

Part 2 Environmental Authorisation amendment application for the

75 MW Humansrus Photovoltaic (PV) 1 Solar Power Facility (referred to as Lesedi Power Company), Northern Cape

Terrestrial vegetation investigation

Date: January 2023

Report drafted on behalf of

EARTHnSKY
environmental



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- Has been working with plants indigenous to South Africa since 1997.

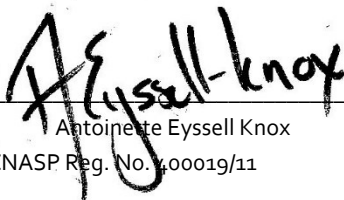
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Based on information provided to Dimela Eco Consulting by the client, and in addition to information obtained during this study, Dimela Eco Consulting present the results and conclusion within the associated document to the best of the authors professional judgement and in accordance with best practise.


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SACNASP Reg. No. 400019/11

_____ 2023.02.26 _____
Date

EXECUTIVE SUMMARY

The 75 MW Humansrus Photovoltaic (PV) 1 Solar Power Facility (referred to as Lesedi Power Company) was granted an Environmental Authorisation on 23 February 2012 (DEA Reference:12/12/20/1903/1). However, a Part 2 EA amendment is sought to change the holder of the Environmental Authorisation to Oakleaf Investment Holdings 79 (RF) (Pty) Ltd, as well as to include several infrastructure localities that were changed, added, or amended from the existing EA.

Dimela Eco Consulting was appointed by EarthnSky Environmental to verify the state of the vegetation that was impacted on (or are still impacted on) by the amended infrastructure as follows:

1. The locality of the overburden stockpile.
2. The locality of the substation and O&M Warehouse and offices.
3. The construction of 22kV powerlines (about 530m long) between the northern solar field and the substation. The overhead powerline crosses the existing railway line and the D3381 road, instead of an underground cable approved by the original EA.

As part of the original EIA, the vegetation within the proposed development footprint was assessed in the year 2011 (du Preez, 2011). Vegetation input is now required to ascertain any impacts that could have taken place / or can still take place due to the addition of the overburden stockpile, changed locality of the substation and O&M Warehouse and offices, as well as the construction of the overhead powerlines instead of an underground cable.

The following information pertaining to the site is relevant as detailed by the National Web based Environmental Screening Tool downloaded on the 21/11/2022:

- The site is classified as 'low terrestrial biodiversity sensitivity'
- The site is also classified as "low for sensitive plant species"

The 75 MW Humansrus Photovoltaic (PV) 1 Solar Power Facility is situated on the farm Remainder of Farm 469, Hay Rd. The areas investigated are situated about 3km south of the R358 road between Owendale in the east and the town of Postmansburg in the west (Northern Cape). The solar facility comprises a southern and northern solar field, separated by a railway line and the D3381 ribbon development. The overburden stockpile and the substation are near the fenced southern solar field, while the O&M Warehouse and offices are situated within the development footprint of the southern solar field. The powerline connects the northern solar field with the substation.

The terms of reference were as follows:

- Supply background information on the site relating to conservation plans and threatened ecosystems;
- Review the historical vegetation report that was submitted as part of the Environmental Impact Assessment for which the Environmental Authorisation was granted on 23 February 2012 (du Preez, 2011).
- Short field survey to assess the state of the vegetation on and directly adjacent to the overburden, substation and along the powerline;
- Report on any impacts that took place/ are taking place/ or could take place due to the activities and include recommendations to limit or negate such impacts.

The site visit was undertaken on the 24th of January 2023 and was preceded by good rains. The site verification focussed on assessing the vegetation around the infrastructure and comparing it with that described in the historical report and existing literature. The current vegetation on the overburden stockpile, around the substation and underneath the powerlines were also noted.

The table below shortly summarises the background info to the site.

Province	Northern Cape
Quarter Degree Grid Square	2823AD
Protected areas:	None in proximity to the site.
Topography and Hydrology	<p>The overburden stockpile is situated at an elevation of about 1529m, while the substation is lower at about 1507m. The powerlines traverse the Groenwaterspruit adjacent to the northern solar field at an elevation of 1500m.</p> <p>A non-perennial stream flows from the southern extent of the site northwards to the Groenwaterspruit. The non-perennial river flows more than 200m north of the overburden stockpile and about 55m west of the substation. The substation is located outside of the 1:100 year floodline, as confirmed through an Aquatic Assessment and Floodline Determination done by Knight Piésold in June 2018.</p>
Strategic Water Source Areas (SWSA)	The site falls within the Southern Ghaap Plateau ground water recharge zone.
Northern Cape Critical Biodiversity Areas (CBA) Map:	The study area falls within 'Other Natural Areas'. Such areas have not been identified as a priority for conservation in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.
Vegetation	The study site is situated within the Savanna biome of South Africa and in the Eastern Kalahari Bushveld bioregion. The Savanna biome is characterised by a grassy ground layer and a distinct upper layer of woody plants (Mucina & Rutherford, 2006). The Eastern Kalahari Bioregion comprises several vegetation types that is characterised by plant species composition, soil, topography and the climatic conditions in which it occurs. The site is situated within the Olifantshoek Plains

	Thornveld vegetation type. This vegetation occurs on plains and consist of open tree and shrub layers with trees such as <i>Vachellia luderitzii</i> , <i>Boscia albitrunca</i> (Shepherd's tree), <i>Searsia tenuinervis</i> and a usually sparse grass layer.
Listed- and Threatened ecosystems:	According to the 2022 Revised National List of Threatened Terrestrial Ecosystems, the Olifantshoek Plains Thornveld is of Least Concern (Government Gazette 47526, Government Notice 2747, 18 November 2022)
Ecological drivers and processes in savanna	Summer rainfall coupled with winter fire and regular grazing ensures that the grass layer remains dominant in the bushveld. In addition, the lack of sufficient rainfall prevents the upper layer (trees) from dominating. However, where disturbances and development are present, the tree layer could become increasingly dominant. Also, increased moisture, as well as soil disturbances will result in a densification of the tree layer, particularly in the presence of grazing, in the absence of fire and around frequently used areas.

The vegetation on the stockpile consisted mainly of pioneer- and hardy indigenous species, naturally occurring in the area. The stockpile vegetation is stable and although some invasive species were recorded, the vegetation is in a semi-natural state and in a fair ecological condition (ecological function is maintained even though composition and structure have been compromised). The surrounding vegetation served as a seedbank to vegetate the stockpile and although the diversity on the stockpile is lower, the vegetation can be considered like the surrounding vegetation. No protected tree or other protected plant species were recorded in the walked transects around or on the stockpile, which makes it unlikely that the stockpile impacted on such species.

Two vegetation groups were recorded around the substation. To the west, the vegetation along the non-perennial stream included a tree layer dominated by *Searsia lancea*. The substation construction did not directly impact on this vegetation. The original locality was wedged between the solar field in the west and this stream in the east and could have had an impact on the stream as it would have been closer to it. It is therefore thought that the current locality might have reduced perceived impacts to the *Searsia lancea* vegetation along the non-perennial stream.

The vegetation to the north, east and south of the substation comprised an open grassland with small karroid shrubs and forbs. No protected tree or other protected plant species were recorded in the walked transects around the substation, which makes it unlikely that the construction of the substation impacted on such species.

Two vegetation groups were recorded around the powerlines. Most of the vegetation comprised grassland with karroid shrubs that also surrounds much of the substation. However, compaction along the line, particularly close the substation, has diminished the species diversity. The area is also grazed and includes a water point for cattle. The northern extent of the powerline, within the northern solar field, traversed a portion of the Groenwaterspruit, dominated by *Pentzia globosa*. This area was historically impacted on by intense grazing.

The vegetation along the powerline displays a lower species diversity than the surrounding vegetation; however, if the underground cable was trenched in, this vegetation would comprise a secondary state on disturbed soils. The vegetation is in a semi-natural and fair ecological condition with limited impacts noted other than compaction and alien invasive plant species.

This assessment found that the amended infrastructure did not have a significant negative impact on surrounding vegetation. Edge effects were limited, and current impacts can be mitigated. The historic ecological report of 2011 also did not observe extensive areas of floral sensitivity and habitat diversity, species richness and uniqueness of the vegetation was classified as low. The 2011 report concluded that the proposed development would have a medium local impact on the plant communities on-site and was not regarded as a significant threat to the status and presence of these species as they occur abundantly in the general area.

This assessment, as well as the 2011 ecological assessment (du Preez, 2011), thus concurs with the screening tool report for the site in that the vegetation and plant species sensitivity are low. However, impacts to the surrounding vegetation must be limited and alien invasive plant species must be controlled for the duration of the operation phase.

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1 INTRODUCTION

The 75 MW Humansrus Photovoltaic (PV) 1 Solar Power Facility (referred to as Lesedi Power Company) was granted an Environmental Authorisation on 23 February 2012 (DEA Reference: 12/12/20/1903/1). However, a Part 2 EA amendment is sought to change the holder of the Environmental Authorisation to Oakleaf Investment Holdings 79 (RF) (Pty) Ltd, as well as to include several infrastructure localities that were changed, added, or amended from the existing EA.

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As part of the original EA, the vegetation within the proposed development footprint was assessed in the year 2011 (du Preez, 2011). Vegetation input is now required to ascertain any impacts that could have taken place / or can still take place due to the addition of the overburden stockpile, changed locality of the substation, as well as the construction of the overhead powerlines instead of an underground cable.

The following information pertaining to the site is relevant as detailed by the National Web based Environmental Screening Tool downloaded on the 21/11/2022:

- The site is classified as 'low terrestrial biodiversity sensitivity'
- The site is also classified as "low for sensitive plant species"

1.1 Project background and locality

The 75 MW Humansrus Photovoltaic (PV) 1 Solar Power Facility is situated on the farm Remainder of Farm 469, Hay Rd (Figure 1). The areas investigated are situated about 3km south of the R358 road between Owendale in the east and the town of Postmansburg in the west (Northern Cape).

The solar facility comprises a southern and northern solar field, separated by a railway line and the D3381 regional road. The overburden stockpile and the substation are situated adjacent to the southern solar field and the overhead powerline connects the northern solar field with the substation adjacent to the southern solar field (Figure 2). The site falls within the quarter degree square 2823AD.

