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**BIODIVERSITY ASSESSMENT AS PART OF THE
ENVIRONMENTAL IMPACT ASSESSMENT PROCESS FOR
THE HALFGEWONNEN SOLAR PHOTOVOLTAIC (PV)
PROJECT, NEAR HENDRINA, MPUMALANGA PROVINCE**

Prepared for



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Part B: Floral Assessment

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SAS Environmental Group of Companies

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1 INTRODUCTION

Scientific Terrestrial Services (STS) was appointed to conduct a Biodiversity Assessment as part of the Environmental Impact Assessment (EIA) process for the proposed Halfgewonnen Solar Photovoltaic (PV) Project, near Hendrina, Mpumalanga Province – henceforth referred to as the “**study area**”, unless referring to specific infrastructure or direct footprint areas. The study area is further associated with both linear developments (High-Voltage Line) and surface infrastructure, including the Solar PV Panels, BESS, Laydown Areas, Main Substation, O&M Building, Reference Pyranometer & Temperature Sensor, Site Offices, Weather Stations.

For a complete project description, refer to **Part A: Section 1**.

This report aims to define the floral ecology of the study area, identify areas of increased Ecological Importance and Sensitivity (EIS), as well as the mapping of such areas, and describe the Present Ecological State (PES) of the study area. The primary objective of the floral assessment is not to compile an exhaustive species list but rather to ensure that sufficient data are collected to describe all the vegetation communities present in interest, to optimise the detection of Species of Conservation Concern (SCC) and to assess habitat suitability for other potentially occurring SCC (SANBI, 2020).



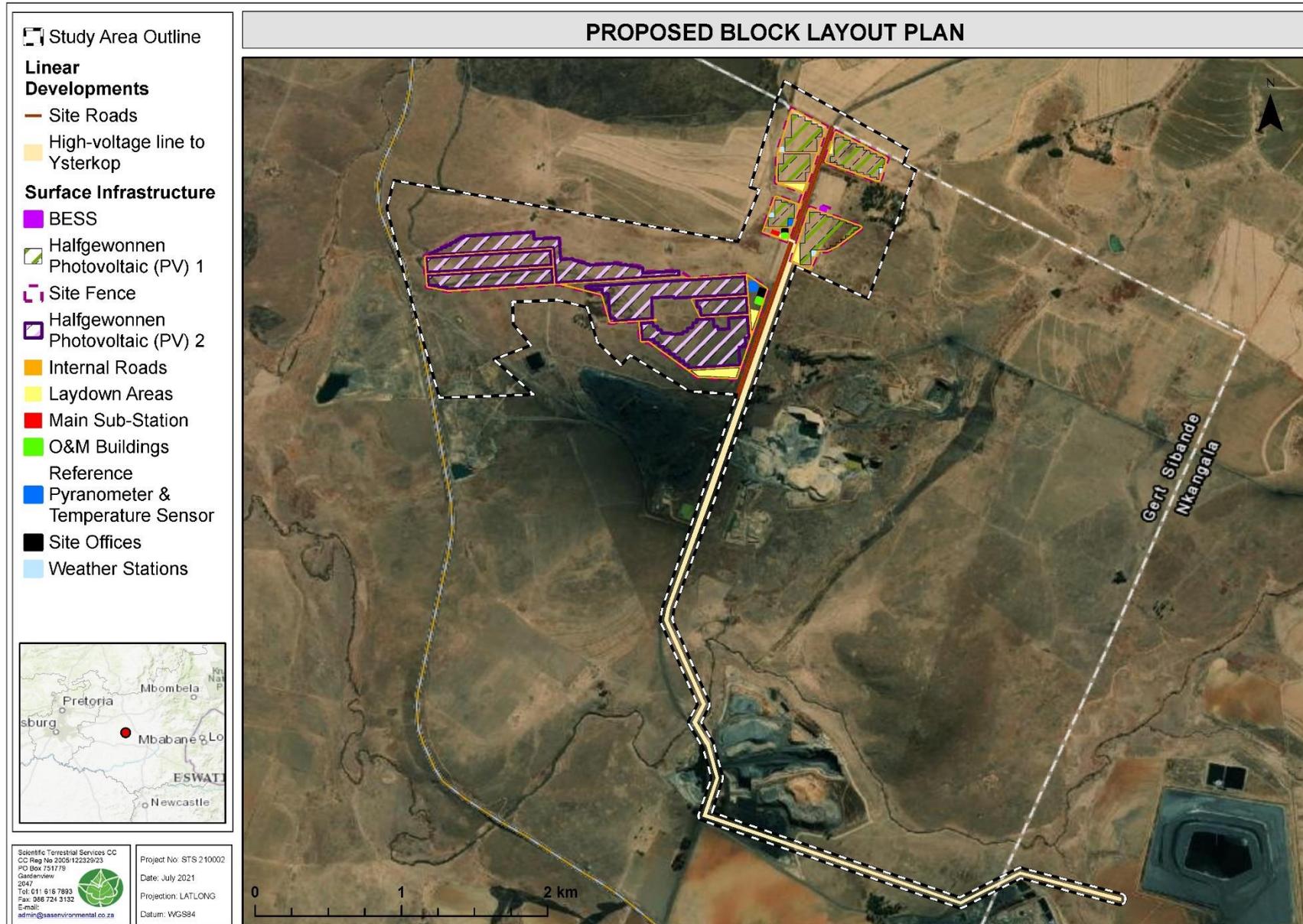


Figure 1: The location of study area superimposed onto digital satellite imagery.



1.1 Scope of Work

Specific outcomes in terms of the report are as follows:

- To determine and describe habitat types, communities and the ecological state of the study area and to rank each habitat type based on conservation importance and ecological sensitivity;
- To provide inventories of floral species as encountered within the study area;
- To identify and consider all sensitive landscapes such as indigenous forests, rocky ridges, wetlands and/ or any other special features such as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs);
- To conduct a Red Data Listed (RDL) floral species assessment as well as an assessment of other SCC, including the potential for such species to occur within the study area;
- To provide detailed information to guide the activities associated with the proposed development within the study area; and
- To ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements, to allow regional and national biodiversity targets to be met, and the provision of ecological services in the local area is sustained.

1.2 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The floral assessment is confined to the study area. For the proposed High-Voltage Line, a buffer of 30 m was applied and ground-truthed. The entire study area and immediate surroundings were, however, included in the desktop analysis of which the results are presented in **Part A: Section 3**;
- Sampling by its nature means that not all individuals are assessed and identified. With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. The field assessment took place in February 2021 (summer season), following adequate rain, and was thus an ideal time to conduct the assessment. A more comprehensive assessment would require that more than one assessment take place and that these assessments occur across all seasons of the year (but ideally within October – February to match the flowering time of most plant taxa in the region). To account for seasonal limitations and frequency of assessments, on-site data were augmented with all available desktop data, together with project experience in the area;



- Changes to the layout took place after the field assessments. These changes largely fell within the assessed area, with smaller sections of the study area falling outside of the direct footprint not ground-truthed, and data were thus extrapolated to these areas. An avifaunal winter assessment took place from the 24th to the 25th of June 2021, during which ad hoc observations were made relating to the Floral ecology of the study area. These observations were used to compliment the results presented in Part B; and
- Some floral SCC identities will not be made known in this report and are referred to as “**sensitive species**” with an identifying number as provided by the National Web Based Environmental Screening Tool outcome (hereafter referred to as the Screening Tool). The potential of these species to occur on site is still assessed; however, as per the best practise guideline that accompanies the SANBI protocol and Screening Tool, the name of the sensitive species may not appear in the final EIA report nor any of the specialist reports released into the public domain. It will be referred to as sensitive plants, and its threat status included, e.g., critically endangered sensitive species.

An on-site visual investigation of the assessment areas was conducted from the 3rd – 5th of February 2021 to confirm the assumptions made during the consultation of the background maps and to determine whether the sensitivity of the terrestrial biodiversity associated with the assessment areas confirms the results of the online National Web-based Environmental Screening Tool; hereafter the “Screening Tool”.

2 ASSESSMENT APPROACH

2.1 General Approach

The vegetation surveys are based on the subjective sampling method which is a technique where the specialist chooses specific sample sites within the area of interest, based on their professional experience in the area and background research done prior to the site visit. This allows representative recordings of floral communities and optimal detection of SCC (refer to the methodology description in **Appendix A**).

The below list includes the steps followed during the preparation for, and the conduction of, the field assessments:

- To guide the selection of appropriate sample sites, background data and digital satellite images were consulted before going to site, during which broad habitats, vegetation types and potentially sensitive sites were identified. The results of these analyses were then used to focus the fieldwork on specific areas of concern and to identify areas



where targeted investigations were required (e.g., for SCC detection and within the direct footprint of the proposed Solar PV Development);

- All relevant resources and datasets as presented by the South African National Biodiversity Institute's (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (<http://bgis.sanbi.org>) and the Environmental Geographical Information Systems (E-GIS) website (<https://egis.environment.gov.za/>), including the Mpumalanga Biodiversity Sector Plan (MBSP) of 2019, and the online National Web-based Environmental Screening Tool, were consulted to gain background information on the physical habitat and potential floral diversity associated with the assessment areas;
- Based on the broad habitat units delineated before going to site and the pre-identified points of interest, which is updated based on on-site observations and access constraints, the selected sample areas were surveyed on foot, following subjective transects, to identify the occurrence of the dominant plant species and habitat diversities, but also to detect SCC which tend to be sparsely distributed; and
- Photographs were taken of each vegetation community that is representative of typical vegetation structure of that community, as well as photos of all detected SCC (where their identities may be made known).

Additional information on the method of assessment is provided in **Appendix A** of this report.

2.2 Definitions, descriptions, and taxon nomenclature

Scientific nomenclature for plant species in this report follows that of the SANBI's Red List of South African Plants Online, as it relates to the Botanical Database of Southern Africa (BODATSA). For alien species, the definitions of Richardson et al. (2011) are used. Vegetation structure is described as per Edwards (1983) (refer to Figure A1).

2.3 Sensitivity Mapping

All the ecological features of the assessment areas were considered, and sensitive areas were assessed and projected onto satellite imagery. The sensitivity map should assist the Environmental Assessment Practitioner (EAP), the regulatory authorities and the developing proponent, by means of the presentation of results and recommendations as to the viability of the proposed development activities from a floral ecological resource management perspective.



3 RESULTS OF FLORAL ASSESSMENT

3.1 *Broad-scale vegetation characteristics*

The study area is located within the Eastern Highveld Grassland vegetation type (Mucina and Rutherford, 2006), which was used as the reference state in this assessment. Described as having slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition with small, scattered rocky outcrops with wiry, sour grasses and some woody species. This vegetation type is one of 17 national vegetation types making up the Mesic Highveld Grasslands ecosystem (SANBI, 2013), of which a large proportion is considered threatened, and this ecosystem group is generally poorly protected (SANBI, 2013). Mesic Highveld grassland ecosystems are key water production landscapes with many wetlands and pans occurring throughout.

Many key economic activities take place in the Mesic Highveld Grassland ecosystem, including mining, grazing, cultivation, plantation forestry and urban settlement. Within the study area, mining and cultivation are the main economic activities impacting on the remaining extent of grasslands.

3.2 *Ground-truthed vegetation characteristics*

Based on the results of the field investigation of February 2021, and the ad hoc observations from the Avifaunal winter assessment, four broad habitat units were distinguished for the study area:

- **Degraded and Transformed Habitat Unit:** habitat that is currently either mined or cultivated, or which has experienced historic mining without rehabilitation to the reference state;
- **Eastern Highveld Grassland Habitat Unit:** largely intact grasslands with minimal alien vegetation and disturbances – meets the definition of primary grassland¹;

¹ SANBI (2013): “Primary grasslands are those that have not been significantly modified from their original state; even though they may no longer have their full complement of naturally occurring species, they have not undergone significant or irreversible modification and still retain their essential ecological characteristics.”



- **Secondary Grassland² Habitat Unit** stretches of grassland where floral communities display evidence of significant historic disturbance – in this case, historic cultivation. Also includes grasslands that despite not being historically transformed, no longer represent the reference state due to prolonged edge effect impacts and alteration of key ecological processes and drivers (e.g., fire and herbivory exclusion); and
- **Wetland Habitat Unit:** includes sections where vegetation is still largely **intact**, comprising mainly indigenous graminoids and forb species. Also includes several sections where vegetation is **degraded**, i.e., where there is a clear dominance of alien forb species, encroaching *Seriphium plumosum*, and a general lack of expected wetland graminoids.

For a breakdown of the floral communities, habitat characteristics and conservation sensitivities associated with the above-mentioned habitat units, refer to Section 3.2.1 – 3.2.4. Figures 2 and 3 depict the full extent of the study area, with Figure 2 depicting the wetland communities as they will be discussed in this report, and Figure 3 displaying the wetland types as they relate to the delineations of the Freshwater Ecologist (SAS 220163, 2021). Within this report there is only referred to the Wetland Habitat as a whole and not distinguished between the Hydrogeomorphic (HGM) types as the SAS 220163 (2021) does. For a discussion on the HGM types, please refer to Figure 3 below and the SAS 220163 (2021) report.

