-rich habitats).

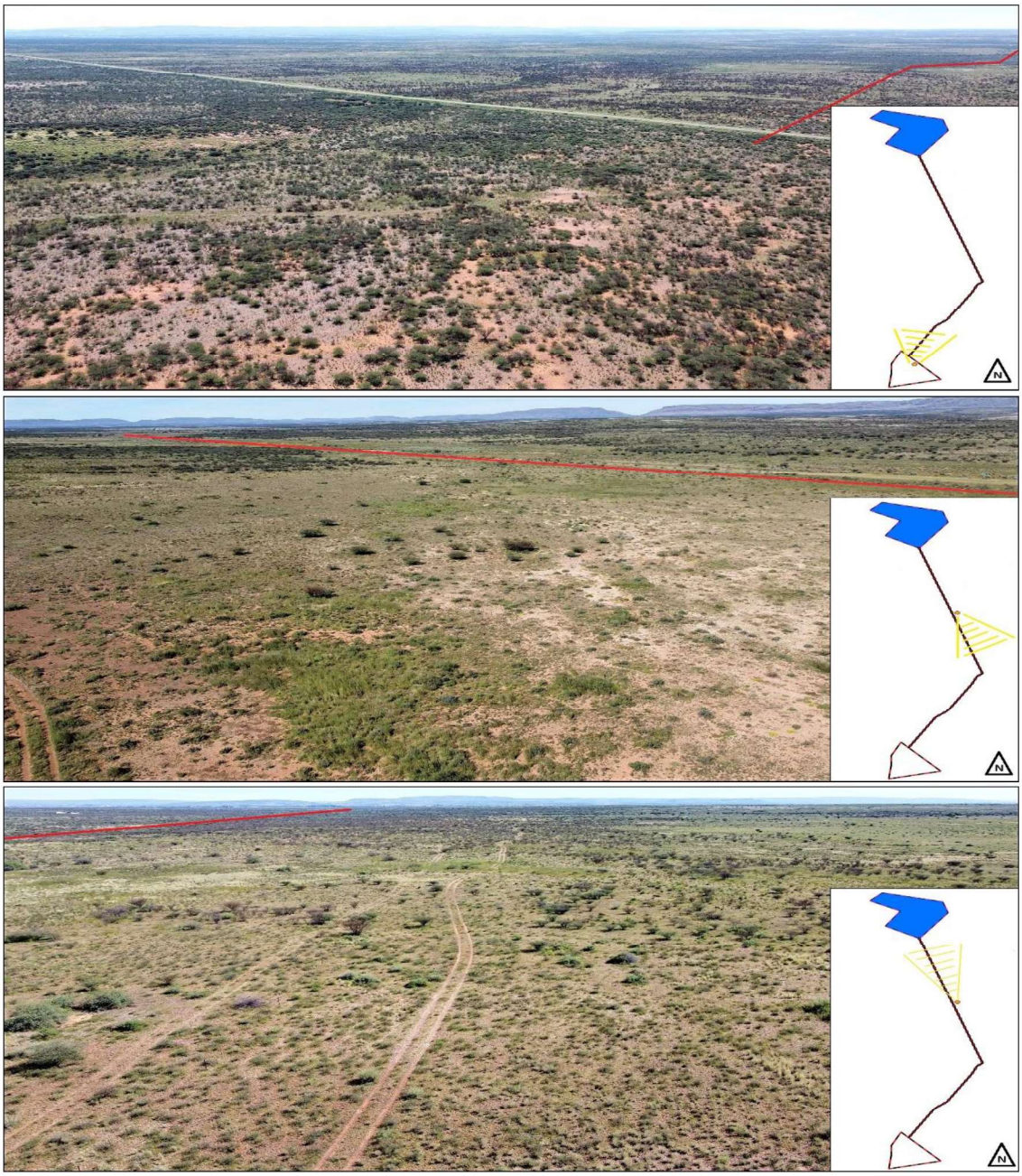

Figure 9 Aerial perspective of the landscape where the transmission line (red line) will be constructed. The small map on the right depicts the connection line between Camel Thorn and the Wonderpan solar facilities. The small map also depicts each perspective's point of capture (small orange dot) along with the estimated view angle (yellow triangle). The top perspective illustrates the landscape closer to the Wonderpan solar facility, while the middle and bottom perspectives illustrate the landscape roughly in the middle of the transmission line's layout.

8.3. Unit sensitivity:

A unit sensitivity evaluation for each delineated VU was performed and calculated by evaluating each unit to a set of criteria (Tables 1-12). These criteria attempt to objectively assign unit sensitivity and guide sustainable development. Unit sensitivity was calculated for the Wonderpan facility and not for the proposed transmission layout since the impacts generated by the transmission line are restricted to pole placement and therefore regarded as insignificant.