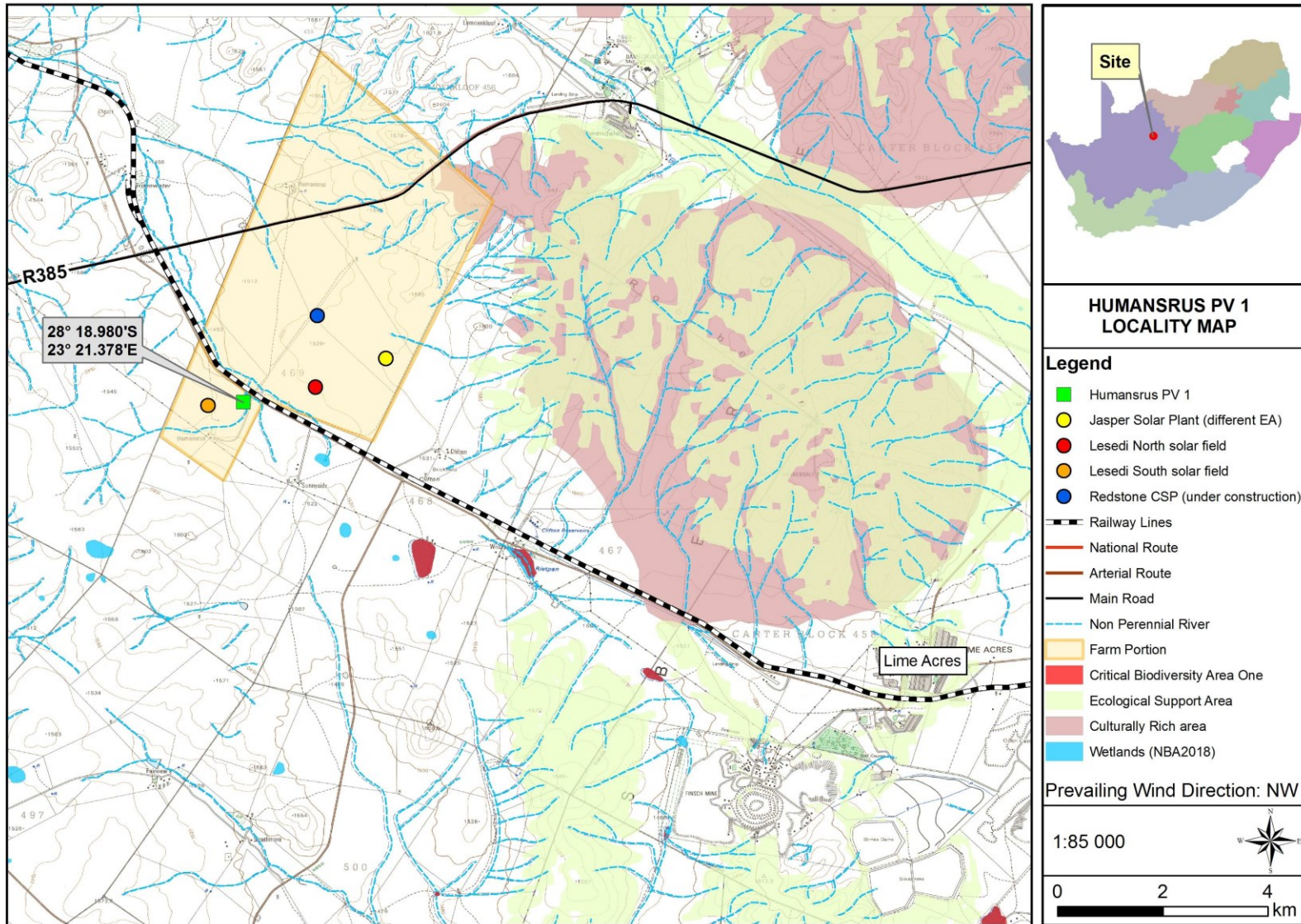


Figure 1: Locality map

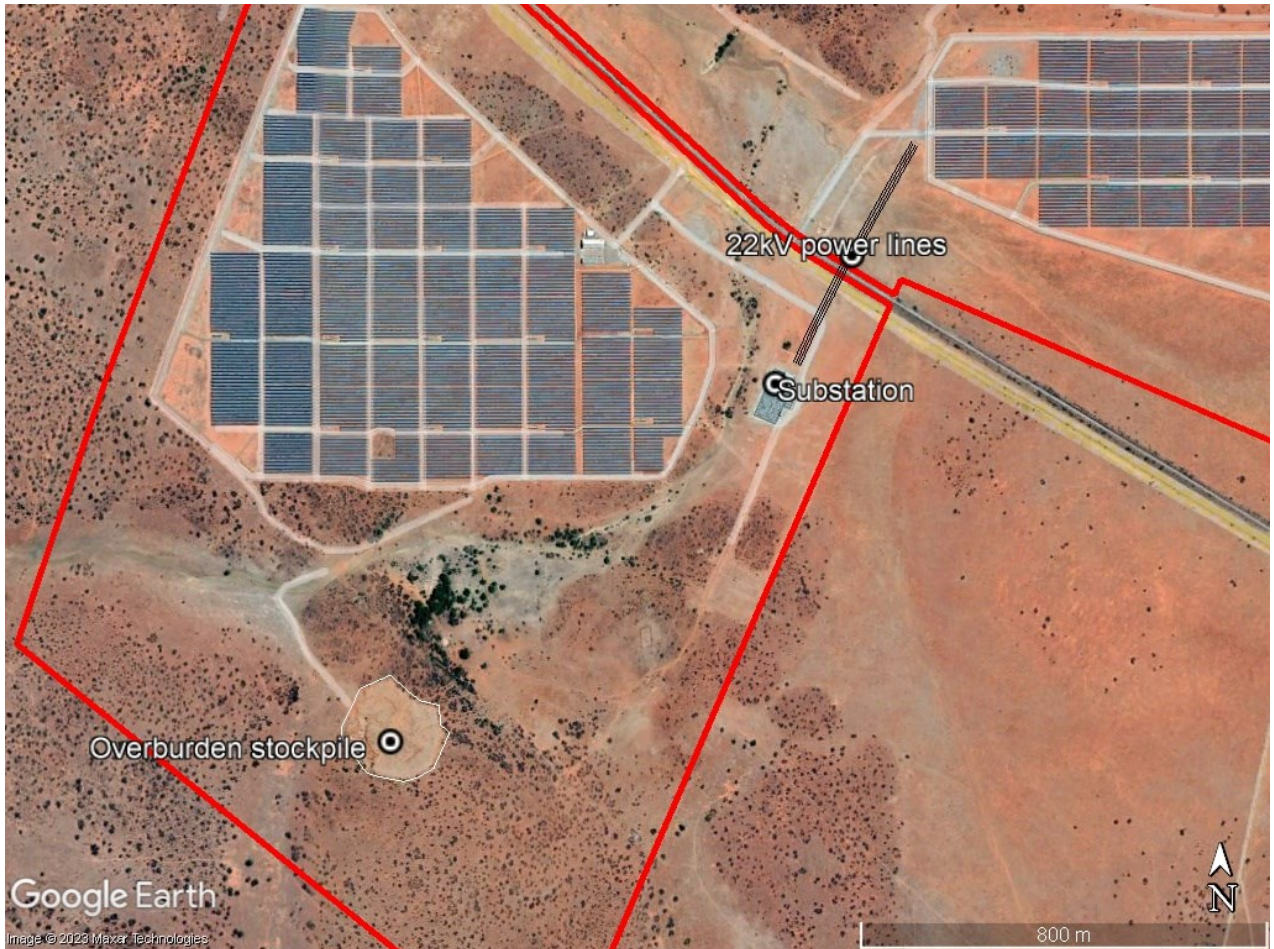


Figure 2: Google Earth image dated 23 March 2019. The areas assessed in this report is indicated on the image

1.2 Terms of reference

Complete a high-level terrestrial vegetation verification, including:

- Supply background information on the site relating to conservation plans and threatened ecosystems;
- Review the historical vegetation report that was submitted as part of the Environmental Impact Assessment for which an Environmental Authorisation was granted on 23 February 2012 (du Preez, 2011).
- Short field survey to assess the state of the vegetation on and directly adjacent to the overburden, substation and along the powerline;
- Report on any impacts that took place/ are taking place/ or could take place due to the activities and include recommendations to limit or negate such impacts.

1.3 Assumptions and limitations

The following limitations are applicable:

- Vegetation studies should be conducted during the growing season of all plant species that may potentially occur. This may require more than one season's survey with two visits undertaken

preferably during November and February. However, this assessment formed part of a high-level assessment and a single site verification visit was undertaken on the 24th of January 2023.

- Several species were not in flower, which hampered positive identification to species level.
- The historical ecological report reviewed as part of this assessment, did not include a vegetation- and sensitivity map, or a comprehensive species list. Vegetation along the powerline and substation could not readily be compared to the 2011 report (du Preez, 2011).

2 METHODOLOGY

The methodology used is shortly summarised below.

2.1 Literature and data review

Data and literature consulted include:

- The Northern Cape Critical Biodiversity Areas (CBA) Map.
- Information on plant species recorded for the Quarter Degree Square (QDS) that the site is situated in was extracted from the Botanical Database of Southern Africa hosted by SANBI on the new Plants of Southern Africa website (<https://posa.sanbi.org>). Additional info was sourced from Citizen Science websites such as iNaturalist.org.
- A short list of plant species of conservation concern was derived from the above and the Threatened Species Programme, Red List of South African Plants (Red List of South African plants version 2020 (<http://redlist.sanbi.org/>)).
- The Revised National List of Threatened Terrestrial Ecosystems, 2022 (Government Gazette 47526, Government Notice 2747, 18 November 2022)
- Historical aerial imagery downloaded from Chief Directorate: National Geospatial Information Geospatial Portal (<http://www.cdngiportal.co.za/cdngiportal>) and / or Google Earth.
- Citizen Science Website: iNaturalist.org

An historical vegetation report that submitted as part of the Environmental Impact Assessment for which the Environmental Authorisation was granted on 23 February 2012 (du Preez, 2011) was also assessed. This informed the baseline vegetation prior to the construction of the solar facility.

2.2 Site verification

The site visit was undertaken on the 24th of January 2023 and was preceded by good rains. The site verification focussed on assessing the vegetation around the infrastructure and comparing it with that described in the historical report and Mucina and Rutherford (2006). The current vegetation on the overburden stockpile, around the substation and underneath the powerlines were also noted. A map of the walked track and sampling areas is attached in Appendix A.

2.3 Vegetation / Ecological Condition

Standardised definitions, as recommended by Lexicon for Biodiversity Planning in South Africa by the South African National Biodiversity Institute (SANBI) were used to describe the state of vegetation and ecological condition (SANBI, 2016). The condition of the vegetation followed the following definitions:

Natural or near natural:	An ecological condition class in which composition, structure and function are still intact or largely intact. Can apply to a site or an ecosystem (good ecological condition). Usually of high sensitivity to development.
Semi-natural or moderately modified	An ecological condition class in which ecological function is maintained even though composition and structure have been compromised (Fair ecological condition). Usually of medium sensitivity to development
Severely or irreversibly modified	An ecological condition class in which ecological function has been compromised in addition to structure and composition. Can apply to a site or an ecosystem (Poor ecological condition). Usually of a low sensitivity to development.
<hr/>	
Good ecological condition:	An ecological condition class in which composition, structure and function are still intact or largely intact. Can apply to a site or an ecosystem. (Natural or near natural). Usually of high sensitivity to development.
Fair ecological condition	An ecological condition class in which ecological function is maintained even though composition and structure have been compromised (Moderately modified, semi-natural). Usually of medium sensitivity to development.
Poor ecological condition	An ecological condition class in which ecological function has been compromised in addition to structure and composition. Can apply to a site or an ecosystem (Severely or irreversibly modified). Usually of a low sensitivity to development.

3 BASELINE DESCRIPTION OF THE SITE

The table below shortly summarises the background info to the site.

Table 1: Background information to the site

Province	Northern Cape
Quarter Degree Grid Square	2823AD
Protected areas:	None in proximity to the site.
Topography and Hydrology (Figure 3):	<p>The overburden stockpile is situated at an elevation of about 1529m, while the substation is lower at about 1507m. The powerlines traverse the Groenwaterspruit adjacent to the northern solar field at an elevation of 1500m.</p> <p>A non-perennial stream flows from the southern extent of the site northwards to the Groenwaterspruit. The non-perennial river flows more than 200m north of the overburden stockpile and about 55m west of the substation. The substation is located outside of the 1:100 year floodline, as confirmed through an Aquatic Assessment and Floodline Determination done by Knight Piésold in June 2018.</p>
Strategic Water Source Areas (SWSA)	The site falls within the Southern Ghaap Plateau ground water recharge zone.
Northern Cape Critical Biodiversity Areas (CBA) Map: (Figure 4)	The study area falls within 'Other Natural Areas'. Such areas have not been identified as a priority for conservation in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.
Vegetation (Mucina and Rutherford, 2006; Skowno, 2019): (Figure 5)	The study site is situated within the Savanna biome of South Africa and in the Eastern Kalahari Bushveld bioregion. The Savanna biome is characterised by a grassy ground layer and a distinct upper layer of woody plants (Mucina & Rutherford, 2006). The Eastern Kalahari Bioregion comprises several vegetation types that is characterised by plant species composition, soil, topography and the climatic conditions in which it occurs. The site is situated within the Olifantshoek Plains Thornveld vegetation type. This vegetation occurs on plains and consist of open tree and shrub layers with trees such as <i>Vachellia luderitzii</i> , <i>Boscia albitrunca</i> (Shepherd's tree), <i>Searsia tenuinervis</i> and a usually sparse grass layer.
Listed- and Threatened ecosystems:	According to the 2022 Revised National List of Threatened Terrestrial Ecosystems, the Olifantshoek Plains Thornveld is of Least Concern (Government Gazette 47526, Government Notice 2747, 18 November 2022)
Ecological drivers and processes in savanna	Summer rainfall coupled with winter fire and regular grazing ensures that the grass layer remains dominant in the bushveld. In addition, the lack of sufficient rainfall prevents the upper layer (trees) from dominating. However, where disturbances and development are present, the tree layer could become increasingly dominant. Also, increased moisture, as well as soil disturbances will result in a densification of the tree layer, particularly in the presence of grazing, in the absence of fire and around frequently used areas.