Figures 4 and 5 are zoomed-in maps with the proposed infrastructure superimposed onto the delineated floral habitat units.

² SANBI (2013): “**Secondary grasslands** are those that have undergone extensive modification and a fundamental shift from their original state (e.g., to cultivated areas), but have then been allowed to return to a ‘grassland’ state (e.g., when old cultivated lands are re-colonised by a few grass species). Although secondary grasslands may superficially look like primary grasslands, they differ markedly with respect to species composition, vegetation structure, ecological functioning and the ecosystem services they deliver.”



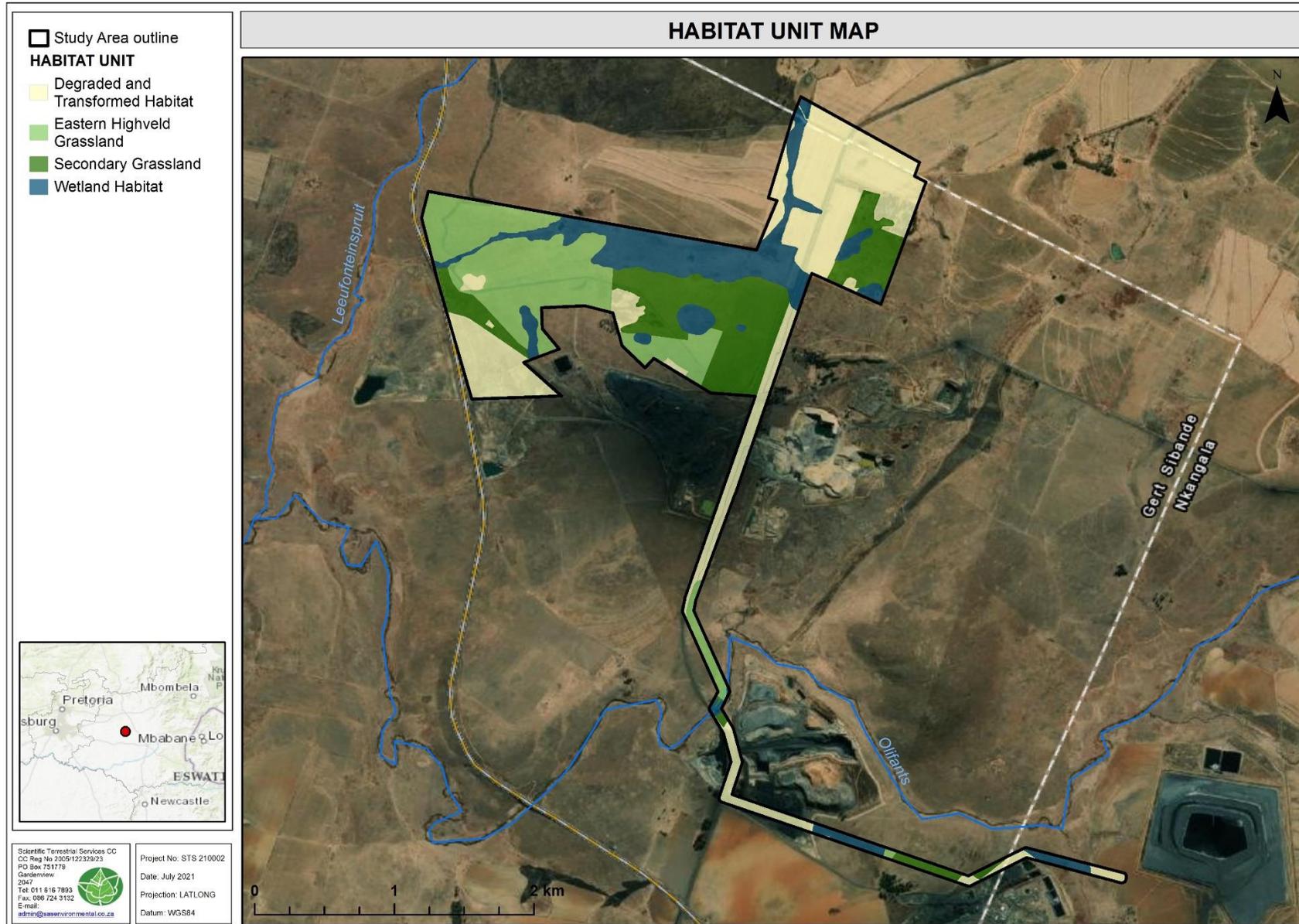


Figure 2: Conceptual illustration of the habitat units associated with the study area. (Note, this map illustrates the wetlands as they were discussed in this report, not as discussed in the SAS 220163, 2021 report – i.e., not distinguished between HGM types).



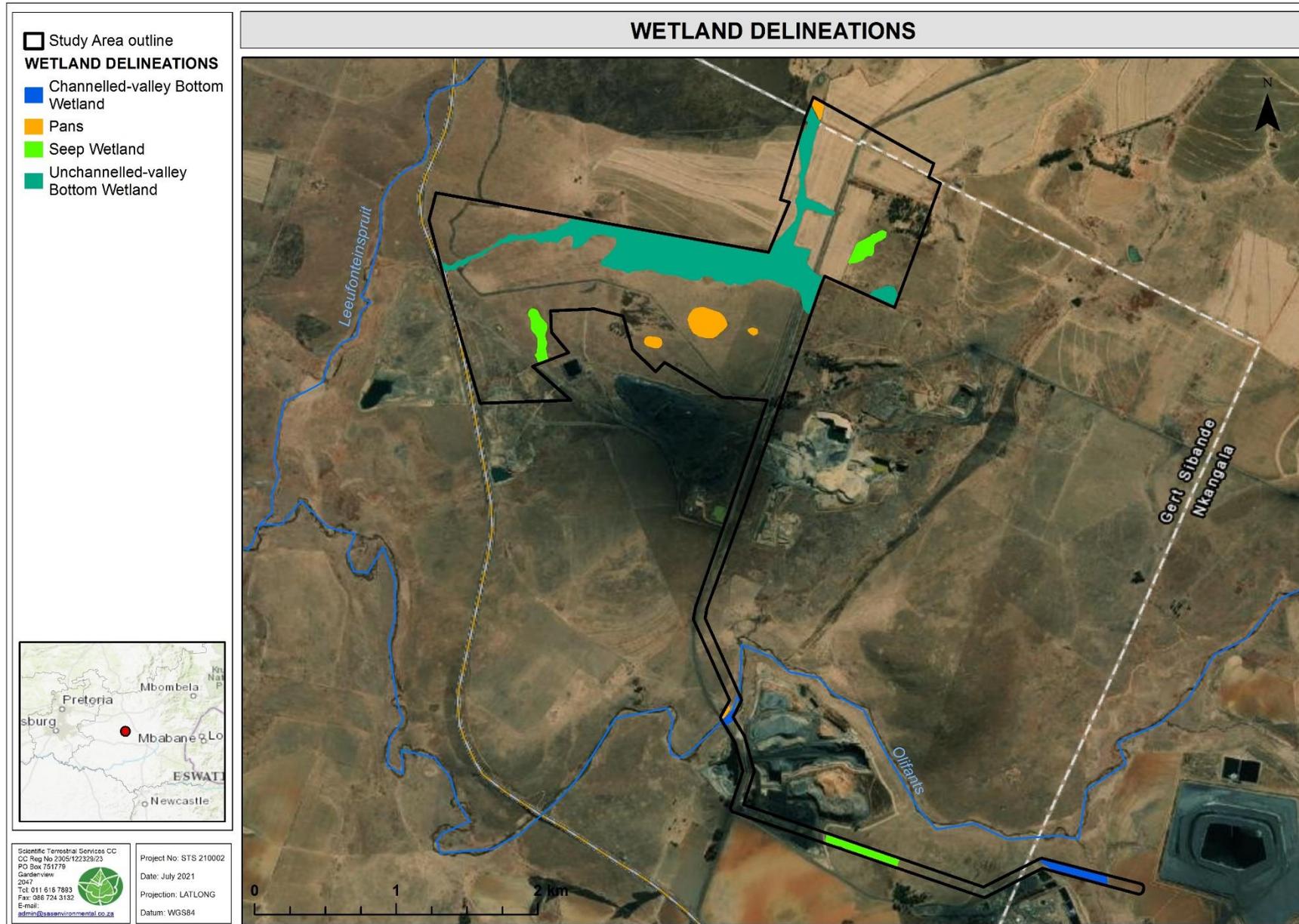


Figure 3: Conceptual illustration of the wetlands and HGM types as they relate to the delineations of the Freshwater Ecologist (SAS 220163, 2021).



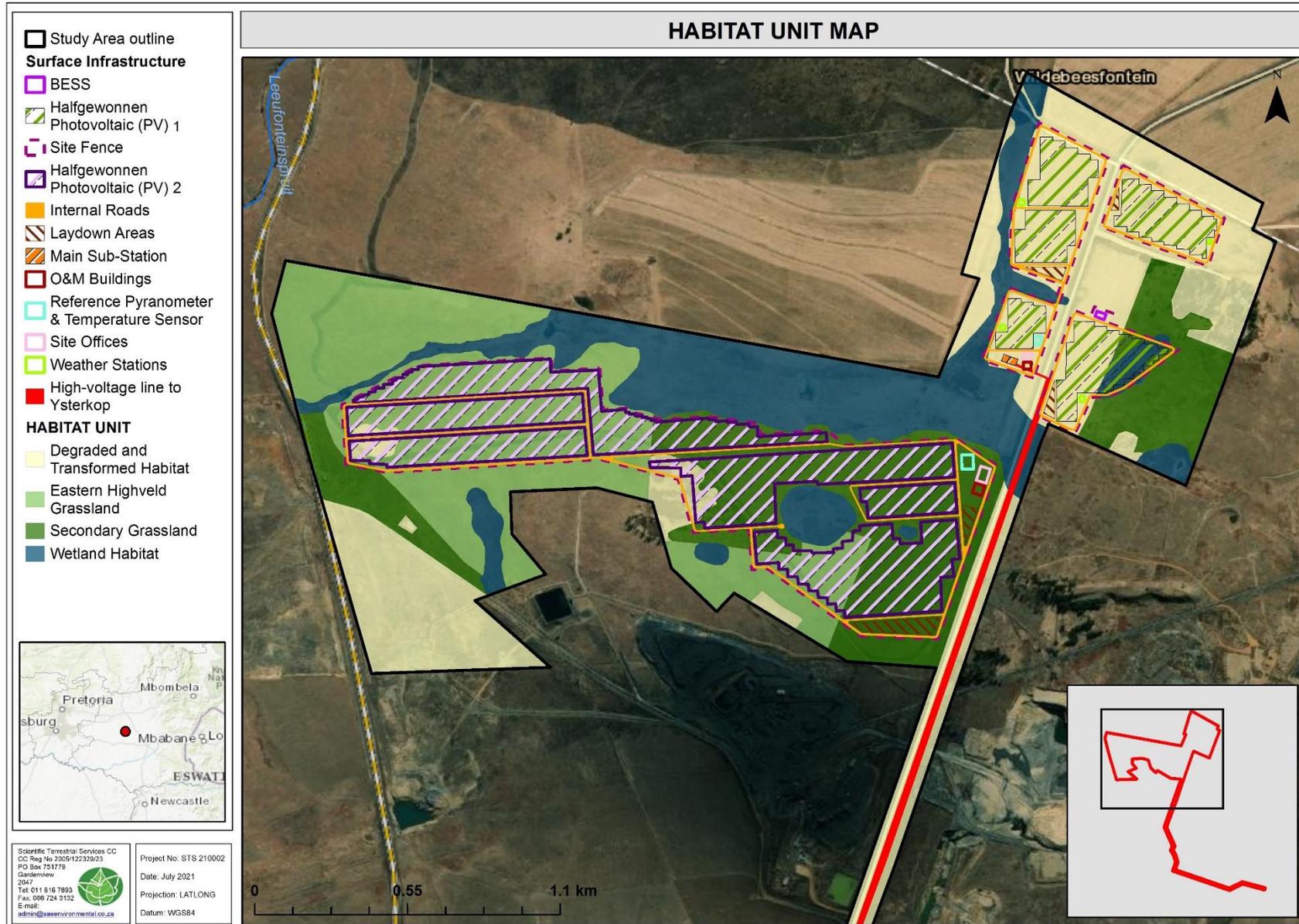


Figure 4: Conceptual illustration of the proposed surface infrastructure and linear developments (northern section of the study area) and their relation to the vegetation communities identified on site.