Table 13 Unit sensitivity evaluations for the three identified VUs.

Assessment criteria	Score (1-3)		
	VU-A	VU-B	VU-C
Rare, threatened and or protected flora	3	1	2
Ecological function	3	3	3
Conservation value	0	0	0
Biodiversity planning	2	2	2
Percentage ground cover	2	2	2
Vegetation structure and composition	2	2	2
Infestation of exotic and invasive plants	3	3	3
Impact of grazing/ browsing	2	2	2
Erosion	2	2	2
Connectivity	3	3	3
Rare and endangered species	1	1	1
Total score:	**23**	**21**	**22**
Sensitivity evaluation:	**Medium**	**Medium**	**Medium**

All three VUs featured natural vegetation with little signs of notable habitat disturbance. The natural habitats, intact ecological function, few recorded exotics, good connectivity to other open spaces, and the numerous recordings of provincially protected flora and one SCC contributed to a **medium** sensitivity rating. Development is acceptable within medium sensitive environments; however, mitigation measures should be strongly enforced.

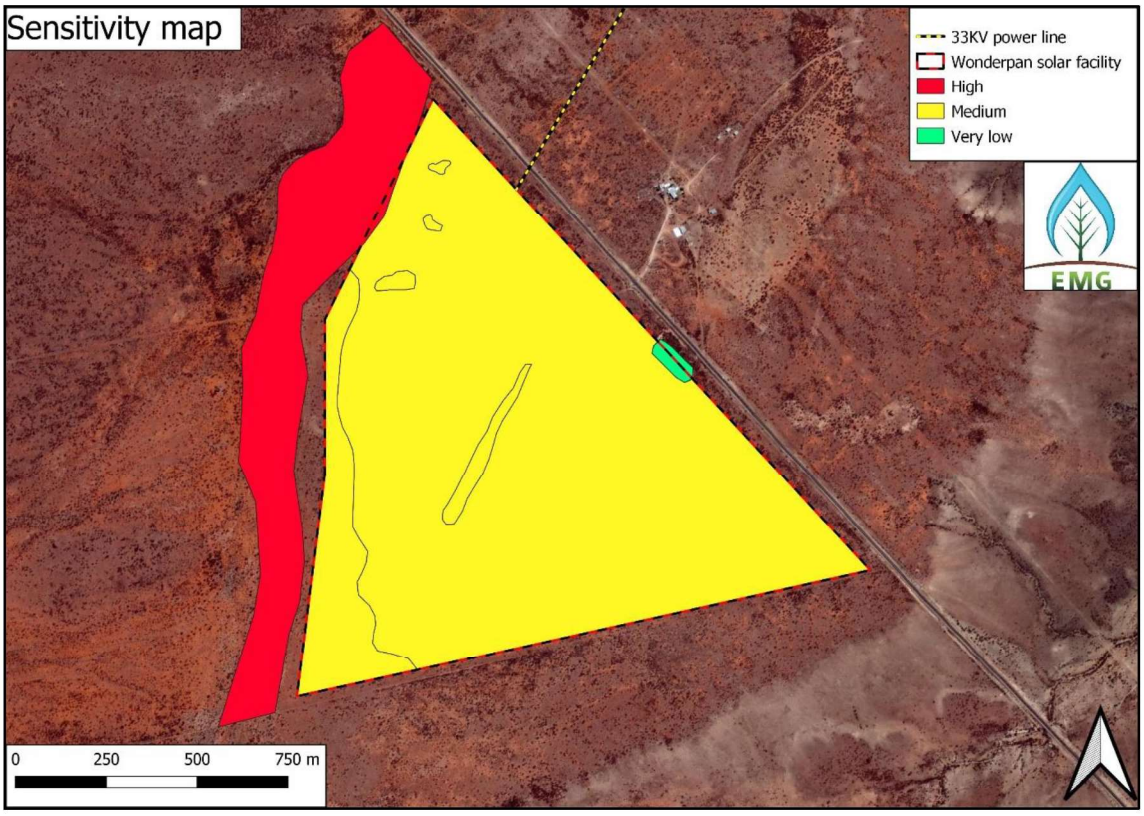

Figure 10 Map illustrating the Wonderpan solar facility's VU sensitivity. The old quarry situated on the northern boundary of the site is indicated as very low sensitivity. Details concerning the wetland stretching along the site's western boundary are discussed in Van Rensburg's (2022) wetland delineation report.