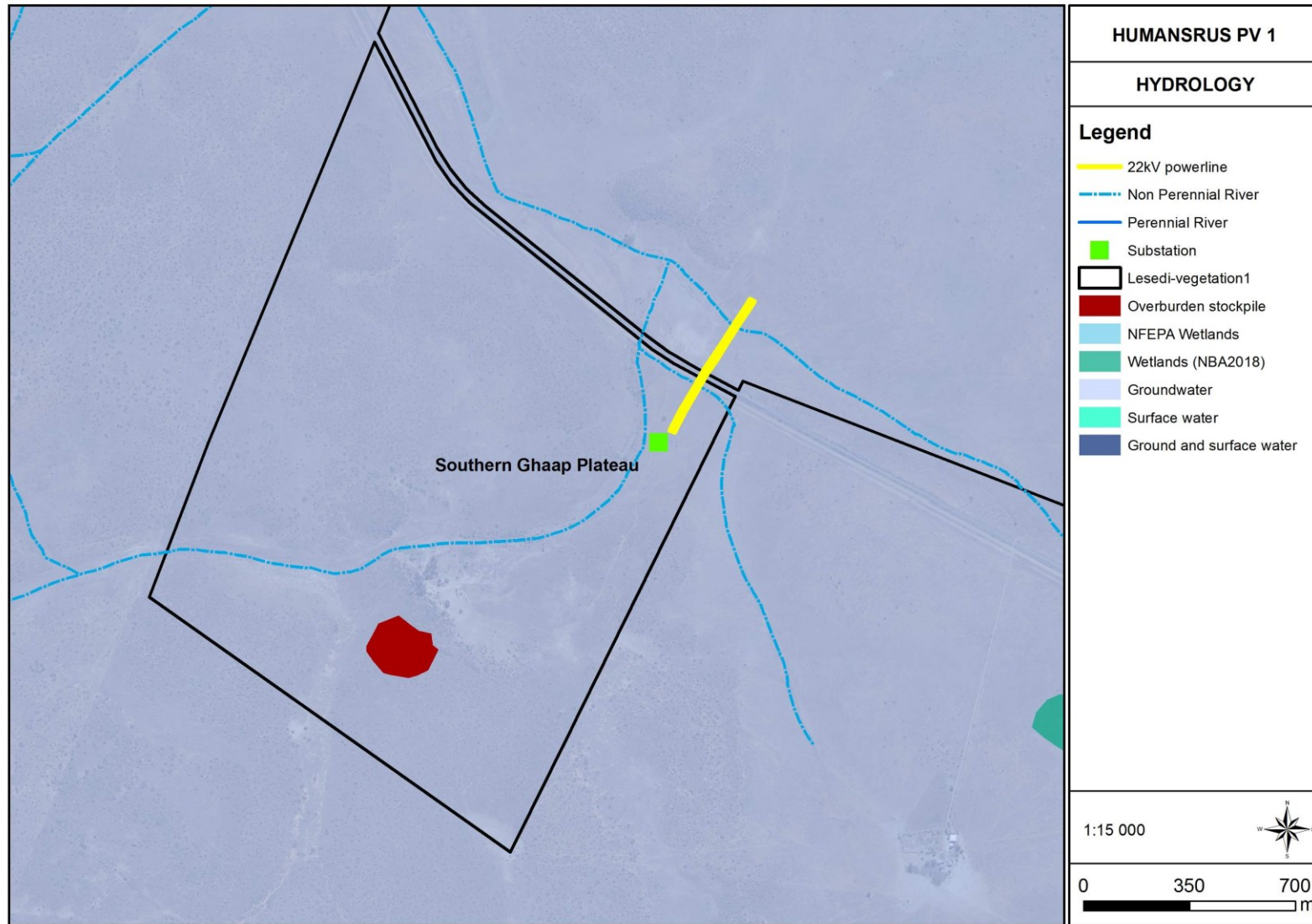


Figure 3: Hydrology of the site and surrounds as per existing spatial layers

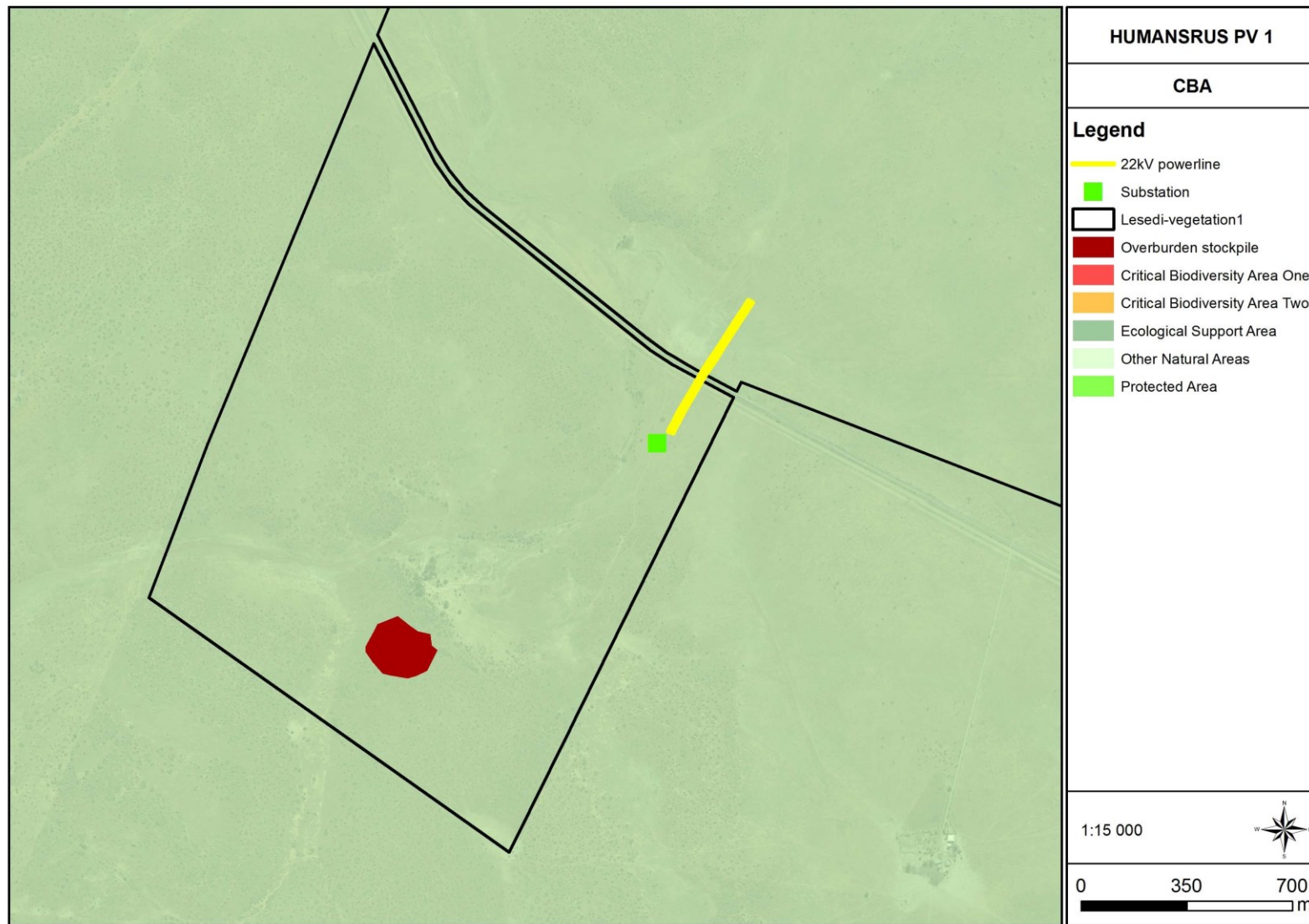


Figure 4: The site in relation to the Northern Cape Critical Biodiversity Areas

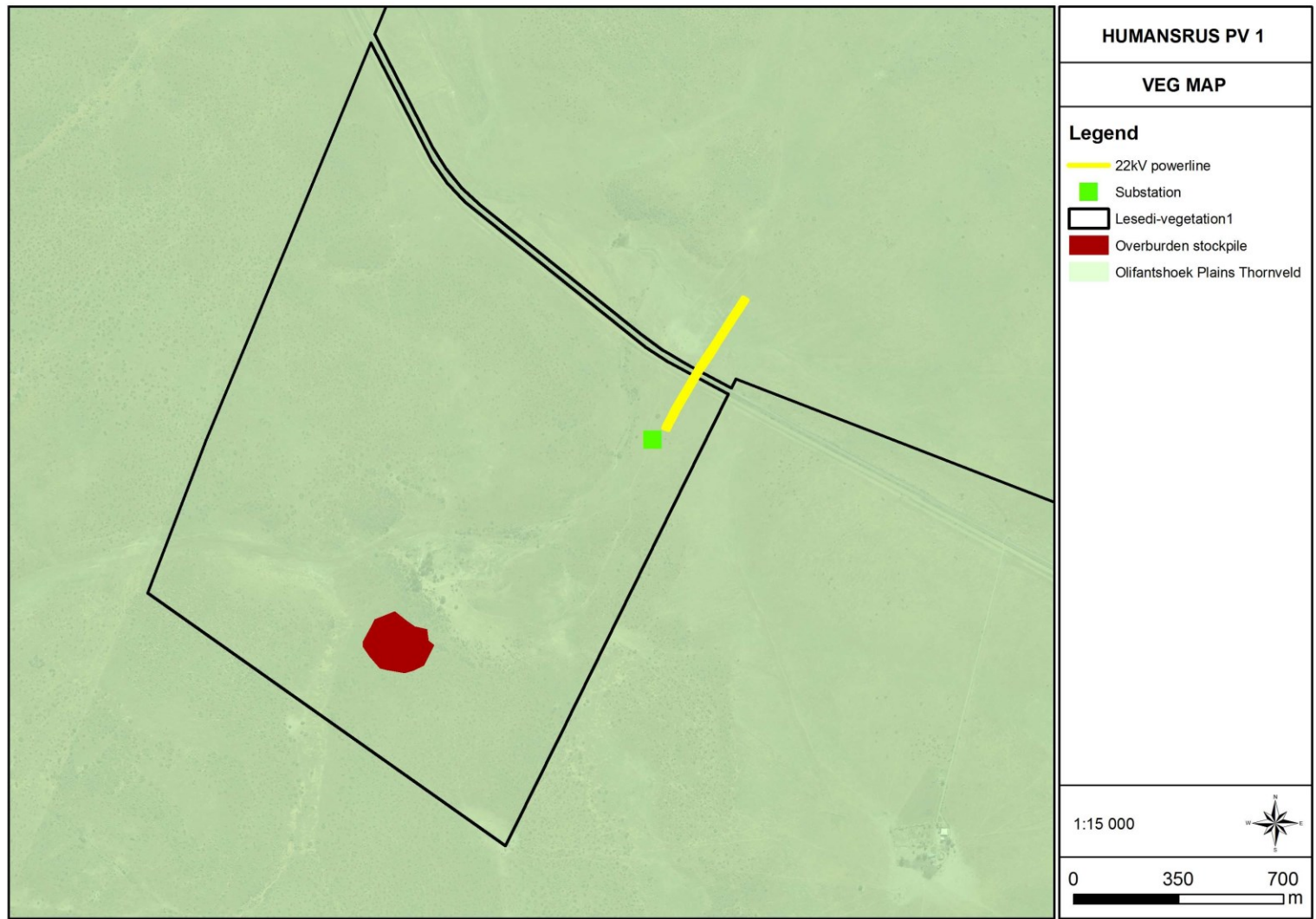


Figure 5: The site is within the Olifantshoek Plains Thornveld

4 FINDINGS OF HISTORICAL VEGETATION REPORT

4.1 General vegetation

An ecological report for the northern and southern solar field development was undertaken in the year 2011 (du Preez, 2011). This report observed that the vegetation in general was relatively homogenous, however on a local scale a mosaic of smaller vegetation units did occur. Three (3) vegetation communities were identified as follows:

1. Areas Impacted by Anthropogenic Influences (Disturbed Areas)
2. Shrub Community on Sandy Soils.
3. Shrub community on Rocky Outcrops.

4.2 Protected and threatened plant species

Two (2) national protected trees were recorded, namely *Acacia erioloba* (camel thorn) and *Boscia albitrunca* (Shepard's tree). One (1) provincially protected species, *Pachypodium succulentum*, was also recorded.

4.3 Conclusion

No extensive areas of floral sensitivity were observed. Provincially protected species are present but in relatively low numbers on site and they also occur elsewhere. Habitat diversity, species richness and uniqueness of the vegetation was classified as low. The report concluded that the proposed development would have a medium local impact on the plant communities on-site and was not regarded as a significant threat to the status and presence of these species as they occur abundantly in the general area.

5 FINDINGS OF THIS REPORT

5.1 Land cover and land use

Historical Google Earth Satellite imagery of the year 2005 shows that the vegetation was largely in a natural state prior to the construction of the solar facilities site (Figure 6). This is further supported by the historical ecological report (du Preez, 2011). The Google Earth image taken in the year 2016, post construction, shows that the disturbances are contained, and seemingly limited edge effects took place. The 2005 image shows that a tree-shrub layer is absent from the Substation and powerline localities, prior to construction.

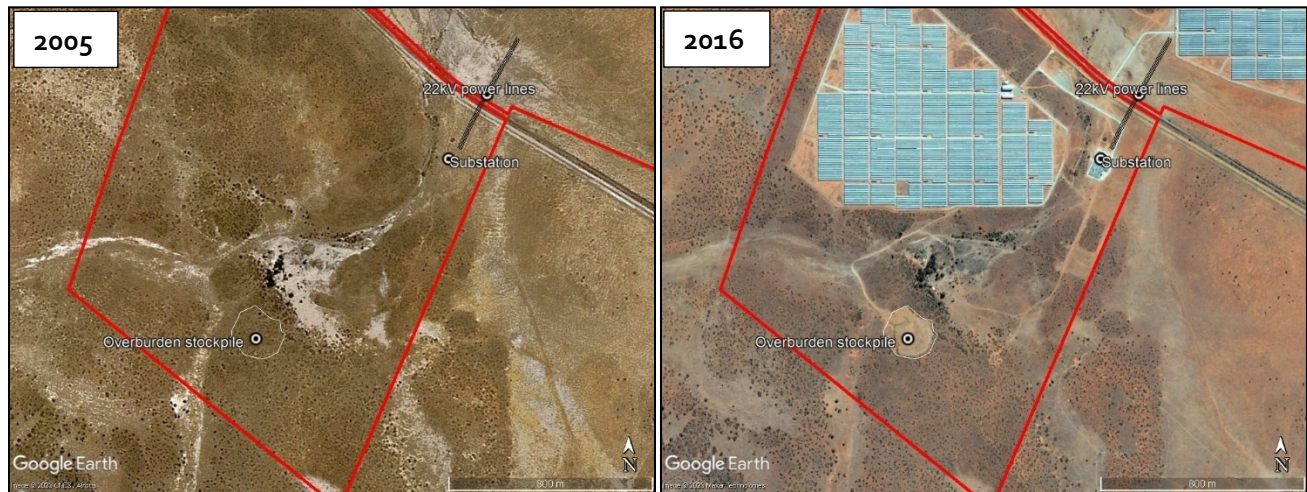


Figure 6: Historical Google Earth satellite images of the year 2005 prior to construction of the PV facility (left) and in the year 2016, after the construction (right)

5.2 Vegetation groups

The vegetation observed at the infrastructure are shortly discussed below and mapped to a 50m buffer around the infrastructure in Figure 7. Plant species recorded at each area is listed in Appendix B.