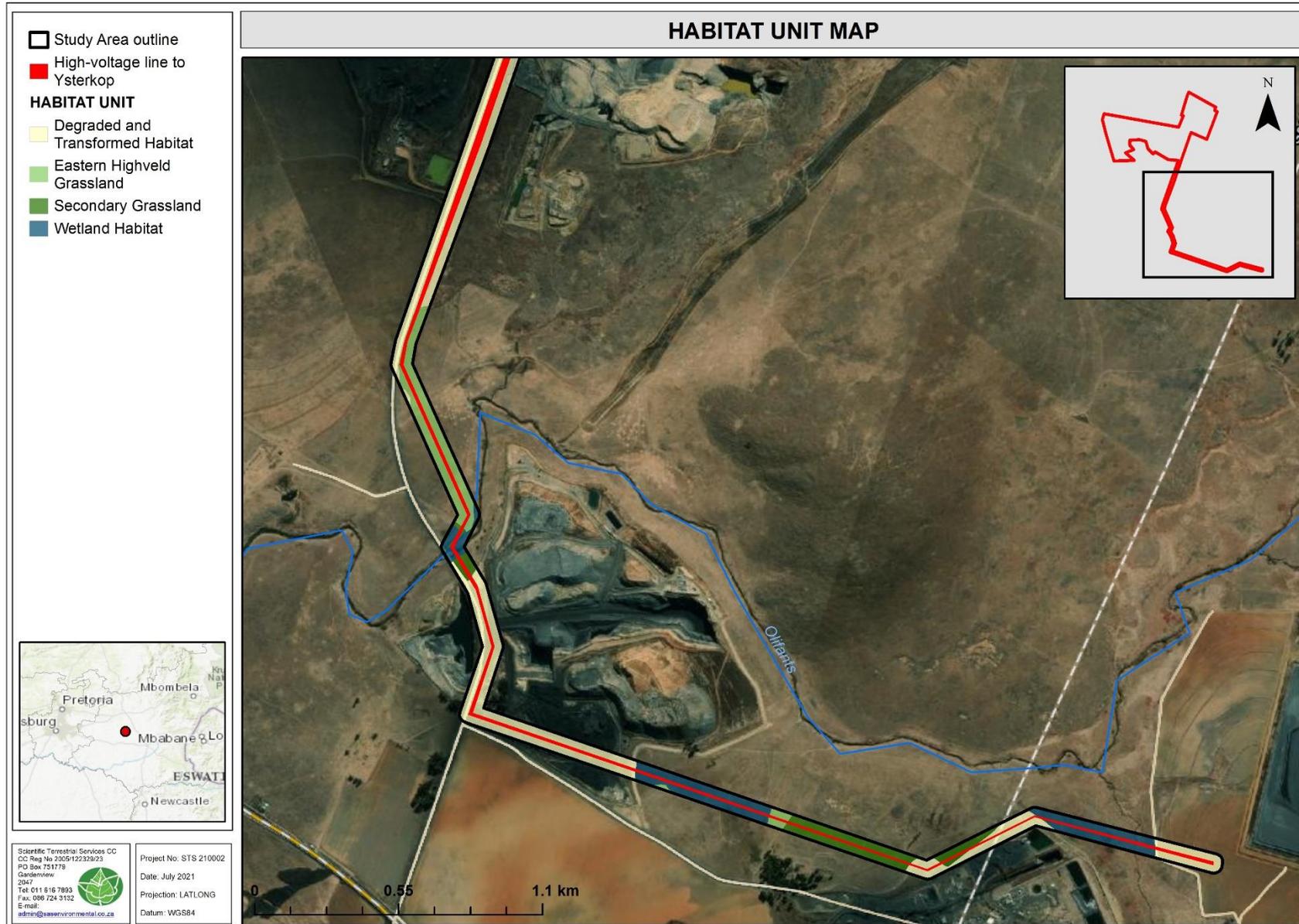


Figure 5: Conceptual illustration of the proposed High-Voltage Line (southern section of the study area) and its relation to the vegetation communities identified on site.



3.2.1 Degraded and Transformed Habitat Unit

REFERENCE PHOTOS	
	
<p>Degraded habitat associated with the Surface Infrastructure (a). Degraded and Transformed habitat associated with much of the proposed High-Voltage Line (b - c).</p>	
HABITAT OVERVIEW	SPECIES OVERVIEW
<p>This habitat unit includes areas where the vegetation structure and species composition have shifted significantly from the reference state (Eastern Highveld Grassland) due to both current and historical surface mining activities and various agricultural practices. The extent of transformation and degradation has resulted in suboptimal conditions for indigenous floral species to establish. High disturbance levels do, however, provide the necessary conditions for alien and invasive plant (AIP) species to proliferate.</p> <p><u>Vegetation structure:</u> No definitive structure can be linked to areas that are currently transformed. Where vegetation is however present, the vegetation structure is sparse to open grassland with bare soil patches throughout.</p> <p><u>Impacting Infrastructure:</u> PV Panels (mainly PV 1 panels with small sections of PV 2), BESS, Several of the northern Laydown Areas, Main Substation, O&M Building, Reference Pyranometer & Temperature Sensor, Site Offices, Weather Stations, and a large stretch of the High-Voltage Line.</p>	<p>A total of 33 plant taxa were recorded within this habitat unit with roughly half of these represented by AIP species (45%). This habitat unit is particularly species-poor, and lacking diversity in its indigenous floral compliment.</p> <p>Within transformed areas vegetation is largely lacking, apart from some AIP species and/or agricultural weeds. Within current agricultural fields, the floral communities exclude any indigenous vegetation and comprise monocultures. Degraded veld (historically mined or cultivated) typically either comprised a monodominance of a disturbance-loving species (e.g., <i>Hyparrhenia hirta</i> or <i>Seriphium plumosum</i>) or was dominated by AIPs.</p> <p>Refer to Appendix C for a list of species recorded within this Habitat Unit.</p>
SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC)	
<p>Presence of Unique Landscapes</p>	<p>None. Habitat too severely degraded and/or transformed. The Degraded and Transformed Habitat Unit does not occur within a CBA or ESA, nor does it form part of the remaining extent of the threatened Eastern Highveld Grassland ecosystem.</p>
<p>Species of Conservation Concern</p>	<p>No floral SCC were recorded within this habitat unit. Due to the extent to which natural floral community structure and composition has been altered by both historic and current anthropogenic activities, floral SCC are less likely to establish viable populations (if any), especially within areas that have been completely transformed.</p> <p>Refer to Appendix B for the complete floral SCC assessment results.</p>



SOME REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT



From left to right (all alien species): *Cirsium vulgare*, *Cosmos bipinnatus*, *Cuscuta campestris*, and *Solanum sisymbriifolium*

CONCLUDING REMARKS

This habitat unit is not considered important from a floral ecological importance and resource management perspective.

Key considerations:

- The habitat is severely degraded and no longer represents the original state, nor is it suitable to sustain viable populations of floral SCC. The infrastructure proposed within this habitat unit is unlikely to disrupt any significant ecological processes or impede any ecological corridors (from a purely floral perspective). No CBAs or ESAs are mapped within this habitat unit and thus no constraints on development are recognised for this habitat unit in the land-use guideline for terrestrial critical biodiversity areas as presented in the Mpumalanga biodiversity Sector Plan Handbook (MTPA, 2014).
- In terms of the Screening Tool outcome, these areas match the Low Sensitivity assigned to the Plant Species Theme; however, it does not align with the Very High Sensitivity assigned to the Terrestrial Biodiversity Theme (due to habitat being significantly degraded and/or transformed).
- Due to the area already being exposed to disturbances and edge effect impacts from mining and agricultural practices, this habitat unit is susceptible to AIP proliferation. Care must be taken to limit edge effects on the surrounding natural areas. Furthermore, it is recommended that an AIP species management plan be developed to manage AIP proliferation within the study areas.



3.2.2 Eastern Highveld Grassland Habitat Unit

REFERENCE PHOTOS	
	
HABITAT OVERVIEW	SPECIES OVERVIEW
<p>This habitat unit includes grassland communities that have not been historically transformed and is currently still considered a fair representation of the reference vegetation type. Due to a lack of significant anthropogenic disturbances, especially within the preceding 10 years, the Eastern Highveld Grassland Habitat Unit meets the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) definition of indigenous vegetation³ and the SANBI (2013) definition of primary grassland⁴. The Eastern Highveld Grassland Habitat Unit within the study area is located adjacent to two anthropogenic sources of disturbance, namely the agricultural fields and the current mining areas. As such, the vegetation displays signs of disturbance (edge effect impacts) such as the introduction of AIPs and the encroachment of <i>Seriphium plumosum</i>, which is also a clear indication of grazing pressures on grassland communities.</p> <p><u>Vegetation structure:</u> Where the grasslands were less exposed to edge effect disturbances and retain intact habitat integrity, the vegetation structure can be described as short to tall, open rocky grassland. Where increased disturbances were evident, the grass and forb cover as well as species diversities were lower, and the vegetation structure described as short, sparse to open grassland.</p> <p><u>Impacting Infrastructure:</u> Large portions of the PV 2 Panels, as well as small stretches of the proposed High-Voltage Line.</p>	<p>A total of 81 plant taxa were recorded within this habitat unit, with the forb component best represented (65%), followed by the graminoid component (19%). Woody species and succulents were poorly represented in terms of diversity; however, in terms of abundance, woody and/or succulent species were better represented in several sections of the grassland. Woody species mainly include shrubs and dwarf shrublets, which is characteristic of the reference vegetation type.</p> <p>AIPs did not dominate in this habitat unit, and this habitat unit has the highest diversity of indigenous grasses and forb species when compared to other habitat units identified in the study area. These are good indicators of intact, healthy grassland communities (SANBI, 2013).</p> <p>Refer to Appendix C for a list of species recorded within this Habitat Unit where species are further distinguished between subunits within this habitat unit.</p>

³ **The NEMA definition of indigenous vegetation:** "Indigenous vegetation: refers to 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.

⁴ **SANBI (2013): Primary grasslands** are those that have not been significantly modified from their original state; even though they may no longer have their full complement of naturally occurring species, they have not undergone significant or irreversible modification and still retain their essential ecological characteristics.



SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC.)	
Presence of Unique Landscapes	<p>Within both Optimal and Irreplaceable CBAs.</p> <ul style="list-style-type: none"> - The MBSP Handbook (MTPA, 2014) has specific land-use guidelines set out for terrestrial biodiversity areas which are likely to affect the proposed development (refer to concluding remarks within this dashboard). An approximate 53 ha of ground-truthed, Irreplaceable CBA is in the direct footprint of the proposed Solar PV 2. <p>Meets the definition of primary grassland and indigenous vegetation.</p> <ul style="list-style-type: none"> - As part of best-practices and minimum ecological requirements for managing grasslands for biodiversity (SANBI, 2013), wherever possible, primary grasslands should be kept in a natural or near-natural state and should be managed to avoid degradation. This includes very strict edge effect management from activities occurring within the adjacent, less sensitive areas (e.g., introduction of AIPs from adjacent Degraded and Transformed Habitat unit). - Clearance of indigenous vegetation requires environmental authorisation. <p>Occurs within a threatened ecosystem:</p> <ul style="list-style-type: none"> - This habitat unit occurs within the remaining extent of a listed threatened ecosystem (NEMBA Section 52), namely the Eastern Highveld Grassland ecosystem, with a Vulnerable (VU) threat status. Approximately 50 ha of this ecosystem (where still primary grassland) occurs within the direct footprint of the proposed Halfgewonnen PV Project. Activities within these ecosystems require environmental authorisation as contemplated in section 24(2)(b) of NEMA.
Species of Conservation Concern	<p>As part of the SCC assessment, the following classes were considered:</p> <ul style="list-style-type: none"> - Threatened species. In terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEMBA), threatened species are Red Data Listed (RDL) species falling into the following categories of ecological status: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected in term of the NEMBA Threatened or Protected Species (TOPS) list (Government Gazette [GN] 29657, as amended). - Protected Species. Species that do not necessarily fall within the above categories of ecological status, but that are deemed important from a provincial biodiversity perspective, e.g., the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA) provides a list of Protected Species (Schedule 11) (Section 69(1)(a) of the MNCA) and Specially Protected Species (Schedule 12) (Section 69(1)(b) of the MNCA) for the Mpumalanga Province for which restricted activities may not occur without permit applications. <p>No threatened (i.e., RDL) floral SCC were recorded on site during the February 2021 field assessment. However, the below listed threatened SCC as they relate to Section 56 of NEMBA, as well as the NEMBA TOPS list, are likely to be present in this habitat unit due to suitable habitat. One species obtained a Potential of Occurrence (POC) score of 'High' and two species obtained a POC score of 'Medium': <i>Brachycorythis conica</i> subsp <i>transvaalensis</i> (POC = High. Status = CR), <i>Drimia elata</i> (POC = Medium. Status = DDT. Is of Muthi importance), and <i>Khadia carolinensis</i> (POC = Medium. Status = VU).</p> <p>The Screening Tool indicated that the Eastern Highveld Grassland Habitat Unit is in an area of Medium Sensitivity from a Plant Species Theme perspective. As such, some RDL species are expected to be associated with this habitat unit. The triggered species included three RDL species for which suitable habitat conditions are available only for <i>Pachycarpus suaveolens</i> (VU) – which obtained a POC score of Medium.</p> <p>Two provincially important species, i.e., Schedule 11 Protected Species under the MNCA, were recorded within this habitat unit, namely <i>Aloe bergeriana</i> and <i>Gladiolus crassifolius</i>. Several species from the Orchidaceae family are also anticipated to occur within this habitat unit, especially in the sections bordering the Wetland Habitat.</p>



Permits from the Mpumalanga Tourism and Parks Agency (MTPA) and authorisation from the Department of Forestry, Fisheries and the Environment (DFFE) should be obtained to remove, cut, or destroy any of the above-mentioned protected and/or threatened species before any vegetation clearing may take place. Refer to **Appendix B** for the complete floral SCC assessment results.