8.4. Floral survey discussion:

The receiving environment associated with the Wonderpan solar facility can be physiognomically described as a semi-closed shrubland with a well-developed herbaceous stratum. The shrub stratum is almost entirely dominated by *Senegalia mellifera*, which makes traversing the landscape particularly challenging. The site's specific floral composition and vegetation structure is not a good representation of the Bushmanland Arid Grassland in which it is mapped (SANBI, 2006-2018); rather, the overall shrubland associated vegetation features strong associations with the Northern Upper Karoo, which dominates the area immediately north of the site. The receiving environment featured little evidence of significant habitat transformation, and the vegetation is considered natural for the NKu 3.

The DFFE screening tool outlined the possible occurrence of two SCC (Table 14). During the survey, emphasis was placed on finding these species; however, none were recorded. Refer to (Table 14) for a brief rationale and probability of occurrence for each listed species.

Table 14 Plant species of special conservation concern as identified through the DFFE screening tool.

Species	Habitat requirements	Probability of occurrence

Tridentea virescens (rare[6])	Dwarf karroid shrubland, karroid shrubland and false grasslands. This species are often found in rocky soils, hard loam or in floddplains, and often grows beneath *Lycium spp.* or *Rhigozum trichotomum.*	This species was not recorded during the survey, even considering the survey taking place within its flowering season; regardless, a **medium** occurrence probability is assigned to this species due to the following aspects: • Vegetation structure and composition match the habitat in which this species is often recorded. • The receiving environment features little signs of significant habitat disturbance. • The species could have been missed due to the challenge of traversing dense thickets of *S. mellifera* and the large terrain that had to be surveyed.
Sensitive species 144	Prefers rocky shrublands, particularly situated on small to large hills. May also occur in arid grasslands, desert mountains and desert succulent thickets.	This species was not recorded during the field survey and considering the following aspects a low probabilty of occurrence is assigned. : • This species gets quite large and is easy to recognise.

The floral survey resulted in the identification of several provincially and nationally protected species (Table 15). Protected species identified by Van Rensburg (2022), and Götze and Kotze (2016) were also reviewed and indicated as possibly occurring in the area. No protected species may be harmed or removed without the acquisition of a relevant permit. It is strongly advised that a search and rescue operation for all SCC be considered prior to construction.

Table 15 Protected species located within the study area. Species following the green row were identified in relevant ecological investigations near the Wondepran solar site.

Familly	**Species**	**Red list status**	**Protection level**
Aizoaceae	*Trianthema triquetrum*	NE	NCNCA (2009), Schedule 2
Aizoaceae	*Aizoon africanum (Galenia africana)*	LC	NCNCA (2009), Schedule 2
Aizoaceae	*Drosanthemum hispidum*	LC	NCNCA (2009), Schedule 2

[6] Victor (2009) at http://redlist.sanbi.org/species.php?species=2667-24

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Aizoaceae	*Tetragonia arbuscula*	LC	NCNCA (2009), Schedule 2
Amaryllidaceae	*Ammocharis coranica*	LC	NCNCA (2009), Schedule 2
Amaryllidaceae	*Nerine laticoma*	LC	NCNCA (2009), Schedule 2
Apocynaceae	*Hoodia gordonii*	DD	NCNCA (2009), Schedule 1
Capparaceae	*Boscia albitrunca*	LC	NCNCA (2009), Schedule 2 NFA (1998)
Euphorbiaceae	*Euphorbia mauritanica*	LC	NCNCA (2009), Schedule 2
Iridaceae	*Moraea polystachya*	LC	NCNCA (2009), Schedule 2
Oxalidaceae	*Oxalis haedulipes*	LC	NCNCA (2009), Schedule 2
Oxalidaceae	*Oxalis lawsonii*	LC	NCNCA (2009), Schedule 2
Oxalidaceae	*Oxalis obliquifolia*	LC	NCNCA (2009), Schedule 2
Asphodelaceae	*Aloe claviflora*	LC	NCNCA (2009), Schedule 2
Asphodelaceae	*Bulbine cf. abyssinica*	LC	NCNCA (2009), Schedule 2
Protected species identified by Van Rensburg (2022), and Götze and Kotze (2016)			
Euphorbiaceae	*Euphorbia fusca*	LC	NCNCA (2009), Schedule 2
Apocynaceae	*Hoodia officinalis*	NT	NCNCA (2009), Schedule 2
Aizoaceae	*Titanopsis calcarea*	LC	NCNCA (2009), Schedule 2
Asphodelaceae	*Aloe claviflora*	LC	NCNCA (2009), Schedule 2
Aizoaceae	*Mesembryanthemum junceum*	LC	NCNCA (2009), Schedule 2

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