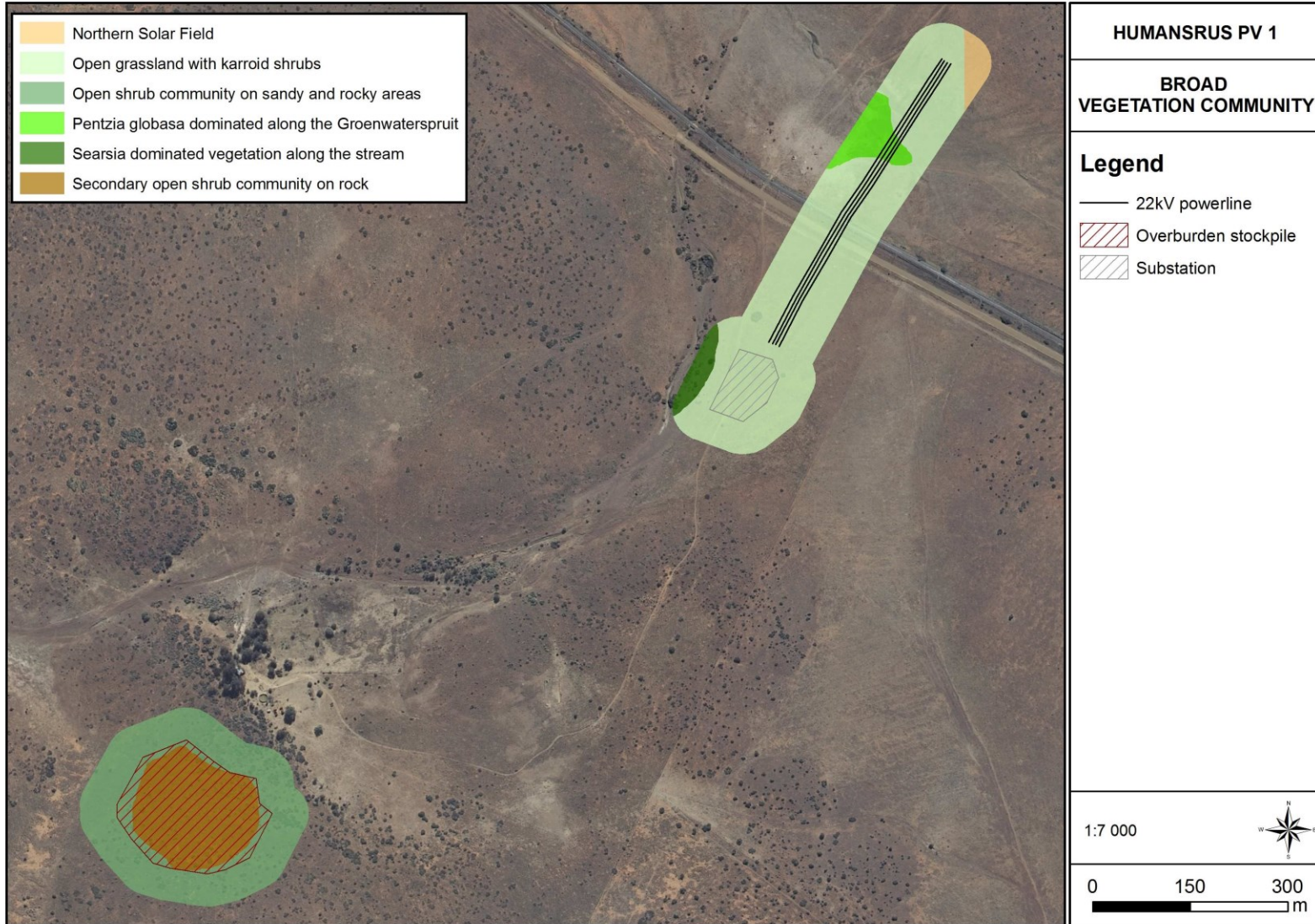


Figure 7: Vegetation groups on and around the infrastructure

5.2.1 Overburden stockpile

5.2.1.1 *Open shrub community on rocky areas*

The overburden stockpile covers a circular area of about 2.55ha in extent. The overburden is about 1.5m to 2.0m high and comprises mainly of rock and gravelly soils that was removed to level the soils for the solar panels (Photo plate 1). The stockpile was left to naturally revegetate. At the time of the site verification, cattle grazed on and around the stockpile area.

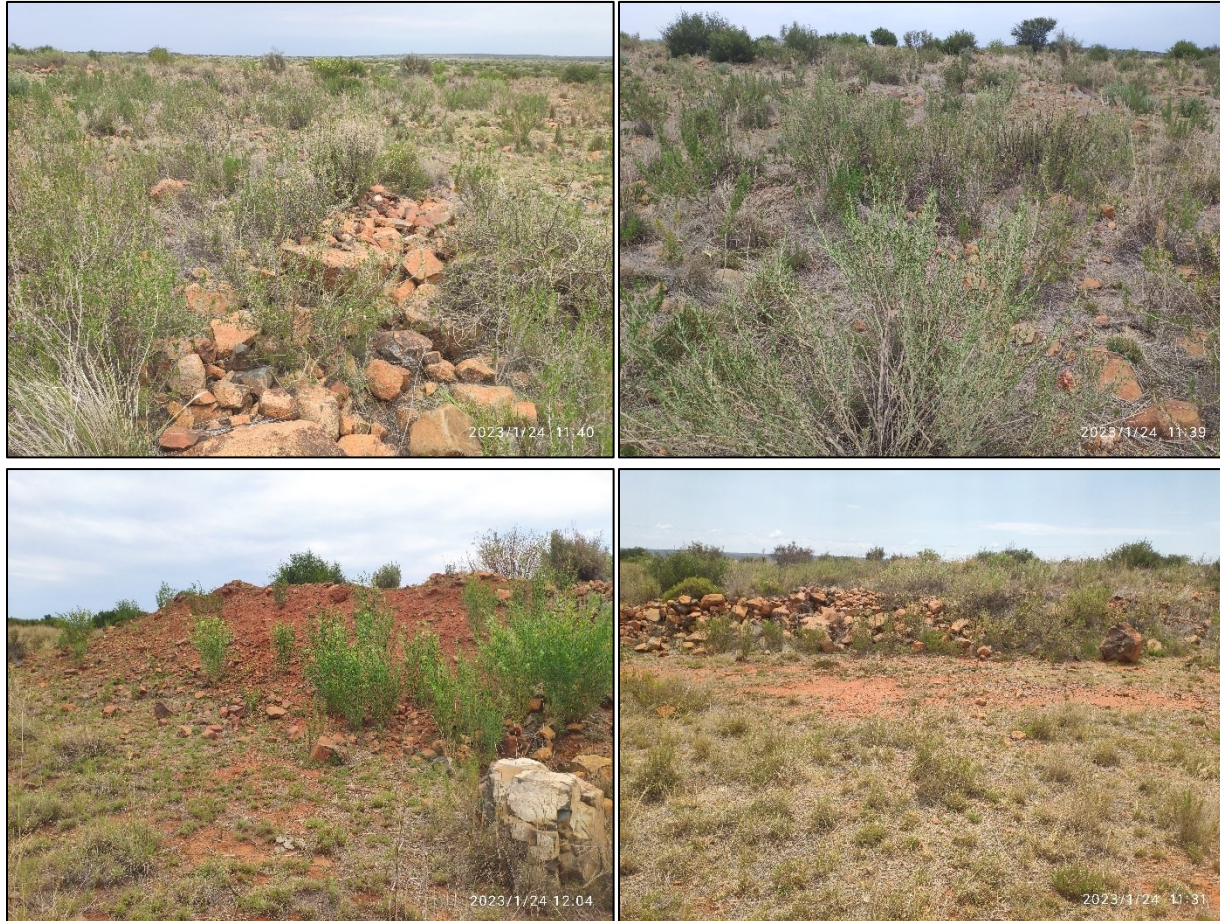


Photo plate 1: Vegetation on the stockpile (top images) and the stockpile as seen from the side (bottom images)

The vegetation on the stockpile consisted mainly of pioneer- and hardy indigenous species, naturally occurring in the area. The vegetation comprised an open shrubland dominated by *Searsia tridactyla* (sour karee), *Parkinsonia africana* (greenhair tree), *Gomphocarpus fruticosus* (milkweed) and the herb *Chrysocoma ciliata* (bitterbos) that often proliferates in overgrazed areas. Other trees recorded included *Vachellia karroo*, *Ziziphus mucronata* and *Ehretia rigida*. Common species included *Gazania krebsiana*, *Laggera decurrens* (silky sage) and *Hertia pallens* (springbokbossie) (Appendix B). The grass layer was grazed short, however species such as *Stipagrostis uniplumis* (silky bushman grass), *Cymbopogon excavates* (broad-leaved turpetine grass),

Cynodon dactylon (couch grass) and *Themeda triandra* (red grass) were recorded. No bulbous species were recorded.

The stockpile vegetation is stable and although some invasive species were recorded (i.e., *Argemone mexicana*, *Trichocereus spachianus* (torch cactus) and *Xanthium spinosum* (spiny cocklebur)), the vegetation is considered to be in a semi-natural state and in a fair ecological condition (ecological function is maintained even though composition and structure have been compromised).

5.2.1.2 Open shrub community on sand and rocky areas

The vegetation around the stockpile also comprised open bushveld, although larger trees and a higher diversity of forbs, including geophytes, were recorded (Photo plate 2). Shallow rocky areas are present, as well as deeper sands and the vegetation seems to be an ecotone between the Shrub Community on Sandy Soils and the Shrub Community on Rocky Outcrops as discussed by du Preez in the 2011 ecological report (du Preez, 2011). The tree layer included *Searsia lancea*, *S. tridactyla*, *Olea europea subsp africana* (wild olive), *Senegalia mellifera subsp detinens* (black thorn) and the shrubby *Tarchonathus camphoratus* (vaalbos). Shrubs and forbs included *Eriocephalus africanus*, *Barleria macrostegia*, *Geigeria filifolia* (vermeerbos), and the geophyte *Ledebouria leptophylla* (spotted squil).



Photo plate 2: Shrubland around the overburden stockpile

To the lower lying west of the stockpile, the tree layer became sparser, with *Searsia tridactyla* the dominant tree/shrub (Photo plate 3). Additional forb species recorded include a *Wahlenbergia* species, *Bulbine narcissifolia* (strap-leaved Bulbine), *Ipoemoa* cf *oenotheroides* species and *Thesium hystrix* (ystervarkbossie).



Photo plate 3: Open shrubland to the west of the overburden stockpile

No protected tree or other protected plant species were recorded in the walked transects around or on the stockpile, which makes it unlikely that the stockpile impacted on such species. The surrounding vegetation served as a seedbank to vegetate the stockpile and although the diversity on the stockpile is lower, the vegetation can be considered similar to the surrounding vegetation.

5.2.2 Substation

The substation is situated on a relatively flat area and directly east of the non perennial stream (Photo plate 4). No natural vegetation remains within about 3m adjacent to the substation (Photo plate 4, insert).



Photo plate 4: View of the substation, looking northwards, in a grass dominated landscape

5.2.2.1 *Searsia lancea* dominated vegetation along the dry non-perennial stream

The vegetation along the non-perennial stream west of the substation included a tree layer of *Searsia lancea*, *Olea europea* subsp *africana* (wild olive), *Ziziphus mucronata* (buffalo thorn), and the shrubs *Tarchonanthus camphoratus* and *Asparagus africanus* species (Photo plate 5). The substation construction did not directly impact on this vegetation. The original locality was wedged between the solar field in the west and this stream in the east and could have had an impact on the stream as it would have been closer to it.