SOME REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT



From left to right: *Psammotropha mucronata* (typical species of rockier environments), *Aloe bergeriana* (scattered throughout the Eastern Highveld Grassland), *Delosperma hirtum* (Scattered throughout the Eastern Highveld Grassland, including areas where more disturbances were present), and *Euphorbia clavarioides* (typical of rockier environments)

CONCLUDING REMARKS

This habitat unit is important from a floral ecological and resource management perspective.

Key considerations:

- The vegetation has not experienced historical transformation or significant degradation, thus retaining floral communities that are representative of important biodiversity features such as primary grassland characteristics, thus validating the CBA status as a representation of threatened ecosystems. The habitat supports several floral species protected under the MNCA and provides suitable habitat to support several RDL taxa. The proposed infrastructure within this habitat unit has the potential to impact on important ecological processes in the area by fragmenting the remaining intact patches of primary grasslands (i.e., 50 ha of the VU Eastern Highveld Grassland and 53 ha of the Irreplaceable CBA). Where surface infrastructure occurs within Irreplaceable CBAs in the Eastern Highveld Grassland, the proposed activities are considered land-uses that will compromise the CBA's biodiversity objectives and are deemed conflicting to the area's management objective. Linear infrastructure within the Optimal CBAs has similar restrictions; however, since loss of habitat can be better mitigated, linear developments can be permitted under certain conditions determined/approved by the relevant authorities, e.g., the Mpumalanga Tourism and Park Agency (MTPA). Refer also to **Section 5.3.3** for further discussion on impacts to CBAs and threatened ecosystems.
- In terms of the Screening Tool outcome, these areas align with the Medium Sensitivity assigned to the Plant Species Theme as the habitat is suitable for the triggered species *Pachycarpus suaveolens* (VU). In terms of the Very High Sensitivity assigned to the Terrestrial Biodiversity Theme, this habitat unit aligns with the screening tool outcomes. The validity as classification as CBA habitat of threatened ecosystems was confirmed during the ground-truthing of the site.
- Several provincially protected floral species were recorded within the footprint of especially the PV 2 facility. If the proposed layout is authorised, it will be necessary to conduct a thorough walkdown of the footprint areas, including at least a 10 m buffer around the footprint area, where all protected floral species are marked for relocation to suitable habitat outside the direct footprint (as far as is feasible). The protected species walkdown must be conducted during the flowering season of the species to ensure adequate detection and identification of the species – November to March will be ideal for this area. Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. Geophytes (such as *Gladiolus crassifolius*) and succulents (such as *Aloe bergeriana*) are good candidates for rescue and relocation initiatives. Where



possible, propagules of such species must also be harvested and propagated in a plant nursery to use in rehabilitation activities during the operational and maintenance phase of the project in the event that some of the mature plants do not transplant successfully. The relocation site will need to be fenced-off (or otherwise appropriately barricaded) and monitoring of relocated / transplanted species will be essential until it is evident that the species have successfully established.

- According to SANBI's RL of South African Plants website, ex situ ('search and rescue') options for RDL plants is strongly discouraged and is not seen as a valid means of mitigating impacts on their populations. As such, the best mitigation to limit impacts on these species is avoidance and development within the habitat of remaining populations of threatened species must be prohibited as far as possible. With the potential for RDL species to occur within the footprint areas that are in the Eastern Highveld Grassland Habitat Unit, if the proposed development is authorised, it will be necessary to conduct a thorough walkdown of the footprint areas, including at least a 10 m buffer around the footprint area, where all potentially occurring RDL floral species are searched and marked. All RDL plant species that will be lost due to clearing of vegetation must be replaced either during rehabilitation initiatives or through translocation to suitable habitat surrounding the disturbance footprint. Refer also to **Section 5.3.2**.



3.2.3 Secondary Grassland Habitat Unit

REFERENCE PHOTOS



HABITAT OVERVIEW

The Secondary Grassland occurs scattered throughout the study area and the various sections have received different historical and current impacts. As such, some sections are more degraded than other. As per the SANBI (2013) definition of secondary grasslands⁵, these areas have historically been significantly disturbed and/or transformed; however, due to the nature of disturbance or transformation (anthropogenic not natural), the soil properties have been altered and the historic vegetation communities are not returning despite several years having passed since the disturbance occurred. Within these historically cultivated lands, the vegetation communities are in large part degraded and has a prominent presence of AIP species, with a lack of a diverse grassland community (i.e., comprising a homogenous graminoid layer and having a general lack of grassland forbs), or a combination of the aforementioned. This has resulted in poor veld conditions and homogenous vegetation communities which is not considered representative of the reference vegetation type, nor does it meet the definition of indigenous vegetation.

The Secondary Grassland also includes grasslands that despite not being historically transformed, have received prolonged exposure to edge effect impacts such as fragmentation from larger, intact grasslands, and the presence of increased anthropogenic influences due to these areas being surrounded by currently cultivated fields. Increased wetness was also noted in the Secondary Grassland within the north-eastern section, which supported a more diverse floral community. However, key ecological processes and drivers are no longer present in these sections (e.g., fire and herbivory exclusion) and the grassland community no longer considered representative of the reference state.

Vegetation structure: Some sections still resemble grasslands, but the vegetation communities are greatly altered and typically several areas lack a grass layer. See e.g., the above photos, mainly the left and right photos. The structure can thus be described as **short, sparse grassland and/or herbland** within sections historically cultivated. Where the grassland communities were not historically cultivated, the structure can be described as **short to tall, dense grassland** with altered floral composition.

Impacting Infrastructure: Large portions of the PV 2 Panels with small portions of PV 1, several of the southern Laydown Areas, O&M Building, Reference Pyranometer & Temperature Sensor, Site Offices, as well as small stretches of the proposed High-Voltage Line.

⁵ SANBI (2013): "Secondary grasslands are those that have undergone extensive modification and a fundamental shift from their original state (e.g., to cultivated areas), but have then been allowed to return to a 'grassland' state (e.g. when old cultivated lands are re-colonised by a few grass species). Although secondary grasslands may superficially look like primary grasslands, they differ markedly with respect to species composition, vegetation structure, ecological functioning and the ecosystem services they deliver."



SPECIES OVERVIEW

A total of 44 plant taxa were recorded within this habitat unit, making this the habitat unit more species-rich than the Degraded and Transformed Habitat Unit. A high diversity of AIPs is associated with this habitat unit, especially when compared to the Eastern Grassland Habitat Unit where AIPs were largely lacking, thus indicating a degraded floral community.

Compared to the Eastern Highveld Grassland Habitat Unit, the forb component within the Secondary Grassland was greatly underrepresented. The graminoid component was also poorly represented and typically included homogenous communities of grasses that are prone to become abundant in disturbed and degraded habitat.

Refer to **Appendix C** for a list of species recorded within this Habitat Unit.

SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC)

<p>Presence of Unique Landscapes</p>	<p>None. The floral communities are indicative of disturbed habitat and do not have the complement of species that would render this habitat unit a representative of the Optimal CBA and threatened Eastern Highveld Grassland ecosystem in which it occurs. As such, no restrictions are recognised for this habitat unit in the land-use guidelines of the Mpumalanga Biodiversity Sector Plan handbook (MTPA, 2014).</p>
<p>Species of Conservation Concern</p>	<p>No floral SCC were recorded within this habitat unit. Due to the extent to which natural floral community structure and composition has been altered by both historic and current anthropogenic activities, floral SCC are less likely to establish viable populations (if any), especially within areas that have been completely transformed.</p> <p>Refer to Appendix B for the complete floral SCC assessment results.</p>

SOME REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT



From left to right: *Gomphocarpus fruticosus* (typical encroacher of historically cultivated lands), *Eragrostis plana*, *Selago densiflora*, and *Zornia milneana*



CONCLUDING REMARKS

This habitat unit is not considered important from a floral ecological importance and resource management perspective.

Key considerations:

- The habitat is degraded and no longer represent the original state, nor is it suitable to sustain viable populations of floral SCC. The infrastructure proposed within this habitat unit is unlikely to disrupt any significant ecological processes or impede any ecological corridors (from a purely floral perspective). No CBAs or ESAs are mapped within this habitat unit and thus no constraints on development are recognised for this habitat unit in the land-use guideline for terrestrial critical biodiversity areas as presented in the Mpumalanga biodiversity Sector Plan Handbook (MTPA, 2014). However, if development will take place in this habitat unit, it will be important to manage edge effects (such as AIP proliferation) to surrounding sensitive habitat that falls outside of the direct footprint areas. The area is already exposed to disturbances and edge effect impacts from mining and agricultural practices, which makes this habitat unit and adjacent sites susceptible to AIP proliferation. Furthermore, it is recommended that an AIP species management plan be developed to manage AIP proliferation within the study areas.
- In terms of the Screening Tool outcome, these areas match the Low Sensitivity assigned to the Plant Species Theme; however, it does not align with the Very High Sensitivity assigned to the Terrestrial Biodiversity Theme (due to habitat being significantly degraded and/or transformed).
- *Seriphium plumosum* encroachment was evident in this habitat unit and this poses a threat to the surrounding, more sensitive Eastern Highveld Grassland Habitat Unit and the Wetland Habitat Unit. *Seriphium plumosum* is an aggressive encroacher of mesic grasslands that leads to severe veld degradation. It is recommended that *Seriphium plumosum* be controlled as currently, it is estimated about 10 million ha in South Africa have been infested by *Seriphium plumosum* which endangers sustainable grassland production, animal production, food security, and biodiversity.



The 49th Southern African Plant Invaders Atlas (SAPIA) Newsletter (July 2018⁶) gave the following comment on its control: “Various control methods are available for bankrupt bush and recommended depending on a number of factors for example, plant density, cost effectiveness and timelines. Chemical control is the most effective recommended method, while burning and manual clearing of the shrub lead to higher densities if not properly managed. Manual clearing and chemical control, however, can become economically unfeasible. All these control measures are probably temporary, with re-invasion inevitable. Aftercare needs to focus on the control of seedlings”.

⁶ <https://www.arc.agric.za/arc-ppri/Newsletter%20Library/SAPIA%20News%20No.%2049.%20July%202018.pdf>



3.2.4 Wetland Habitat Unit

REFERENCE PHOTOS	HABITAT OVERVIEW
 <p data-bbox="206 566 1106 619">Permanently wet zones of the wetlands, comprising species adapted to these more permanently inundated habitat conditions.</p>	<p data-bbox="1133 226 2036 311">The remaining vegetation communities found within the study area include grassland patches that fall within wetlands - as defined in the National Water Act, 1998 (Act No. 36 of 1998) (NWA) – and as delineated by a freshwater ecological specialist (SAS 220163, 2021).</p> <p data-bbox="1133 343 2036 526">The delineated wetlands include Channelled-Valley Bottom (CVB) wetlands, Unchannelled-Valley Bottom (UCVB) wetlands, Seep wetland, and Pans. In this report, however, the floral communities will not be distinguished for each wetland type (please refer to the SAS 220163, 2021 report for these details). Instead, species were grouped together based on 1) their occurrence within the permanently wet zones or seasonally wet zones and/or 2) whether the floral communities were indicative of degraded habitat or intact habitat.</p> <p data-bbox="1133 558 2036 678"><u>Vegetation structure:</u> The intact Wetland Habitat comprised grassy wetlands that can be described as tall, open to closed moist grassland. The degraded Wetland Habitat largely lacked a graminoid layer and comprised AIP and weedy herbaceous species. The degraded Wetland Habitat can be described as short to tall, open herbland.</p> <p data-bbox="1133 710 2036 774"><u>Impacting Infrastructure:</u> PV 1 and PV 2 Panels along with the associated Main Pipelines, the Main Substation, Buildings, as well as small stretches of the proposed High-Voltage Line.</p>
 <p data-bbox="212 965 1097 1018">Wetlands on site included a species composition that mainly comprised graminoids and forbs. Woody species were largely lacking in this habitat unit.</p>	<p data-bbox="1473 785 1697 810" style="text-align: center;">SPECIES OVERVIEW</p> <p data-bbox="1133 817 2036 1061">A total of 98 plant taxa were recorded within this habitat unit, making this the most species-rich of the habitat units. However, the Wetland Habitat Unit was characterised by more AIPs than the Eastern Highveld Grassland Habitat Unit. This increased abundance of AIPs within the wetlands are related to both the historic and current disturbance that have occurred (cultivation and grazing), as well as due to seeds/propagules of AIPs being dispersed along the wetland channels from upstream sites - indicating that the Wetland Habitat Unit is more susceptible to disturbances. This habitat unit has a lower diversity of indigenous floral species than that recorded within the Eastern Highveld Grassland Habitat Unit.</p> <p data-bbox="1133 1093 2036 1396">Vegetation communities range from intact to degraded, depending on the historical disturbances that have occurred in the Wetland Habitat Unit. Where the wetland vegetation is still intact, there was a good representation of indigenous forbs, grasses, and sedges. The degraded wetland vegetation mostly comprised AIP species with a notable lack of graminoids. The floral species occurring within sections of the Wetland Habitat that is frequently to permanently inundated included unique species – i.e., species not found within other habitat units on site. The sections of the Wetland Habitat that transition into the terrestrial habitat included more species-rich communities with several of the graminoids and forbs shared with the adjacent grassland habitat. Refer to Appendix C for a list of species recorded within this Habitat Unit where species are further distinguished between subunits within this habitat unit.</p>
 <p data-bbox="206 1316 1106 1372">Sections of degraded wetland vegetation occurred throughout the study area and was dominated by weedy herbaceous species with the graminoid component almost entirely absent.</p>	