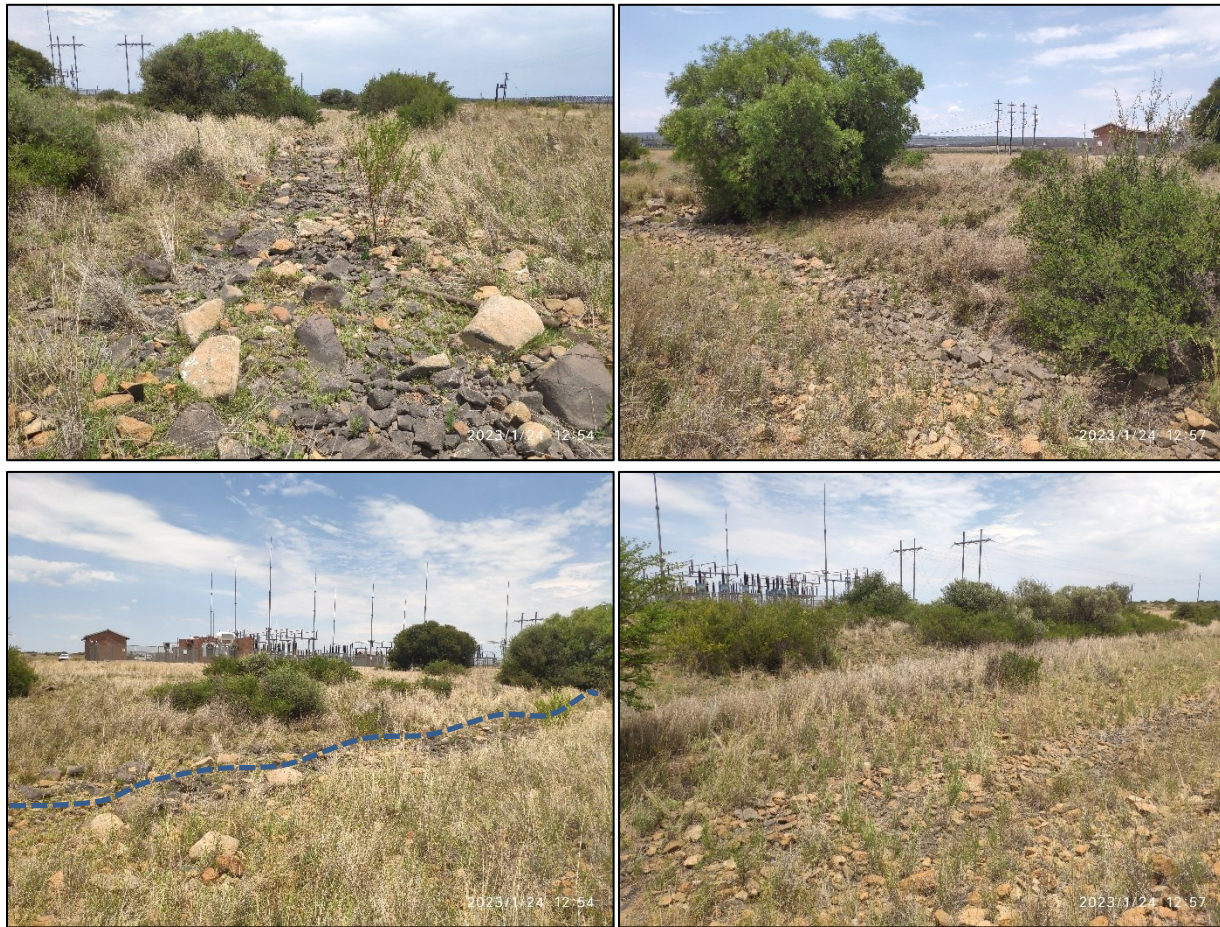


Photo plate 5: Rocky streambank of the non-perennial stream (top) and a view of the substation from west of the non-perennial stream (bottom)

5.2.2.2 *Open grassland vegetation with karroid shrubs*

The vegetation to the north, east and south of the substation comprised an open grassland, dominated by the grass *Themeda triandra* and small karroid shrubs and forbs such as *Lycium hirsutum*, *Eriocephalus africanus*, *Thesium cf hystrix*, *Melolobium candicans*, *Menodora africana* (balbossie), the succulent species *Ruschia*, and an abundance of *Chrysochoma ciliata* (Photo plate 6). Only one tree, *Searsia tridactyla*, occurred sporadically.



Photo plate 6: Open grassy vegetation around the substation

This vegetation is not quite comparable to any of the vegetation communities described by du Preez (2011), however, it was probably grouped into the Shrub Community on Sandy Soils. From the 2005 Google Earth satellite imagery in Figure 6, this vegetation was present at the substation site prior to construction. Edge effects from the substation construction had a limited impact on this vegetation.

No protected tree or other protected plant species were recorded in the walked transects around the substation, which makes it unlikely that the construction of the substation impacted on such species.

5.2.3 Powerlines

5.2.3.1 *Open grassland vegetation with karroid shrubs*

The vegetation along the southern extent of the powerlines (south of the railway) comprised open grassland (Photo plate 7). However, compaction along the line, particularly close the substation, has diminished the species diversity. The area is also grazed and includes a water point for cattle. The vegetation was impacted and displays a lower species diversity than the surrounding vegetation; however, if the underground cable was trenched in, this vegetation would comprise a secondary state on disturbed soils. The vegetation is in a semi-natural and fair ecological condition.



Photo plate 7: Vegetation under the southern extent of the powerlines

This vegetation extends north of the railway line into the northern solar field (Photo plate 8). The succulents *Bulbine narcissifolia* and a *Ruschia* species were noted, as well as the small *Nananthus cf aloides*. Other small shrubs and forbs included *Eriocephalus africanus* (kapokbos), *Selago densifolia*, and *Felicia muricata*. Overgrazed and compacted areas close to the cattle waterpoints included the spiny *Berkheya pinnatifida* and the invasive *Datura ferox* (thorn apple) (Photo plate 9).



Photo plate 8: Grassy vegetation underneath and to the east of the powerline in its northern extent



Photo plate 9: Compacted and grazed areas

5.2.3.2 *Pentzia globosa* dominated moist grassland

The northern extent of the powerline, within the northern solar field, traversed a portion of the Groenwaterspruit. It is likely that cattle congregate here and species such as *Pentzia globosa* (vaalkaroo), *Chrysochoma ciliata* and *Helichrysum cf cerastioides* proliferated in the moist areas, while the palatable grass layer was limited (Photo plate 10). The sedge *Scirpoides dioeca* was noted within the seasonally / temporary inundated areas.



Photo plate 10: Vegetation along the Groenwaterspruit. *Pentzia* is prominent in overgrazed areas

This vegetation is not comparable to any of the vegetation communities by du Preez (2011), however, it was probably grouped into the Shrub Community on Sandy Soils. From the 2005 Google Earth satellite imagery in Figure 6, this vegetation was along the powerlines prior to construction.

No protected tree or other protected plant species were recorded in the walked transects around the powerlines, which makes it unlikely that the construction of the substation impacted on such species.

5.3 Plant Species of Conservation Concern

Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened, Extinct in the wild, Data deficient, Near-threatened, Critically rare and Rare (Figure 8). Chapter 4, Part 2 of NEMA Biodiversity Act, 2004 (Act No. 10, 2004) provides for listing of species that are threatened or in need of protection to ensure their survival in the wild, while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival.

Information from the South African National Biodiversity Institute's (SANBI) checklist (SANBI, 2009), Raimondo *et al*, (2009), and species listed in the screening tool report were assessed, but no plant species of conservation concern were previously recorded in the area that the site is located in. The screening tool report indicates the site to be of low plant species sensitivity, indicating that it is highly unlikely for sensitive plant species to be present.

No such species were recorded in walked transects and therefore it is unlikely that species were impacted on by the amended infrastructure.

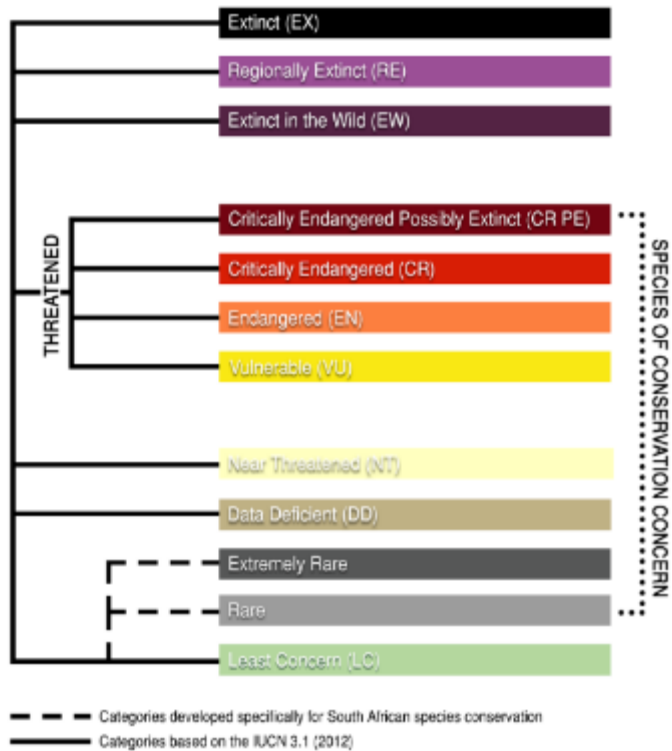


Figure 8: Categories of species of conservation concern (SCC) modified from the IUCN's extinction risk categories (reproduced in part from IUCN, 2012).

5.4 Protected plants

5.4.1 NEMBA Threatened or Protected Plant Species (TOPS)

Chapter 4, Part 2 of the National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA) provides for listing of plant and animal species as threatened or protected. If a species is listed as threatened, it must be further classified as Critically Endangered, Endangered or Vulnerable. These species are commonly referred to as TOPS listed. The Act defines these classes as follows:

- Critically endangered species: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- Endangered species: any indigenous species facing a high risk of extinction in the wild soon, although it is not a critically endangered species.
- Vulnerable species: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category will include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, known as 'Restricted Activities', are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the act are keeping, moving, having in possession, importing and exporting, and selling. The first list of threatened and protected species published under NEMBA was published in the government gazette on the 23rd of February 2007 along with the Regulations on Threatened or Protected Species.

One TOP listed species could be present in the area that the site is situated in, although it was not recorded in walked transects at the time of this assessment, and the 2011 assessment (du Preez, 2011). This species, *Harpagophytum procumbens* subsp *procumbens* (devil's claw), is listed as a Protected medicinal plant species and may not be traded.

5.4.2 Provincially Protected Plants

Provincially, several plants are protected by the Northern Cape Nature Conservation Act No.9 of 2009. Of the species listed by this Act, the species listed in the Table 2 below were observed on the site. These species are listed in Schedule 2 of the Act. Although not observed at the time of the field survey, *Harpagophytum* species could likely occur. *Harpagophytum* is specially protected by Schedule 1.

Table 2: Plant species protected by in Schedule 1 & 2 of the Northern Cape Nature Conservation Act No.9 of 2009 which were observed at the time of the field survey or for which historical records are present for the site

Plant species occurring on site	Provincial protection	Occurrence on site / data
<i>Oxalis</i> species	All species in this family (Oxalidaceae) are protected	Historical records (M Momberg pers comm, 26 January 2023)
<i>Brunsvigia</i> species <i>Ammocharis</i> species	All the species in this family (Amaryllidaceae) are protected	Historical records (M Momberg pers comm, 26 January 2023)
<i>Nananthus aloides</i>	All species in this family (Aizoaceae) are protected	West of northern extent of powerline
<i>Gymnosporia heterophylla</i>	All species in the genus <i>Gymnosporia</i>	Occurs sporadically on and around the stockpile area
<i>Olea europea</i> subsp <i>africana</i>	Only this species in the genus	Occurs sporadically around the stockpile area and along the <i>Searsia lancea</i> vegetation along the non-perennial stream, west of the substation
<i>Babianacf hypogaea</i>	All species in the family Iridaceae are protected	Historical records (M Momberg pers comm, 26 January 2023)

5.4.3 Nationally Protected Trees

The National Forest Act, 1998 (Act No. 84 of 1998) enforces the protection of several indigenous trees. The removal, thinning or relocation of protected trees will require a permit from the Department of Agriculture, Land Reform and Rural Development (DALRD, formerly Agriculture, Forestry and Fisheries) (Notice of the List of Protected Tree Species under the National Forests Act, 1998 (ACT NO 84 OF 1998), Notice 1935,

Government Gazette No 46094, 25 March 2022). The table below list the two species most likely to be present in the area, however, none were recorded in the areas assessed and were thus unlikely to be impacted on.

Table 3: National protected trees that was recorded on the site

Tree species	Common Name
<i>Boscia albitrunca</i>	Shepherd's Tree
<i>Vacehllia erioloba</i>	Camel thorn

5.4.4 Endemic Plant Species and Centre of Plant Endemism

Endemic plants are species that are naturally only found in a particular and usually restricted geographic area or region. These plants are therefore restricted in their distribution and vulnerable to habitat loss.

The study site is situated in the Griqualand West Centre of Endemism (GWC). A centre of plant endemism is an area with high concentrations of endemic plant species. Centres of endemism are important because it is these areas, which if conserved, would safeguard the greatest number of plant species. They are extremely vulnerable; relatively small disturbances in a centre of endemism could pose a serious threat to its many range-restricted species. The GWC is considered a priority in the Northern Cape, as the number of threats to the area is increasing rapidly and it has been little researched and is poorly understood. Furthermore, this centre of endemism is extremely poorly conserved, and is a national conservation priority.

The following endemic plant species could occur within the area that the site is situated in.

- *Acacia luderitzii* var *luderitzii*
- *Justicia puberula*
- *Lebeckia macrantha*
- *Sutera griquensis*
- *Tarchonanthus obovatus*

None of these species were recorded in walked transects at the time of the site visit. However, *Lebeckia macrantha* was recorded in the Open Shrub Community on Rocks in the 2011 assessment (du Preez, 2011). This species is more likely to be present to the north of the infrastructure that was assessed.

5.5 Alien Invasive Plant Species

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition, and function of natural ecosystems. The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to alien invasive plant species. On 18 September 2020 the list of Alien Invasive Species was published in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 43726 of 2020). The legislation calls for the removal and / or control of alien invasive

plant species (Category 1 species). In addition, unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse.

Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA):

Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species 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 to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. 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 any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

The alien plant species identified on the study site are listed in Appendix B.

6 IMPACT STATEMENT^[LC1]

The following table summarises the vegetation at each of the assessed infrastructures, list possible and current impacts as well as mitigation recommendations to limit or negate such impacts.

6.1 Overburden stockpile:

The vegetation on the stockpile consisted mainly of pioneer- and hardy indigenous species, naturally occurring in the area. The stockpile vegetation is stable and although some invasive species were recorded, the vegetation is in a semi-natural state and in a fair ecological condition (ecological function is maintained even though composition and structure have been compromised). The surrounding vegetation served as a seedbank to vegetate the stockpile and although the diversity on the stockpile is lower, the vegetation can be considered like the surrounding vegetation. No protected tree or other protected plant species were recorded in the walked transects around or on the stockpile, which makes it unlikely that the stockpile impacted on such species.

Table 4: Impacts and mitigation: overburden stockpile

Possible impacts of the overburden:	Mitigation measures
It is likely that the overburden was placed on top of provincial protected species as listed in Table 2. However, two provincially protected species were recorded growing on top of the overburden: <i>Olea europea subp africana</i> (wild olive) and <i>Gymnosporia heterophylla</i> (common spike thorn).	<ul style="list-style-type: none"> Surrounding vegetation serves as a seed bank to revegetate the stockpile. Prevent further disturbances to the stockpile vegetation and allow succession to take its course Do not disturb surrounding vegetation
Alien invasive plant species were recorded on the stockpile in limited numbers: (i.e., <i>Argemone mexicana</i> , <i>Trichocereus spachianus</i> <i>Xanthium spinosum</i>)	<ul style="list-style-type: none"> Remove category 1b alien invasive plant species and monitor re-emergence. Do not disturb soils unnecessary during removal. Manual / mechanical removal is preferred to chemical control. The removed vegetation must be destroyed to prevent any regrowth or germination of seeds. All alien seedlings and saplings must be removed as they become evident for the duration of operation. Ensure that only properly trained people handle and make use of chemicals

6.2 Substation:

Two vegetation groups were recorded around the substation. To the west, the vegetation along the non-perennial stream included a tree layer dominated by *Searsia lancea*. The substation construction did not directly impact on this vegetation. The original locality was wedged between the solar field in the west and this stream in the east and could have had an impact on the stream as it would have been closer to it. It is therefore thought that the current locality might have reduced perceived impacts to the *Searsia lancea* vegetation along the non-perennial stream.

The vegetation to the north, east and south of the substation comprised an open grassland with small karroid shrubs and forbs. No protected tree or other protected plant species were recorded in the walked transects around the substation, which makes it unlikely that the construction of the substation impacted on such species.

Table 5: Impacts and mitigation: substation

Possible impacts of the substation locality	Mitigation measures
Compaction of soils and trampling	<ul style="list-style-type: none"> A service road around the substation separates the activities from the surrounding vegetation and no operational impacts were noted at the time of this assessment.

Possible impacts of the substation locality	Mitigation measures
	<ul style="list-style-type: none"> • However, vehicles must stay on dedicated roads and may not veer into natural vegetation. • No operational activities may impact on the <i>Searsia lancea</i> vegetation along the non-perennial watercourse.
Colonisation by alien invasive plant species	<ul style="list-style-type: none"> • No such species were recorded at the time of this assessment • All alien seedlings and saplings must be removed as they become evident for the duration of operation.

6.3 Powerlines

Two vegetation groups were recorded along the powerlines. Most of the vegetation comprised grassland with karroid shrubs that also surrounds much of the substation. However, compaction along the line, particularly close the substation, has diminished the species diversity. The area is also grazed and includes a water point for cattle. The northern extent of the powerline, within the northern solar field, traversed a portion of the Groenwaterspruit, dominated by *Pentzia globosa*. This area was historically impacted on by intense grazing.

The vegetation along the powerline displays a lower species diversity than the surrounding vegetation; however, if the underground cable was trenched in, this vegetation would comprise a secondary state on disturbed soils. The vegetation is in a semi-natural and fair ecological condition with limited impacts noted other than compaction and alien invasive plant species.

Table 6: Impacts and mitigation: powerlines

Possible impacts of the substation locality	Mitigation measures
Compaction of soils and trampling	<ul style="list-style-type: none"> • Compaction along the route was noted, albeit limited. • Operational activities / maintenance / decommissioning must limit further compaction and not disturb vegetation along the powerlines unnecessarily
Colonisation by alien invasive plant species	<ul style="list-style-type: none"> • Species such as <i>Datura ferox</i> (category 1b) and the category 3 <i>Prosopis glandulosa</i> (honey Mesquite) were recorded here and should be removed. • All alien seedlings and saplings must be removed as they become evident for the duration of operation.

7 CONCLUSION

This assessment found that the amended infrastructure did not have a significant negative impact on surrounding vegetation. Edge effects were limited, and current impacts can be mitigated. The historic ecological report of 2011 also did not observe extensive areas of floral sensitivity and habitat diversity, species richness and uniqueness of the vegetation was classified as low. The 2011 report concluded that the proposed development would have a medium local impact on the plant communities on-site and was not regarded as a significant threat to the status and presence of these species as they occur abundantly in the general area.

This assessment, as well as the 2011 ecological assessment (du Preez, 2011) thus concurs with the screening tool report for the site in that the vegetation and plant species sensitivity are low. However, impacts to the surrounding vegetation must be limited and alien invasive plant species must be controlled for the duration of the operation phase.

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Websites and spatial data:

BGIS: <http://bgis.sanbi.org/website.asp>

SANBI databases: <http://posa.sanbi.org/searchsp.php> / <http://SIBIS.sanbi.org>

9 GLOSSARY

Alien species	Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity
Azonal	Water-logged and salt-laden habitats require specially adapted plants to survive in these habitats. Consequently the vegetation deviates from the typical surrounding zonal vegetation and are considered to be of azonal character (Mucina & Rutherford, 2006)
Biodiversity	Biodiversity is the variability among living organisms from all sources including inter alia terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems
Biome	A major biotic unit consisting of plant and animal communities having similarities in form and environmental conditions, but not including the abiotic portion of the environment.
Buffer zone	A collar of land that filters edge effects.
Conservation	The management of the biosphere so that it may yield the greatest sustainable benefit to present generation while maintaining its potential to meet the needs and aspirations of future generations. The wise use of natural resources to prevent loss of ecosystems function and integrity.
Conservation concern (Plants of...)	Plants of conservation concern are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened (see Threatened), Extinct in the wild, Data deficient, Near threatened , Critically rare, Rare and Declining . These plants are nationally protected by the National Environmental Management: Biodiversity Act. Within the context of these reports, plants that are provincially protected are also discussed under this heading.
Conservation status	An indicator of the likelihood of that species remaining <u>extant</u> either in the present day or the near future. Many factors are taken into account when assessing the conservation status of a species: not simply the number remaining, but the overall increase or decrease in the population over time, breeding success rates, known threats, and so on
Conservation Importance	The importance of a site for supporting biodiversity features of conservation concern present e.g. populations of IUCN Threatened and Near-Threatened species (CR, EN, VU & NT), Rare, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.
Community	Assemblage of populations living in a prescribed area or physical habitat, inhabiting some common environment.
Critically Endangered	A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
Data Deficient	There is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. However, "data deficient" is therefore not a category of threat. Listing of taxa in this category

	<p>indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.</p>
Declining	<p>A taxon is declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Threatened or Near Threatened, but there are threatening processes causing a continuous decline in the population (Raimondo <i>et al</i>, 2009).</p>
Development footprint	<p>The area on which the proposed development will take place and includes any area that will be disturbed.</p>
Driver	<p>Any natural or human-induced factor that directly or indirectly causes a change. " A direct driver clearly influences ecosystem processes. An indirect driver operates more diffusely, by altering one or more direct drivers.</p> <p><u>Direct drivers</u> of change in ecosystems are habitat change (land use change and physical modification of rivers or water withdrawal from rivers), climate change, overexploitation, invasive alien species, pollution, and climate change</p> <p><u>Indirect drivers</u>: In the aggregate and at a global scale, there are five indirect drivers of changes in ecosystems and their services: population change, change in economic activity, sociopolitical factors, cultural factors, and technological change. Collectively these factors influence the level of production and consumption of ecosystem services and the sustainability of production.</p>
Ecological Corridors	<p>Corridors are roadways of natural habitat providing connectivity of various patches of native habitats along or through which faunal species may travel without any obstructions where other solutions are not feasible</p>
Ecosystem	<p>Organisms together with their abiotic environment, forming an interacting system, inhabiting an identifiable space</p>
Ecosystem processes	<p>The physical, chemical and biological actions or events that link organisms and their environment. The interactions between plants, animals and the non-living components of the environment like climate or rocks. These processes are crucial for maintaining healthy ecosystems and supporting the long-term persistence of biodiversity</p>
Edge effect	<p>Inappropriate influences from surrounding activities, which physically degrade habitat, endanger resident biota and reduce the functional size of remnant fragments including, for example, the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution</p>
Endangered	<p>A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future</p>
Endemic	<p>Naturally only found in a particular and usually restricted geographic area or region</p>
Exotic species	<p>Plant taxa in a given area, whose presence there, is due to the intentional or accidental introduction as a result of human activity</p>
Forb	<p>An herbaceous plant other than grasses.</p>
Habitat	<p>Type of environment in which plants and animals live</p>
Indigenous	<p>Any species of plant, shrub or tree that occurs naturally in South Africa</p>

Indigenous vegetation:	Vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding 10 years. Listing Notices (December 2014) of the National Environmental Management Act, 1998 (Act No. 107 of 1998)
In Situ	“In the place” In Situ conservation refers to on-site conservation of a plant species where it occurs. It is the process of protecting an endangered plant or animal species in its natural habitat. The plant(s) are not removed, but conserved as they are. Removal and relocation could kill the plant and therefore in situ conservation is preferred/ enforced.
Invasive species	Naturalised alien plants that have the ability to reproduce, often in large numbers. Aggressive invaders can spread and invade large areas
Mitigation	The implementation of practical measures to reduce adverse Impacts
Near Threatened	A Taxon is Near Threatened when available evidence indicates that that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future (Raimondo <i>et al</i> , 2009).
Plant Community	A collection of plant species within a designated geographical unit, which forms a relatively uniform patch, distinguishable from neighbouring patches of different vegetation types. The components of each plant community are influenced by soil type, topography, climate and human disturbance. In many cases there are several soil types within a given plant community (Gobbat <i>et al</i> , 2004)
Protected Plant	According to Provincial Nature Conservation Ordinances or Acts, no one is allowed to sell, buy, transport, or remove this plant without a permit from the responsible authority. These plants are protected by provincial legislation.
Threatened	Species that have naturally small populations, and species which have been reduced to small (often unsustainable) population by man’s activities
Red Data	A list of species, fauna and flora that require environmental protection - based on the IUCN definitions. <i>Now termed Plants of Conservation Concern</i>
Species diversity	A measure of the number and relative abundance of species
Species richness	The number of species in an area or habitat
Suffrutex	Low-growing woody shrub or perennial with woody base, sometimes referred to as underground trees
Threatened	Threatened Species are those that are facing a high risk of extinction, indicated by placing in the categories Critically Endangered (CR), Endangered (E) and Vulnerable (VU) (Raimondo <i>et al</i> , 2009)
Transformation	The removal or radical disturbance of natural vegetation, for example by crop agriculture, plantation forestry, mining or urban development. Transformation mostly results in a serious and permanent loss of biodiversity and fragmentation of ecosystems, which in turn lead to the failure of ecological processes. Remnants of biodiversity may survive in transformed landscapes
Vegetation Association	A complex of plant communities ecologically and historically (both in spatial and temporal terms) occupying habitat complexes at the landscape scale. Mucina and Rutherford (2006) state: “Our vegetation units are the obvious vegetation complexes that share some general ecological properties such as position on major ecological

gradients and nutrient levels and appear similar in vegetation structure and especially floristic composition”.