SPECIES OF CONSERVATION CONCERN AND PRESENCE OF UNIQUE LANDSCAPES (CBAS, ESAS, PROTECTED AREAS, INDIGENOUS FOREST, ETC)

<p>Presence of Unique Landscapes</p>	<p>The Wetland Habitat is considered a unique landscape as it serves as a movement corridor for both fauna and flora. The Wetland Habitat is also part of an important climate change adaptation corridor (see e.g., https://mtpa.maps.arcgis.com/apps/Viewer/index.html?appid=49be4945f29d4e798f339d95b68fd058). The Wetland Habitat Unit provides important niche habitat for several floral species, including a variety of floral SCC (see below section).</p> <ul style="list-style-type: none"> - Where the Wetland Habitat Unit has been classified as true watercourses (SAS 220163, 2021), they are protected under the NWA. <p>Occurs within Optimal CBA (southern section of the study area).</p> <ul style="list-style-type: none"> - As per the MTPA (2014) guidelines, linear infrastructure within Optimal CBAs is not compatible with the desired outcome of the CBA; however, linear infrastructure can be permitted under certain conditions determined by the relevant authorities, e.g., the MTPA. <p>This habitat unit occurs within the remaining extent of a listed threatened ecosystem (NEMBA Section 52), namely the Eastern Highveld Grassland ecosystem (VU). Activities within listed ecosystems require environmental authorisation as contemplated in section 24(2)(b) of NEMA.</p>
<p>Species of Conservation Concern</p>	<p>No threatened floral SCC were recorded on site during the February 2021 field assessment. However, one listed threatened SCC (i.e., RDL plants), as it relates to Section 56 of NEMBA, as well as the NEMBA TOPS list, is likely to be present in this habitat unit due to suitable habitat, namely <i>Gladiolus robertsoniae</i> (POC = High. Status = NT).</p> <p>The Screening Tool indicated that the Eastern Highveld Grassland Habitat Unit is in an area of Medium Sensitivity from a Plant Species Theme perspective. As such, some SCC are expected to be associated with this habitat unit. The triggered species included three threatened plant taxa for which suitable habitat conditions is available for two vulnerable, threatened plant species – both obtained a POC score of High.</p> <p>Three Schedule 11 Protected Species (MNCA) were recorded within this habitat unit, namely <i>Eucomis autumnalis</i>, a <i>Crinum sp.</i> and <i>Gladiolus eliotii</i>. Several species from the Orchidaceae family are also anticipated to occur within this habitat unit.</p> <p>Permits from the MTPA and authorisation from the DFFE should be obtained to remove, cut, or destroy any of the above-mentioned protected and/or threatened species before any vegetation clearing may take place.</p> <p>Refer to Appendix B for the complete floral SCC assessment results.</p>

SOME REFERENCE PHOTOS OF FLORA WITHIN THIS HABITAT UNIT



From left to right: *Cordylogyne cf globosa*, *Gladiolus eliotii*, *Nerine angustifolia*, and *Pulicaria scabra*



CONCLUDING REMARKS

This habitat unit is important from a floral ecological and resource management perspective.

Key considerations:

- The vegetation is representative of important biodiversity features such as wetlands (climate adaptation corridors and of high ecological significance), CBAs, and threatened ecosystems. The habitat supports several floral species protected under the MNCA and provides suitable habitat to support several RDL taxa. The initially proposed infrastructure was planned to place large sections of the PV Panels within the Wetland Habitat; however, following recommendations from STS and Scientific Aquatic Services (SAS), only a small portion of the proposed Solar PV 1 facility occurs within a fragmented section of the Wetland Habitat. The proposed High Voltage Line will have a limited impact on floral communities if vegetation clearing (as part of maintenance activities) is restricted and aims to avoid loss of SCC and to limit habitat fragmentation.
- In terms of the National Web-based Environmental Screening Tool outcome, these areas do not align with the Medium Sensitivity assigned to the Plant Species Theme as the habitat is more likely to be of High Sensitivity. In terms of the Very High Sensitivity assigned to the Terrestrial Biodiversity Theme, this habitat unit aligns with the screening tool outcomes. The CBAs and threatened ecosystems were confirmed during the site ground-truthing.
- Several provincially protected floral species were recorded within the footprint of especially the PV 2 facility. If the proposed layout is authorised, it will be necessary to conduct a thorough walkdown of the footprint areas, including at least a 10 m buffer around the footprint area, where all protected floral species are marked for relocation to suitable habitat outside the direct footprint (as far as is feasible). The protected species walkdown must be conducted during the flowering season of the species to ensure adequate detection and identification of the species – November to March will be ideal for this area. Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. Geophytes (such as *Gladiolus* species and *Nerine* species) are good candidates for rescue and relocation initiatives. Where possible, propagules of such species must also be harvested and propagated in a plant nursery to use in rehabilitation activities during the operational and maintenance phase of the project in the event that some of the mature plants do not transplant successfully. The relocation site will need to be fenced-off (or somehow barricaded) and monitoring of relocated / transplanted species will be essential until it is evident that the species have successfully established.
- According to SANBI's RL of South African Plants website, ex situ ('search and rescue') options for RDL plants is strongly discouraged and is not seen as a valid means of mitigating impacts on their populations. As such, the best mitigation to limit impacts on these species is avoidance and development within the habitat of remaining populations of threatened species must be prohibited as far as possible. With the potential for RDL species to occur within the footprint areas that are in the Wetland Habitat Unit, if the proposed development is authorised, it will be necessary to conduct a thorough walkdown of the footprint areas, including at least a 10 m buffer around the footprint area, where all potentially occurring RDL floral species are searched and marked. All RDL plant species that will be lost due to clearing of vegetation must be replaced either during rehabilitation initiatives or through translocation to suitable habitat surrounding the disturbance footprint. Refer also to **Section 5.3.2**.



3.3 Alien and Invasive Plant (AIP) Species

South Africa is home to an estimated 759 naturalised or invasive terrestrial plant species (Richardson et al., 2020), with 327 plant species, most of which are invasive, listed in national legislation⁷. Many introduced species are beneficial, e.g., almost all agriculture and forestry production are based on alien species, with alien species also widely used in industries such as horticulture. However, some of these species manage to “escape” from their original locations, spread and become invasive. Although only a small proportion of introduced species become invasive (~0.1–10%), those that do proceed to impact negatively on biodiversity and the services that South Africa’s diverse natural ecosystems provide (from ecotourism to harvesting food, cut flowers, and medicinal products) (van Wilgen and Wilson, 2018).

3.3.1 Legal Context

South Africa has released several Acts legislating the control of alien species. Currently, invasive species are controlled by the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) – Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 September 2020. AIPs defined in terms of NEMBA are assigned a category and listed within the NEMBA List of Alien and Invasive Species (2020) in accordance with Section 70(1)(a) of the NEMBA:

- **Category 1a** species are those targeted for urgent national eradication;
- **Category 1b** species must be controlled as part of a national management programme, and cannot be traded or otherwise allowed to spread;
- **Category 2** species are the same as category 1b species, except that permits can be issued for their usage (e.g., invasive tree species can still be used in commercial forestry, providing a permit is issued that specifies where they may be grown and that permit holders “*Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to Regulation 3*”); and

⁷ Government Notice number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004).



- **Category 3** are listed invasive species that can be kept without permits, although they may not be traded or further propagated, and must be considered a Category 1b species if they occur in riparian zones.

Duty of care related to listed invasive species are referred to in NEMBA Section 73⁸. The motivation for this duty of care is both environmentally and economically driven. Management of alien species in South Africa is estimated to cost at least ZAR 2 billion (US\$142 million) each year - this being the amount currently spent by the national government's DFFE - i.e. the Working for Water programme (van Wilgen, 2020). Managing AIPs early on will reduce clearing costs in the long run.

3.3.2 Site Results

The Eastern Highveld Grassland Habitat Unit had the least AIPs, with the Degraded and Transformed Habitat Units comprising the most (Table 1). Of the AIPs recorded during the field assessment, nine species are listed under NEMBA Category 1b. The remaining 20 species are not listed under NEMBA but species such as *Bidens pilosa*, *Cosmos bipinnatus*, *Erigeron* sp., and *Tagetes minuta* are considered problem plants having a negative impact on indigenous floral communities within the study area. Refer to Table 1 below for more information on the AIPs recorded on site.

Due to the extent of AIPs within the study area, as well as the proximity to wetlands, it is highly recommended that an Alien and Invasive Species Control and Management Plan be set up and implemented to ensure further loss of indigenous floral communities do not occur.

⁸ Section 73(2): A person who is the owner of land on which a listed invasive species occurs must-

- a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land;
- b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and
- c) take all the required steps to prevent or minimise harm to biodiversity.



Table 1: Alien and invasive alien species associated with the study area. Species abundance is indicated in the below table, e.g., where a certain species was notably, and unexpectedly, more abundant within a habitat unit compared to other occurring species, they are indicated with “XX”.

SCIENTIFIC NAME	COMMON NAME	ORIGIN	LISTED NEMBA STATUS	Degraded and Transformed Habitat	Wetland: Transitioning to terrestrial habitat	Wetland: More frequently, to permanently, inundated habitat	Wetland: Degraded	EH Grassland: Prominent Rocky Outcrops	EH Grassland: Primary Grassland Habitat	Secondary Grassland
WOODY										
* <i>Eucalyptus sp.</i>	Gum trees	Australia	1b	X						
* <i>Persicaria limbata</i>	Persicaria limbata	Africa, Indian Subcontinent	Not Listed			X				
* <i>Phytolacca octandra</i>	Forest inkberry	Tropical America	1b	X						X
* <i>Salix babylonica</i>	Weeping willow	Dry areas of northern China	Not Listed			X				
FORBS										
* <i>Campuloclinium macrocephalum</i>	Pom weed	South America (Argentina and Brazil), Central America and Mexico	1b		X	X			X	
* <i>Centella asiatica</i>	Pennywort	Pantropical	Not Listed		X	X				
* <i>Cirsium vulgare</i>	Spear thistle, Scotch thistle	Europe	1b		X	X				X
* <i>Cosmos bipinnatus</i>	Cosmos	Central America and the West Indies	Not Listed	X						
* <i>Cuscuta campestris</i>	Common dodder	Central North America	1b		X		X			
* <i>Datura stramonium</i>	Common thorn apple	Central America	1b	X						X
* <i>Erigeron sp.</i>	N/A to genus level. No Erigeron species is listed.		-	X	X	X	X			
* <i>Gomphrena celosoides</i>	Prostrate Globe-Amaranth	Cosmopolitan	Not Listed	X						X
* <i>Hibiscus trionum</i>	Bladder Hibiscus	Uncertain origin	Not Listed	X	X					X
* <i>Hypochaeris radicata</i>	Hairy wild lettuce	Europe	Not Listed		X		XX			
* <i>Oenothera rosea</i>	Rose evening primrose	South America	Not Listed		X					
* <i>Oenothera tetraptera</i>	Fourwing evening primrose	Americas	Not Listed	X						X
* <i>Oxalis corniculata</i>	Creeping sorrel	Europe	Not Listed		X		X			
* <i>Plantago lanceolata</i>	Ribwort Plantain	Uncertain origin	Not Listed							
* <i>Plantago major</i>	Broadleaf ribwort	Europe	Not Listed				X			



SCIENTIFIC NAME	COMMON NAME	ORIGIN	LISTED NEMBA STATUS	Degraded and Transformed Habitat	Wetland: Transitioning to terrestrial habitat	Wetland: More frequently, to permanently, inundated habitat	Wetland: Degraded	EH Grassland: Prominent Rocky Outcrops	EH Grassland: Primary Grassland Habitat	Secondary Grassland
* <i>Raphanus raphanistrum</i>	Wild radish	Western Asia, Europe and parts of Northern Africa	Not Listed	X						
* <i>Richardia brasiliensis</i>	Brazilian clover	South America	Not Listed	X			X			XX
* <i>Rumex acetosella</i>	Sheep sorrel, Red sorrel	Eurasia and the British Isles	Not listed	X						
* <i>Schkuhria pinnata</i>	Dwarf marigold	South America	Not Listed							X
* <i>Solanum sisymbriifolium</i>	Wild tomato, Dense- thorned	South America	1b	X						
* <i>Tagetes minuta</i>	Khaki bush	South America	Not Listed	XX						
* <i>Verbena bonariensis</i>	Tall Verbena	South America	1b	X	X	X	X			X
GRAMINOIDS										
* <i>Cortaderia jubata</i>	Purple pampas grass	Temperate South America (Argentina, Chile, Brazil and Uruguay)	1b	X						
* <i>Paspalum dilatatum</i>	Dallis Grass	South America	Not Listed		X	X				
* <i>Paspalum urvillei</i>	Vasey Grass	Argentina and Uruguay	Not Listed	XX						

4 SENSITIVITY MAPPING

The National Web-Based Environmental Screening Tool identified the study area to be in a **Medium Sensitivity** area for the Plant Species Theme and a **Very High Sensitivity** for the Terrestrial Biodiversity Theme. Based on the *ground-truthed results* of the site visit, Table 2 below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

Figures 7 - 9 conceptually illustrate the areas considered to be of varying ecological sensitivity and how they will be impacted by the proposed infrastructure development. The areas are depicted according to their sensitivity in terms of the presence or potential for floral SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity (compared to a reference type).