Vulnerable

A taxon is Vulnerable when it is not Critically Endangered or Endangered but meets any of the five IUCN criteria for Vulnerable and are therefore facing a high risk of extinction in the wild in the future (Raimondo *et al*, 2009)

APPENDIX A: SAMPLING MAP

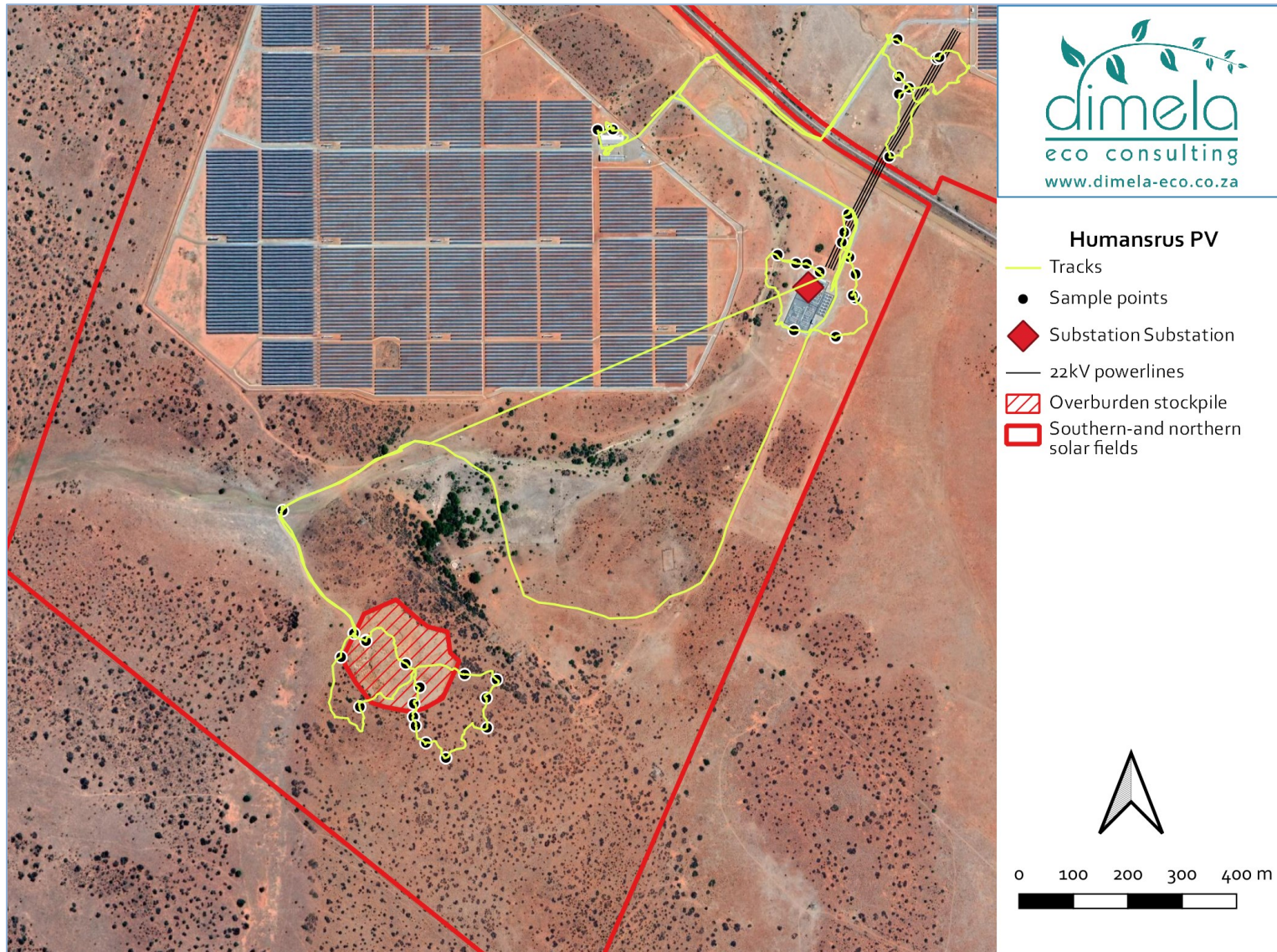


Figure 9: Track and sampling areas

APPENDIX B: PLANT SPECIES RECORDED

The table list the plant species recorded on the site, as well as some species recorded in the semi-natural vegetation north of the site.

Key:

- 1 species recorded in broad vegetation group. Where 1 is not indicated, the species was observed by Mandy Momberg and identified from photographs. However, the locality was not known and thus not indicated
- M Medicinal
- P Protected

Species	Common name	Habitat notes	Overburden stockpile		Substation		
			Secondary shrub community on stockpile	Shrub community on rocky and sandy areas (around stockpile)	Powerlines		
					Searsia lancea dominated along stream	Grassland with karroid shrubs	Pentzia globosa dominated moist grassland
Trees							
<i>Acacia (Vachellia) karroo (M)</i>	Sweet Thorn	Widespread, often proliferate in overgrazed areas	1	1	1		
<i>Senegalia mellifera subsp detinens</i>	Black Thorn	Very thorny shrub to small tree occuring in bushveld and semi-desert areas, often on Kalahari sand and forming impenetrable thickets		1			
<i>Diospyros lycioides</i>	Bluebush	Wide variety of habitats		1			
<i>Ehretia rigida</i>	Puzzle Bush	Wooded grassland, bushveld		1			

Species	Common name	Habitat notes	Overburden stockpile		Substation		
			Secondary shrub community on stockpile	Shrub community on rocky and sandy areas (around stockpile)	Searsia lancea dominated along stream	Powerlines	
						Grassland with karroid shrubs	Pentzia globosa dominated moist grassland
<i>Euclea crispa subsp crispa</i>	Blue Guarri	Rocky slopes, kloofs, along rivers and forest margins		1			
<i>Gymnosporia cf heterophylla</i>	Common Spike-thorn	Gasland and woodland	1	1			
<i>Olea europea subsp africana (M)(P in NC, Mpu)</i>	Wild Olive	Wide range of habitats, usually on rocky hillsides or on streambanks.	1	1			
<i>Parkinsonia africana</i>	Green hair tree	Dry semi-desert or desert areas, especially on sandy plains near watercourses. Also, deep red sand and dunes, Bushmanland	1	1			
<i>Searsia lancea</i>	Sour Karee	Grassland and bushveld		1	1		
<i>Searsia tridactyla</i>	Sour Karee	Hills, rocky areas	1	1	1	1	
<i>Tarchonathus camphoratus</i>	Camphor-bush / Vaalbos	Wide variety of habitats, extensive stands are regarded as an indicator for Kalahari type soils (Venter et al, 1996)	1	1	1		
<i>Ziziphus mucronata</i>	Buffalo-thorn	Widespread, in various habitats	1	1	1	1	
Number of indigenous tree species recorded (excl planted trees) = 12			7	12	5	2	0

Species	Common name	Habitat notes	Overburden stockpile		Substation		
			Secondary shrub community on stockpile	Shrub community on rocky and sandy areas (around stockpile)	Searsia lancea dominated along stream	Powerlines	
						Grassland with karroid shrubs	Pentzia globosa dominated moist grassland
Grasses							
<i>Aristida congesta</i>	Tassel Three-awn	Disturbed, overgrazed or farmed land. Increaser II grass	1	1		1	
<i>Brachiaria serrata</i>	Saw-tooth grass	Rocky, undisturbed grassland		1			
<i>Cymbopogon excavatus</i>	Broad-leaved Turpetine Grass	Adapted to various growing conditions	1	1	1	1	
<i>Cynodon dactylon</i>	Couch grass	Most soils, usually in disturbed areas. Increaser II grass, palatable	1	1		1	1
<i>Elionurus muticus</i>	Copper grass / Wire Grass	Common in overgrazed veld, sour grassland. Increaser III, perennial grass	1	1			
<i>Enneapogon scoparius</i>	Bottlebrush Grass	Shady places, mostly shallow, gravelly soils. Increaser III		1	1	1	
<i>Eragrostis curvula</i>	Weeping Love Grass	Mostly occurs in disturbed areas / sown as pasture. Increaser II grass	1	1		1	

Species	Common name	Habitat notes	Overburden stockpile		Substation		
			Secondary shrub community on stockpile	Shrub community on rocky and sandy areas (around stockpile)	Searsia lancea dominated along stream	Powerlines	
						Grassland with karroid shrubs	Pentzia globosa dominated moist grassland
<i>Eragrostis lehmanniana</i>	Lehmann's Grass	Sandy soil, mostly in disturbed land. Increaser II grass		1			
<i>Fingerhuthia africana</i>	thimble grass	Rocky areas, eroded soils, riverbeds and warm sunny areas. Important climax to sub-climax grass in eroded soils - stabilises soil		1			
<i>Heteropogon contortus</i>	Spear Grass	Rocky, sloped land and common on disturbed road reserves. Increaser II grass. Palatable in early summer	1	1		1	
<i>Melinis repens</i>	Natal Red Top	Disturbed grassland. Increaser II grass.	1				
<i>Panicum coloratum</i>	Small Buffalo Grass	Mostly found in clay soils, especially moist areas.	1		1		1
<i>Stipagrostis uniplumis</i>	Silky Bushman Grass	Open grasland, often in red sandy soil. Dry areas. Increaser II, palatable grass	1	1	1	1	1

Species	Common name	Habitat notes	Overburden stockpile		Substation		
			Secondary shrub community on stockpile	Shrub community on rocky and sandy areas (around stockpile)	Powerlines		
					Searsia lancea dominated along stream	Grassland with karroid shrubs	Pentzia globosa dominated moist grassland
<i>Themeda triandra</i>	red grass	Undisturbed or disturbed open grassland. Decreaser Grass	1	1	1	1	1
<i>Urochloa panicoides</i>	Garden Urochloa	Disturbed areas, farmed land and moist areas. Contributes to grazing in fallow lands	1			1	1
Minimum number of indigenous grass species = 15			11	12	5	9	5
Small shrubs / Forbs / succulents							
<i>Ammocharis coranica</i> (P)	Groundlily	Widespread in hot, dry and flat areas. Observed by M Momberg					
<i>Amphiglossa triflora</i>	Voeltjie-kan-nie-sit-nie	Sandy soils, limestone outcrops or sandstone koppies. Frequently in disturbed or overgrazed veld. Observed by M Momberg					
<i>Aptosimum cf marlothi</i>		Karoo veld. Observed by M Momberg					
<i>Acrotome inflata</i>	Tumble Weed	Sandy areas. Observed by M Momberg		1		1	

Species	Common name	Habitat notes	Overburden stockpile		Substation		
			Secondary shrub community on stockpile	Shrub community on rocky and sandy areas (around stockpile)	Searsia lancea dominated along stream	Powerlines	
						Grassland with karroid shrubs	Pentzia globosa dominated moist grassland
<i>Arctotheca calendula</i>							
<i>Babiana hypogea (P)</i>	Bobbejaanuintjie	Grassland, usually in sandy soils. Observed by M Momberg				1	
<i>Barleria rigida</i>	Scorpion thistle	Plains and hills		1			
<i>Berkheya pinnatifida</i>		Grassland, could become invasive in overgrazed veld				1	
<i>Brunsvigia radulosa (P) (M)</i>	Candelabra Flower	Grassland Observed by M Momberg					
<i>Bulbine narcissifolia</i>	Strap-leaved Bulbine	Poor soils in grassland, proliferation an indication of overgrazing.		1		1	
<i>Chaenostoma (was Sutura) halimifolium</i>		It occurs on rocky slopes and outcrops. Widespread across the dry interior of South Africa. Observed by M Momberg					
<i>Chascanum pinnatifidum</i>		Small shrub, dry areas. Observed by M Momberg					
<i>Chrysocoma ciliata</i>	Bitterbos	Widespread, proliferate in overgrazed areas	1	1		1	1

Species	Common name	Habitat notes	Overburden stockpile		Substation		
			Secondary shrub community on stockpile	Shrub community on rocky and sandy areas (around stockpile)	Searsia lancea dominated along stream	Powerlines	
						Grassland with karroid shrubs	Pentzia globosa dominated moist grassland
<i>Coccinia sessilifolia</i>	wild cucumber	Climbing on shrubs and fences. Observed by M Momberg					
<i>Ericephalus africanus</i>				1		1	
<i>Euryops subcarnosus</i>	Soetharpuisbos	Clay soils in arid and semi-arid regions among various vegetation types.	1	1		1	
<i>Felicia muricata</i>		Grassland, proliferating in overgrazed/disturbed places	1	1		1	
<i>Gazania krebsiana</i>	Botterblom	Grassland, widespread in other habitats	1	1			
<i>Geigeria filifolia</i>	Vermeerbos	Common in overgrazed areas		1		1	1
<i>Gomphocarpus fruticosus</i>	Milkweed	Disturbed areas	1				
<i>Helichrysum argyrospaeum</i>	Wild Everlasting / Poprose	Sandy areas, frequently in disturbed areas				1	1
<i>Helichrysum cerastioides</i> var <i>cerastioides</i>	Wolbossie	Grassland, rocky areas				1	

Species	Common name	Habitat notes	Overburden stockpile		Substation		
			Secondary shrub community on stockpile	Shrub community on rocky and sandy areas (around stockpile)	Searsia lancea dominated along stream	Powerlines	
						Grassland with karroid shrubs	Pentzia globosa dominated moist grassland
<i>Heliotropium ciliatum</i>	Kalahari String of Stars	Common in overgrazed veld	1	1			
<i>Hermannia sp</i>		Observed by M Momberg					
<i>Hermannia cococarpa</i>	Moederkappie	Bushveld. Observed by M Momberg					
<i>Hertia pallens</i>	Springbokbossie	Grows in calcareous soil, sand, loam, shale and white quartzite and can become abundant on degraded grassveld, hillsides, rocky ridges, dry river beds, in low lying areas and along roadsides. Invader on overgrazed veld.	1	1			
<i>Hibiscus pusillus</i>		Grassland, rocky areas and disturbed places	1				
<i>Indigofera daleoides</i>		Grassland, often in disturbed places. Observed by M Momberg					
<i>Indigofera meyeriana</i>				1			