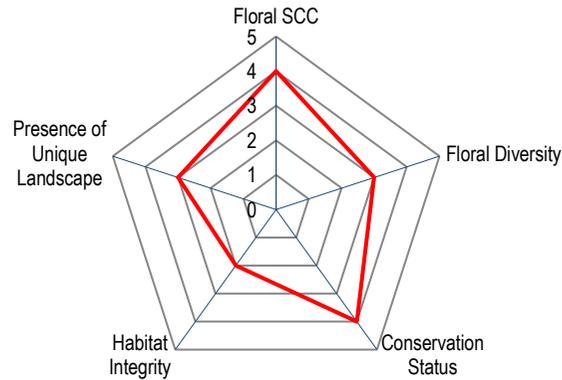
Table 2: A summary of the sensitivity of each habitat unit and implications for development.

Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
Moderately high			
<p>A radar chart with five axes: Floral SCC (top), Floral Diversity (right), Conservation Status (bottom right), Habitat Integrity (bottom left), and Presence of Unique Landscape (left). The chart has concentric lines from 0 to 5. A red line indicates scores of 4 for Floral SCC, 4 for Floral Diversity, 4 for Conservation Status, 3 for Habitat Integrity, and 4 for Presence of Unique Landscape.</p>	<p>Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.</p>	<p>Intact Wetland Habitat</p>	<ul style="list-style-type: none"> - Habitat largely intact and supports a diversity of indigenous floral species. - Meets the definition of primary grassland (SANBI), indigenous vegetation (NEMA), and/or of a watercourse (NWA). - Representative of important biodiversity features, namely Optimal and Irreplaceable CBAs, as well as threatened ecosystems (vulnerable Eastern Highveld Grassland).
Moderately high			
<p>A radar chart with five axes: Floral SCC (top), Floral Diversity (right), Conservation Status (bottom right), Habitat Integrity (bottom left), and Presence of Unique Landscape (left). The chart has concentric lines from 0 to 5. A red line indicates scores of 4 for Floral SCC, 4 for Floral Diversity, 4 for Conservation Status, 3 for Habitat Integrity, and 4 for Presence of Unique Landscape.</p>	<p>Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.</p>	<p>Eastern Highveld Grassland</p>	<ul style="list-style-type: none"> - Habitat is suitable to sustain viable populations of threatened SCC (as per NEMBA Section 56). - Several provincially protected floral species were recorded within these habitat units.



Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
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Intermediate

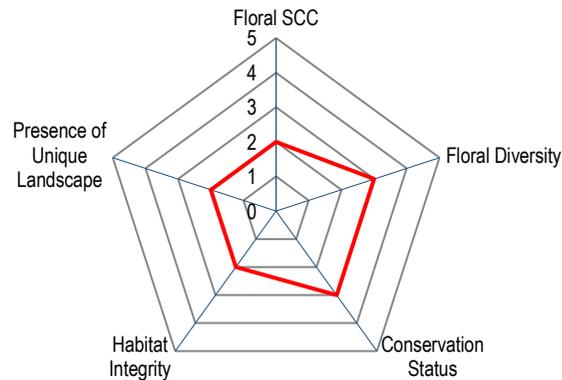


Preserve and enhance biodiversity of the habitat unit and surrounds while optimizing development potential.

Degraded Wetland Habitat Unit
 Secondary Grassland Habitat Unit (not historically cultivated, but fragmented and impacted by edge effects)

- Habitat has been disturbed as is evident with the presence of AIPs and a lack of expected indigenous vegetation.
- The habitat forms part of a larger, connected wetland system and is thus of importance from a biodiversity and conservation perspective.
- No threatened species were recorded in this habitat, but provincially protected flora is present.

Moderately low

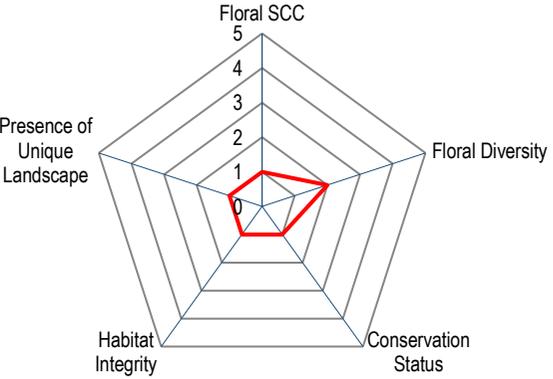


Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.

Secondary Grassland Habitat Unit (historically cultivated)

- Habitat has been degraded due to historic anthropogenic disturbances.
- The floral communities have shifted away from the reference vegetation type and is no longer representative of important biodiversity features such as CBAs or threatened ecosystems.
- Floral SCC are lacking and the potential for the habitat to support viable populations of SCC is deemed low.



Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
<p style="text-align: center;">Low</p>  <p>The radar chart displays scores for five categories on a scale of 0 to 5. The scores are: Floral SCC (0), Floral Diversity (1), Conservation Status (1), Habitat Integrity (1), and Presence of Unique Landscape (1). A red line connects the data points, showing a low overall score across all categories.</p>	<p>Optimise development potential.</p>	<p>Degraded and Transformed Habitat Unit</p>	<ul style="list-style-type: none"> - Indigenous floral diversity was low to absent. - Vegetation largely homogenous and / or AIP infestation is prominent. - Floral SCC are lacking and the potential for the habitat to support viable populations of SCC is deemed low.



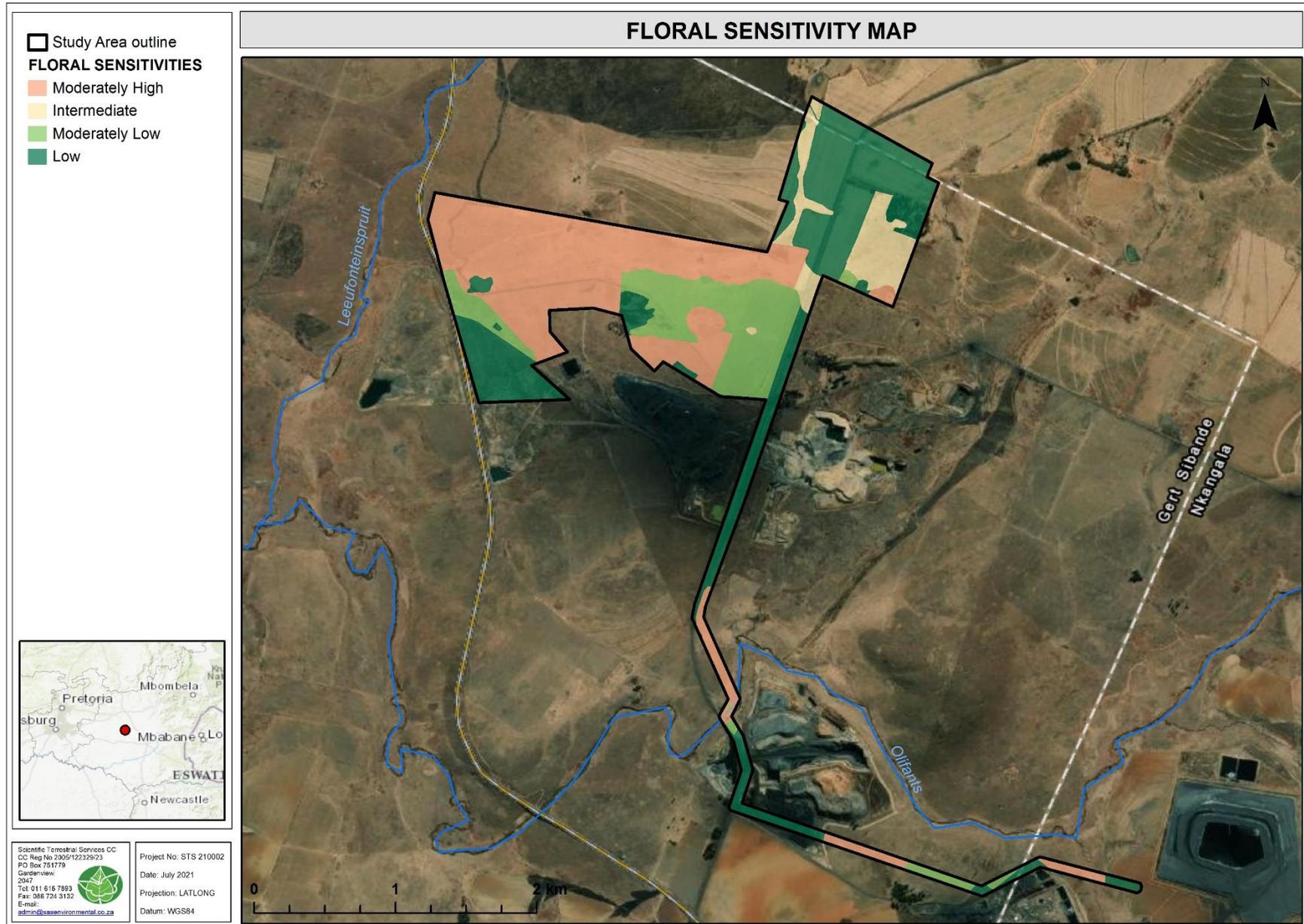


Figure 6: Sensitivity map for the study area.



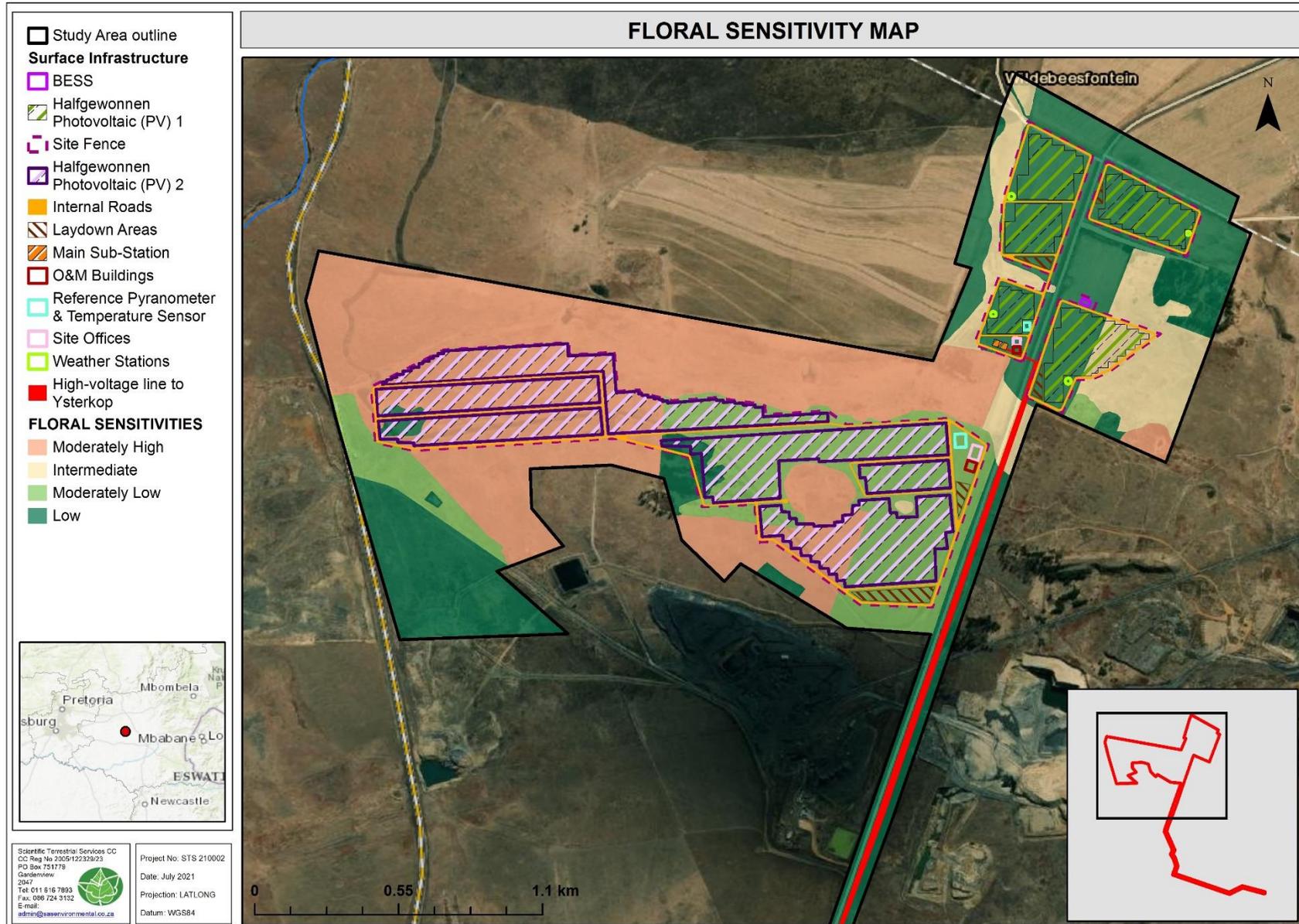


Figure 7: Sensitivity map for the northern section of the study area with the proposed infrastructure superimposed.



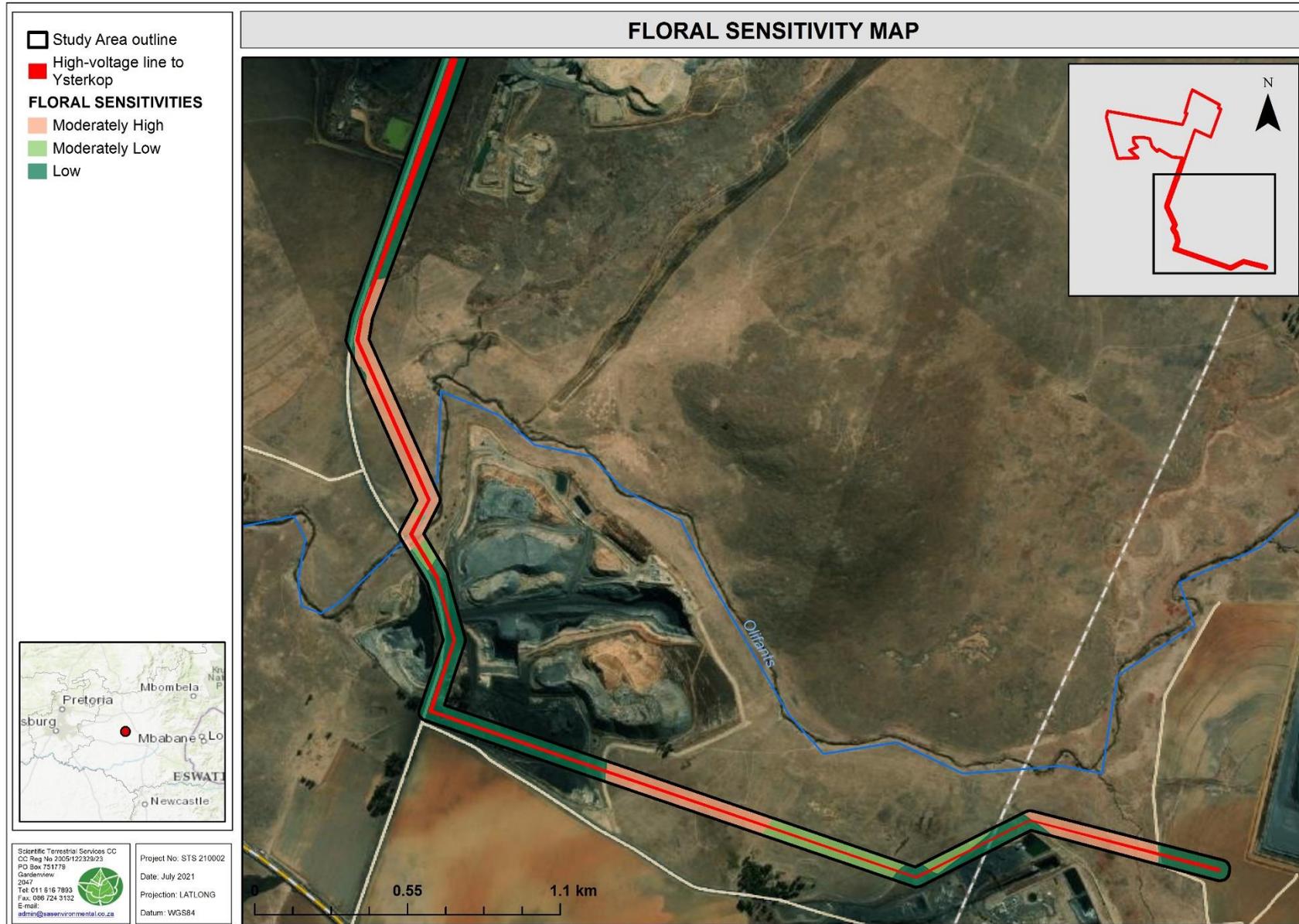


Figure 8: Sensitivity map for the southern section of the study area with the proposed infrastructure superimposed.



5 IMPACT ASSESSMENT

The sections below provide the significance of perceived impacts arising from the proposed development for the study area.

An impact discussion and assessment of all potential pre-construction, construction, operational and maintenance phase impacts are provided in Section 5.2 and 5.3. All mitigatory measures required to minimise the perceived impacts are presented in Section 5.4.

Proposed Activity Description:

Surface developments will include the PV 1 (anticipated 34 Ha) and PV 2 Panels (anticipated 88 Ha), and associated surface infrastructure. Linear developments for the project include the High-Voltage Line (\pm 6.2 km). For a depiction of the proposed layout, refer to Figure 1.

In the initial stages of the project, the proposed Halfgewonnen Solar Photovoltaic (PV) Project was planned with a large portion of the footprint of the PV array in the wetland system. Once this became evident, the project layout was revisited to reduce the risk to the receiving environment – based on recommendations from STS and SAS. Areas outside and adjacent to the study area that were highlighted as “Low Sensitivity” for the Plant Species Theme by the National Web Based Environmental Screening Tool were investigated as alternatives but were deemed unsuitable due to the various technical reasons below:

- Property where land-use and access agreements have not been reached between the developer and land-owner;
- Areas already approved for expansion of the Halfgewonnen Mine;
- Current Halfgewonnen coal processing plant - incompatible with solar PV development due to dust and land availability; and
- Previously mined areas deemed not suitable to develop the PV array.

The final layout prepared was thus put forward as the only alternative, noting that some ecological impacts cannot be avoided any further. This layout thus forms the basis of the impact assessment of this study.



5.1 Activities and Aspects

Table 3: Activities and Aspects likely to impact on the floral resources of the study area.

ACTIVITIES AND ASPECTS REGISTER	
Pre-Construction / Planning Phase	
-	Potential failure to conduct a walkdown of the footprint area before construction activities where protected floral species (Schedule 11) and potentially occurring RDL species are marked for 1) permit applications for rescue and relocation to suitable habitat outside the development footprint (where applicable), or 2) for obtaining authorisation for rescue and relocation, or destruction of such species in the event that they cannot be rescued and relocated.
-	Impact: Avoidable loss of floral SCC within the development footprint areas.
-	Potential failure to develop a Floral SCC Rescue and Relocation Plan for species that MTPA, SANBI and DFFE deem feasible to relocate (or which have been authorised/requested to be relocated).
-	Impact: Permanent loss of floral SCC (both protected and potentially occurring RDL species) from the study area with knock-on effect likely to result in population declines of range-restricted floral SCC.
-	Rescue and Relocation of SCC (Schedule 11 protected species and potentially occurring RDL species) from their natural habitat resulting in (SANBI, 2020):
•	A net habitat and biodiversity loss within the direct footprint areas;
•	Low success rates due to the difficulties of locating and translocating all individuals of an SCC (flowering periods often short and doesn't align with all SCC in a site);
•	Potential for eroding the genetic integrity of the targeted species; and
•	Substantial increased risk to the receiving populations (where the 'rescued' species are being translocated to), through deleterious genes, parasite and pathogen introduction, and excessive competition for resources.
-	Impact: Loss of diversity and floral SCC both locally and potentially also a loss of diversity and SCC regionally.
-	Infrastructure placement and design, leading to the loss of potential sensitive floral species and/or habitat for such species, as well as unnecessary edge effect impacts on areas outside of the proposed development footprint.
-	Impact: Degradation and modification of the receiving environment, loss of floral habitat.
-	Potential failure to design and implement an Alien and Invasive Plant (AIP) Management/Control plan before the commencement of construction activities, resulting in the spread of AIPs from the development footprint to surrounding natural habitat.
-	Impact: Spreading of AIPs, leading to potential loss of floral species diversity from surrounding natural habitat.
-	Potential failure to have a Rehabilitation Plan developed and ready for implementation before the commencement of construction activities.
-	Impact: Rehabilitation of disturbed areas should occur concurrently and without a Rehabilitation plan in place prior to the construction phase, there could be potential delays in the implementation of the rehabilitation plan at later stages, thus leading to the loss of viable soils for optimal plant growth.
-	Inadequate design of infrastructure leading to pollution of soils because of, e.g., leaks from construction vehicles.
-	Impact: Loss of some floral habitat.
Construction Phase	
-	Site clearing and the removal of vegetation.
-	Impact: Loss of floral habitat, diversity, and the possible loss of floral SCC. Loss of CBAs and threatened ecosystems and reduced potential for provincial authorities to achieve biodiversity targets.
-	Potential failure to monitor 1) the success of relocated floral SCC, and 2) the impact of relocated (translocated) species on the receiving populations (where the 'rescued' species are being translocated to).
-	Impact: Loss of SCC individuals.
-	During vegetation clearing activities, potential failure to demarcate floral SCC and sensitive habitat that fall outside of the authorised development footprint where development is not planned.
-	Impact: Loss of floral habitat, diversity, and floral SCC.
-	Overexploitation through the removal and/or collection of important or sensitive floral SCC beyond the direct footprint area.
-	Impact: Local loss of floral SCC abundance and diversity.
-	Proliferation of AIP species that colonise in areas of increased disturbances and that outcompete native species, including the further transformation of adjacent natural habitat.
-	Impact: Loss of favourable floral habitat outside of the direct development footprint, including a decrease in species diversity and a potential loss of floral SCC.
-	Dumping and laydown of construction material within areas where no construction is planned thereby leading to habitat disturbance - allowing the establishment and spread of AIPs and further alteration of habitat.
-	Impact: Loss of intact floral habitat, diversity and SCC as AIPs outcompete the indigenous plant species in these disturbed areas.



ACTIVITIES AND ASPECTS REGISTER

<ul style="list-style-type: none"> - Potentially poorly managed edge effects: <ul style="list-style-type: none"> • Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to the continual proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the floral habitat; and • Compaction of soils outside of the study area due to indiscriminate driving of construction vehicles through natural vegetation. - Impact: Loss of floral habitat, diversity, and SCC within the direct footprint of the proposed development. Loss of surrounding floral diversity and floral SCC through the displacement of indigenous flora by AIP species - especially in response to disturbance in natural areas.
<ul style="list-style-type: none"> - Impaired water quality and reduced flow of wetlands due to altered hydrology in the area because of poor management of sediment loads and the potential for the accumulation of vegetation cuttings and debris resulting from vegetation clearing activities. - Impact: Loss of favourable floral habitat and consequently a further loss of diversity and species reliant on the current pattern, flow, and timing of water in the landscape as well as the chemical constituency of the local water resources.
<ul style="list-style-type: none"> - Potential failure to concurrently rehabilitate bare areas or disturbed sites as soon as they become available, potentially resulting in loss of viable soils, increasing erosion risk and/or permitting the proliferation of AIPs. - Impact: Long-term loss of favourable habitat for the establishment of floral species. Loss of floral diversity and SCC.
<ul style="list-style-type: none"> - Possible increased fire frequency during construction. - Impact: Loss or alteration of floral habitat and species diversity, reducing targets for CBAs.
Operational, Maintenance and Decommissioning Phases
<ul style="list-style-type: none"> - Potential failure to monitor the success of relocated floral SCC until populations are stable. - Impact: Loss of SCC individuals.
<ul style="list-style-type: none"> - Increased introduction and proliferation of alien plant species due to a lack of maintenance activities, or poorly implemented and monitored AIP Management programme, leading to ongoing displacement of natural vegetation outside of the footprint area. - Impact: Ongoing or permanent loss of floral habitat, diversity, and potential SCC.
<ul style="list-style-type: none"> - Increased human presence in the area as part of maintenance activities, potentially leading to illegal harvesting/ collection of medicinal plants and protected floral species. - Impact: Loss of faunal and floral habitat, medicinal flora, and SCC, as well as overall species diversity within the local area.
<ul style="list-style-type: none"> - Ineffective rehabilitation of exposed and impacted areas resulting from maintenance activities or during decommissioning (Solar PV Plants are likely to have an operational lifetime of 20 to 25 years or more.). - Impact: Ongoing loss of floral habitat, diversity and SCC as AIPs proliferate within disturbance areas, and a higher likelihood of edge effect impacts on adjacent and nearby natural vegetation of increased sensitivity.