Species	Common name	Habitat notes	Overburden stockpile		Substation		
			Secondary shrub community on stockpile	Shrub community on rocky and sandy areas (around stockpile)	Searsia lancea dominated along stream	Powerlines	
						Grassland with karroid shrubs	Pentzia globosa dominated moist grassland
<i>Ipomoea cf oenotheroides</i>	Christmas flower	Grassland, koppies and semi-karroid areas		1		1	
<i>Laggera decurrens (M)</i>	Silky Sage	Aromatic herb found along roadsides and disturbed areas	1				
<i>Lycium hirsutum</i>	River Honey-thorn	Sandy plains under trees		1		1	
<i>Melolobium candicans</i>	Heuningbosie	Dry grassland		1			
<i>Monsonia angustifolia</i>	pink Monsonia	Often in disturbed grassland					
<i>Nananthus aloides</i>	vlaktevygie	NCape and North West				1	
<i>Nidorella resedifolia subsp resedifolia</i>	Poverty	Prefers moist areas					1
<i>Oxalis species (likely commutata)</i>		Observed by M Momberg					
<i>Peliostomum leucorrhizum</i>	veldviooltjie	Sandy or moist areas throughout the Karoo.		1			
<i>Pentzia calcarea</i>	Bewerasiekaroo	Seasonally moist soils in or around pans					1
<i>Pentzia globosa</i>	Vaalkaroo	Grassland, in large numbers indicative of overgrazing	1			1	1

Species	Common name	Habitat notes	Overburden stockpile		Substation		
			Secondary shrub community on stockpile	Shrub community on rocky and sandy areas (around stockpile)	Searsia lancea dominated along stream	Powerlines	
						Grassland with karroid shrubs	Pentzia globosa dominated moist grassland
<i>Pentzia incana</i>	Ankerkaroo	Wide distribution throughout the Karoo and encroach into dry grassland if overgrazed				1	1
<i>Salvia cf verbenaca</i>	Salvia	Observed by M Momberg					
<i>Selago densiflora</i>		Grassland and bushveld.		1		1	
<i>Seriocoma avolans</i>	Gras-bo-bas-onder / katstert	Drier, arid areas, resembles a grass Observed by M Momberg					
<i>Sida dregei / ovata</i>	Spiny sida	Disturbed places, shade			1		
<i>Talinum caffrum</i>	Osbossie	Widespread, grassland and bushveld				1	
<i>Thesium cf hystrix</i>	Besembossie / ystervarkbossie	Hemi-root parasite	1	1			
<i>Ursinia nana</i>		Weedy plant, often in disturbed places		1			
<i>Wahlenbergia sp</i>				1		1	
Minimum number of indigenous forb species recorded = 48			11	20	1	19	7
Sedges							
<i>Scirpoides dioeca</i>	Biese	Pentzia dominated moist grassland					1

Species	Common name	Habitat notes	Overburden stockpile		Substation		
			Secondary shrub community on stockpile	Shrub community on rocky and sandy areas (around stockpile)	Searsia lancea dominated along stream	Powerlines	
Number of sedge species recorded= 1			0	0	0	0	1
Alien / Invasive Species							
<i>Alternanthera pungens</i>	kakiedubbeltjie	Weedy pioneer species Observed by M Momberg				1	
<i>Argemone mexicana</i>	Yellow-flowered Mexican Poppy	Category 1b	1				
<i>Datura ferox</i>	Large Thorn Apple	Category 1b				1	
<i>Prosopis glandulosa</i>	Honey Mesquite	Category 3 in Northern Cape. 1b in Eastern Cape, Free State, North-West and Western Cape.				1	
<i>Verbesina encelioides</i> <i>var encelioides</i>	Wilde Sonneblom	Naturalised, weed from S. America. Observed by M Momberg on site					
<i>Xanthium spinosum</i>	spiny cocklebur	Category 1b	1				
Number of alien and invasive species recorded= 6			2	0	0	3	0
Minimum indigenous species per vegetation group			29	44	11	30	13

APPENDIX C: SPECIALIST CV

Curriculum Vitae

Antoinette Eyssell-Knox

Personal Information Summary

Name: Antoinette Eyssell-Knox
Highest qualification: MSc Environmental Science (2010), University of Pretoria
Professional membership: SACNASP Pr Sci Nat (400019/11) Ecological Science
Company: Dimela Eco Consulting
Contact details: Antoinette@dimela-eco.co.za
Tel 083 642 6295

Professional Experience

1. Environmental Management:

I have been working in the field of environmental management as a vegetation specialist since the year 2007 (11 years). I have been self-employed since November 2011.

Nov 2011 – current: Dimela Eco Consulting
Sep 2007 – Nov 2011: Strategic Environmental Focus (SEF)

Main field of work and experience include:

- Vegetation assessments, overviews or scans;
- Strategic ecological assessments;
- Ecological management, rehabilitation- and biodiversity action plans (including alien vegetation management);
- Specialist input: Gauteng and North-West Outlook Reports, ecological conditional requirements for Green Star rating;
- Ground-truthing of vegetation related data;
- Review of ecological reports; and
- Mentoring.

2. Environmental Education:

2011 – current: Writer of the ecology feature for the bimonthly Supernova Kids Magazine
Aug 2003 – Sep 2007: Snr Environmental Education Officer, South African National Biodiversity Institute (SANBI), Pretoria National Botanical Garden

3. Horticulture

Jun – Jul 2003: Horticultural Trainer, 7 Shaft Training Centre, Johannesburg
May 1997 – Mar 2002: Horticulturist, Pretoria National Botanical Garden (then NBI, now SANBI)

Qualifications

- M.Sc Environmental Science, University of Pretoria (2010)
Dissertation: *Land cover change and its effect on future land uses*
- B. Sc (Hons) Horticulture, University of Pretoria (1999-2000)
Dissertation: *Horticultural uses of the indigenous Barleria species*
- B. Sc (Agriculture) Horticulture, University of Pretoria (1993-1996)

Memberships and Affiliations

SACNASP: Registered as a Professional Natural Scientist in the field of ecology since 2011 (Reg no 400019/11)
Botsoc: Member of the Botanical Society of Southern Africa since 2013

Course History

2018: Asteraceae Identification Course
2015: SAGIC Invasive Species Consultant Training
2012: Tools for Wetland Assessment (Rhodes University – September 2012)
2012: Landscape Functional Assessment, introductory workshop with David Tongway and Prof Klaus Kellner (North West University)
2012: Soil Classification and Wetland Delineation (Terra Soil)
2007: ISO 14000 Advanced EMS Auditors Course (SGS & University of Pretoria)
2007: Introduction into Forestry Stewardship Council (FSC) (University of Pretoria)
2006: Permaculture training course (S.E.E.D)
2005: Project Management Course (Wildlife and Environment Society of South Africa (WESSA) Umgeni Valley)
2004: Grass and plant identification courses

Presentations

July 2007: Environmental Education in a changing world, World Environmental Education Conference (WEEC), Durban
Sept2006: Environmental Education, BGCI Conference, Oxford England

Selected Project Experience (2011 onwards)

1. Provincial Environmental Outlook Reports

2017-2018: Vegetation input: Gauteng Outlook Report
in process: Vegetation input: North-West Outlook Report

2. Open Space Planning

Nov 2015: The proposed Kaalspruit Open Space Project, Thembisa, Gauteng. Kaalspruit River Rehabilitation Biodiversity Scan: (NuLeaf Planning and Environmental)

2015-2016: City of Johannesburg Open Space Planning – vegetation input for Linbro Park, Bassonia, Kyalami and Ruimsig areas (Iggdrasil)

3. Management- and Rehabilitation Plans

April-May 2012: Vegetation base line study and input into Biodiversity Action Plan for Kumba Iron Ore (Lidwala Consulting Engineers)

Jan 2015: Environmental Management Plan for the Krugersdorp Nature Reserve – vegetation section

Jan 2016: Tharisa Mine Railway Line – Vegetation rehabilitation plan (Limosella Consulting)

Sept 2016: General vegetation rehabilitation plan for the proposed Mezo Kitchens Panel Processing Facility (Shangoni)

Nov 2016: General Ecological Rehabilitation and Monitoring Plan for the N4 additional lane between: R52 Koster offramp & D1325 Marikana Interchange; and The R512 (Brits West Interchange) & K67 (Ga-Rankuwa Interchange) North West and Gauteng Provinces

Nov 2016: Biodiversity Management Plan: Afrisam (Sa) (Pty) Ltd, Dudfield Cement – vegetation input

June 2017: Rehabilitation planning for the Klip- Lower and Upper Rietspruit Water Management Units (Pregio, via Limosella Consulting)

Dec 2017: Eskom underground cable river crossings – vegetation input into rehabilitation plants (Envirolution)

4. Linear Infrastructure

March 2012: Kranspoort road upgrade Protected tree identification (Lidwala Consulting Engineers)

Oct 2012: Eskom: Perseus to Gamma Vegetation assessment (Mokgope Consulting)

March 2013: Diepsloot Eskom line and substation, Johannesburg (Envirolution)

Nov 2013: Masa Ngwedi 750kV and 400kV lines (Limpopo & North-West Provinces) Section D & E Vegetation Input for EMP (Mandara Consulting)

2013-2014 Eskom: Northern Alignments (Perseus in the Northern Cape to Juno in the Western Cape) (Mokgope Consulting)

Feb 2014: Meteor substation, as well as the 88kV line between the Pulsar, Meteor and Sonland substations, Sebokeng, (Nsovo Environmental Consulting)

Dec 2014: Upgrading of Internal Roads in Stinkwater, Hammanskraal (Gauteng) (GladAfrica)

Sept 2015: Railway Siding for GCMC Open Cast Mine, Lephalale (Limpopo)

Feb 2016: N4 - Additional lane between Brits and Rustenburg (Environamic)

Nov 2016: Aggeneis-Paulputs 400kV Powerline and Substations Upgrades

Feb 2017: Proposed Lulamisa to Diepsloot East to Blue Hills to Crowthorne 88kv Power Line / Cable and 2 Substations Gauteng (Envirolution)

May 2017: Proposed 132 kV Powerline Between Fochville Municipal Substation and an Existing Line, Gauteng Province (Envirolution)

5. Solar Developments

January 2012: Schmidtsdrift, Northern Cape Vegetation Assessment for Solar Panels (Nuleaf)

Aug 2015: Proposed Construction of A 75mw Solar Energy Facility Project, Limpopo Tshikovha Environmental and Communication Consulting

6. Mining

- April 2012: Rietfontein Open Cast Vegetation assessment (Cabanga Concepts)
Jan 2013: Vierfontein Colliery Vegetation assessment and EMP input (Cabanga Concepts)
Jan 2017: G&W Base and Industrial Minerals Koppies Betonite Mine Vegetation Assessment & Management Input Report (Cabanga Concepts)

7. Other Development

- Dec 2013: Marekele Bush camp – vegetation & fauna assessments (NuLeaf)
May 2013: Komati Power Station – Coal stockyard (Enviroolution)
April 2014: Blesboklaagte & Leeupoort Township development (Shangoni)
May 2014: Goldi Farm Composting Site, Section 24G Fauna and Flora assessment and Summary document (Shangoni)
Feb 2015: TOPIGS: Proposed Piggery, Mpumalanga (Shangoni)
May 2015: Kwaggasrant Recycling Facility Upgrade (Shangoni)
Oct 2016: Proposed piggery on portion 139 of the farm Honingnestkrans 269JR Vegetation and Fauna investigation (Methale Environmental Consulting)
Oct 2017: Ongoing Clinic Development & Proposed Emergency Medical Services Facility on Prt 79 of the farm De Wagendrift 417 JR Gauteng Province. (Methale Environmental Consultants)

8. Plant relocation and monitoring

- April 2014: Relocation of *C bulbipermum*, overlooked Colliery in Mpumalanga (Cabanga Concepts)
Feb 2017: Monitoring report for the relocated *Crinum bulbispermum* at Overlooked Colliery
May 2017: Relocation of protected plant species: Evander Mine

9. International:

- Oct 2009: Tatu, Nairobi: Vegetation Assessment (Kenya) (Lokisa Environmental Consulting)
Sept 2014: Vegetation input to the Regional Environmental and Social Assessment of Coal-based Energy Projects along the South Africa- Botswana Border (World bank Project, Mott MacDonald)

10. Mentorship:

- May 2017: Technical Peer Review of the vegetation section for the Emfuleni Bulk Water Supply Pipelines: Ecological Assessment. GIBB Engineering & Architecture (Pty) Ltd
Nov 2017: Mentorship and Technical Peer Review of the vegetation section for the Merensky-Kennedy Powerline: vegetation assessment GIBB Engineering & Architecture (Pty) Ltd
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