5.2 Floral Impact Assessment Results

The below table indicates the perceived risks to the floral ecology associated with all phases of the proposed development. The table also provides the findings of the impact assessment undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.



Table 4: Impact on the floral habitat, diversity, and SCC from the proposed development activities.

Impacting Activities	UNMANAGED							MANAGED								
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
PLANNING PHASE																
Habitat and Diversity																
Photovoltaic (PV) 1 Panels	2	2	2	2	2	4	6	24 Very low	1	2	2	1	2	3	5	15 Very low
Photovoltaic (PV) 2 Panels	3	4	3	3	2	7	8	56 Med-low	3	4	3	2	2	7	7	49 Low
Additional surface infrastructure	2	2	3	2	2	4	7	28 Low	1	2	1	1	2	3	4	12 Very low
High-Voltage Line	2	4	4	3	2	6	9	54 Med-low	1	4	1	1	2	5	4	20 Very low
Species of Conservation Concern																
Photovoltaic (PV) 1 Panels	2	2	2	2	2	4	6	24 Very low	1	2	1	1	2	3	4	12 Very low
Photovoltaic (PV) 2 Panels	5	4	3	3	2	9	8	72 Med-low	4	4	3	2	2	8	7	56 Med-low
Additional surface infrastructure	2	2	2	2	2	4	6	24 Very low	1	2	1	1	2	3	4	12 Very low
High-Voltage Line	3	4	2	2	2	7	6	42 Low	1	4	1	1	2	5	4	20 Very low
CONSTRUCTION PHASE																
Habitat and Diversity																
Photovoltaic (PV) 1 Panels	3	2	2	2	4	5	8	40 Low	2	2	2	1	4	4	7	28 Low
Photovoltaic (PV) 2 Panels	5	4	3	3	5	9	11	99 Medium-high	4	4	3	2	4	8	9	72 Medium-low
Additional surface infrastructure	3	2	2	2	4	5	8	40 Low	2	2	2	1	4	4	7	28 Low
High-Voltage Line	3	4	2	2	4	7	8	56 Med-low	2	4	2	2	4	6	8	48 Low
Species of Conservation Concern																
Photovoltaic (PV) 1 Panels	2	2	2	2	2	4	6	24 Very low	1	2	1	1	2	3	4	12 Very low
Photovoltaic (PV) 2 Panels	3	4	3	3	4	7	10	70 Med-low	3	4	3	3	3	7	9	63 Med-low
Additional surface infrastructure	2	2	2	1	2	4	5	20 Very low	1	2	1	1	2	3	4	12 Very low
High-Voltage Line	2	4	2	2	2	6	6	36 Low	1	4	1	1	2	5	4	20 Very low
OPERATIONAL, MAINTENANCE AND DECOMMISSIONING PHASES																
Habitat and Diversity																
Photovoltaic (PV) 1 Panels	3	2	2	2	4	5	8	40 Low	1	2	1	1	4	3	6	18 Very low
Photovoltaic (PV) 2 Panels	3	4	4	3	4	7	11	77 Med-high	2	4	3	3	4	6	10	60 Med-low
Additional surface infrastructure	3	2	2	2	4	5	8	40 Low	1	2	1	1	4	3	6	18 Very low
High-Voltage Line	3	4	2	2	4	7	8	56 Med-low	2	4	2	2	4	6	8	48 Low
Species of Conservation Concern																
Photovoltaic (PV) 1 Panels	1	2	1	1	4	3	6	18 Very low	1	2	1	1	4	3	6	18 Very low



Impacting Activities	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
Photovoltaic (PV) 2 Panels	2	4	3	2	4	6	9	54 Med-low	2	4	2	2	4	6	8	48 Low
Additional surface infrastructure	1	2	1	1	4	3	6	18 Very low	1	2	1	1	4	3	6	18 Very low
High-Voltage Line	1	4	1	2	4	5	7	35 Low	1	4	1	2	4	5	7	35 Low

5.3 Impact Discussion

The impact assessment was undertaken on all aspects of floral ecology deemed likely to be affected by the proposed Solar PV activities. Much of the amended proposed development will be within already transformed habitat; however, sections of the proposed surface infrastructure and the High-Voltage Line are proposed to be placed in sensitive wetland and grassland habitat. Several aspects of the proposed project will thus impact on sensitive floral communities and protected species (with possible, but restricted, potential for impacts on RDL species).

Impacts on *species habitat and diversity* will be higher during the construction phase where vegetation clearance will take place, especially impacts stemming from the PV 2 Panels that will be impacting on Irreplaceable CBAs (53 ha), threatened ecosystems (50 ha), and may have edge effect impacts on the Wetland Habitat Unit if not mitigated for. Impacts on *protected floral species* (as well as potentially occurring RDL species) will be higher during the planning phase where SCC will be relocated and/or destroyed – this needs to take place prior to construction phase, especially with obtaining permit applications that can delay the relocation and/or destruction process. Relocation of most of the SCC on site will likely be successful, however, population genetics will be impacted. Impacts during the Operation and Maintenance Phase can be reduced to lower impact significance on all aspects of floral ecology. Impact on floral SCC varies significantly between the habitat units.

5.3.1 Impact on Floral Habitat and Diversity

The data gathered during the site visit indicate that the Degraded and Transformed Habitat Unit is of **Low Sensitivity**, the Secondary Grassland Habitat Unit (where historically cultivated) of **Moderately Low Sensitivity**, the Degraded Wetland Habitat Unit and Secondary Grassland Habitat Unit (not historically cultivated, but fragmented and impacted by edge effects) of **Intermediate Sensitivity**, and the Intact Wetland Habitat and Eastern



Highveld Grassland Habitat Unit of **Moderately High Sensitivity**. The proposed Solar PV project activities will impact on these habitat units to varying degrees and is discussed in more detail below.

Impacts from the Additional Surface Infrastructure: The proposed Additional Surface Infrastructure (BESS, Laydown Areas, Main Substation, O&M Building, Reference Pyranometer & Temperature Sensor, Site Offices, Weather Stations) are largely proposed to be placed within habitat that is of moderately low sensitivity (Secondary Grassland) to low sensitivity (currently cultivated lands). As such, the impact on floral communities will not be significant and can be kept localised given that mitigation measures are adequately implemented and edge effects such as AIP threats are managed. The structures will not impact directly on the Wetland Habitat Unit but due to proposed placement of these structures within close proximity of the wetlands, there is risk of edge effects to the system. It will thus be important to manage edge effects stemming from AIPs.

Impacts from the Solar PV 1 and 2 Panels: The proposed Solar PV 1 is largely placed within the Transformed and Degraded Habitat Unit and only a small section traverses the Wetland Habitat and Secondary Grassland in the north-eastern extent of the study area. Overall impacts from the Solar PV 1 are thus anticipated to be localised in extent and with mitigation measures implemented (e.g., managing edge effects, ensuring footprint does not creep into adjacent natural habitat, considering recommendations of the freshwater ecologist), the impacts on floral ecology will be minimal.

The activities associated with the Solar PV 2 will result in the clearance of 50 ha of primary Eastern Highveld Grassland Habitat Unit. This habitat is the remaining extent of a threatened ecosystem and occurs in an Irreplaceable CBA (refer to section 5.3.3). This habitat unit also represents the few remaining natural and untransformed primary grasslands within a region that has been under mining and cultivation pressures for several decades. Clearance of this habitat will result in unavoidable local loss of floral habitat and diversity (mainly during the construction phase). If the footprint is restricted to the authorised areas only, with AIPs and indigenous encroacher species such as *Seriphium plumosum* strictly managed within the study area, the overall impact to floral diversity and habitat can be reduced and kept localised. If the PV panels will be decommissioned later down the line (which will only be an option after approximately 20 to 25 years), it is recommended that as much of the pre-development habitat be reinstated as far as possible.

Placement of the Solar PV 2 Panels in the Secondary Grassland and Degraded and Transformed Habitat Unit will not result in significant loss of floral habitat and diversity as these



habitat units are already severely degraded and currently serves as a source of AIPs that can negatively impact on intact floral communities adjacent to these habitat units.

Impacts from the High-Voltage Line: The High-Voltage Line stretches over several habitat units varying from low to moderately high sensitivity. Where the powerline crosses over the intact Wetland and Eastern Highveld Grassland, care must be taken to limit the footprint of the surface infrastructure. Due to the nature of the development, it is possible to avoid loss of sensitive floral communities and alteration to the wetland system can also be prevented. As such, impacts on floral communities can be reduced to be activity-specific and is anticipated to avoid significant impacts on a regional scale.

Activities which are likely to negatively affect the floral habitat integrity of the study area includes, but are not limited to, the following:

- Placement of infrastructure within sensitive floral habitat;
- Destruction of floral habitat during construction and operational activities;
- Alien floral invasion and erosion in disturbed areas;
- Increased human movement during maintenance activities, leading to greater pressure on natural floral habitat and increasing the potential for harvesting of floral SCC; and
- Alteration of hydrology and runoff patterns if Wetland Habitat is allowed to be degraded due to edge effects.

Prior to mitigation measures implemented, impact significance on floral habitat and diversity varies between **Low and Very low** for activities pertaining to the PV 1 Panels, **Medium-High** and **Medium-Low** for the PV 2 Panels, **Low** for additional infrastructure, and **Medium-Low** for the High-Voltage Line. With mitigation measures implemented, the direct and indirect impacts on the floral habitat and diversity for the study area can mostly be reduced to **Low and Very low** for activities pertaining to the PV 1 Panels, **Medium-Low** and **Low** for the PV 2 Panels, **Low to Very low** (additional infrastructure), and **Low to Very low** (High-Voltage Line).

5.3.2 Impacts on Floral SCC

The study area is associated with floral SCC and the proposed PV 2 Panels will directly impact on these species. Although the SCC recorded on site only include species protected under the MNCA (Schedule 11) and are not threatened in terms of NEMBA Section 56, the habitat associated with the Wetland Habitat Unit and the Eastern Highveld Grassland Habitat Unit provide favourable conditions for threatened species to occur and their potential occurrence within the study area cannot be excluded.



Placement of development infrastructure such as the Solar PV 2 Panels is anticipated to have an unfavourable impact on floral SCC on a local extent only if mitigation measures are implemented. Without mitigation measures implemented there could be regional-scale risks to floral SCC. Schedule 11 Protected Species (MNCA) such as *Aloe bergeriana*, *Gladiolus crassifolius* and *Gladiolus eliotii* were recorded within the proposed footprint of the PV 2 Panels and require permits from the MTPA before vegetation clearing can commence. These species are good candidates for rescue and relocation, and it is recommended that where these species will be cleared as part of site preparation activities or maintenance activities, they rather be relocated to suitable, similar habitat outside of the proposed footprint area. However, it is important to consider the following risks regarding 'search and rescue' operations as highlighted by the SANBI 2020 guidelines:

- A net habitat and biodiversity loss within the direct footprint areas will result. With mitigation measures such as making use of experienced workers, impacts can be kept localised and excessive loss of habitat can be avoided;
- Potential lowered success rates due to the difficulties of locating and translocating all individuals of an SCC (flowering periods often short and does not align with all SCC in a site). It is therefore recommended that along with translocation attempts, propagules of the targeted species be harvested and grown in plant nurseries. Once ready for translocation, these species can form part of rehabilitation actions and will allow added security in ensuring SCC numbers do not decline due to potential failure in translocation of mature individuals;
- Potential for eroding the genetic integrity of the targeted species; and
- Increased risk to the receiving populations (where the 'rescued' species are being translocated to), through deleterious genes, parasite and pathogen introduction, and excessive competition for resources. It will thus be important to monitor impacts to the receiving environment so that any negative impacts can be stopped before becoming irreversible. There is also opportunity to rehabilitate some of the degraded sections outside of the direct footprint which can then serve as receiving environment for relocated / transplanted species.

Although no RDL species were recorded on site, there is suitable habitat for several species and thus the potential for threatened plant species (RDL plants as per NEMBA Section 56) to occur within the proposed project footprint. As such, it is recommended that a walkdown of the site take place prior to vegetation clearance activities. The walkdown should take place in the optimal season for detecting the threatened species, i.e., typically between November and March. However, for one of the vulnerable threatened plant species triggered by the Screening



Tool, the flowering season is from October – November and these months will serve best for detecting this species. According to SANBI's Red List of South African Plants website, *ex situ* ('search and rescue') options for RDL plants is strongly discouraged. The best mitigation to limit impacts on these species is therefore avoidance. However, if the proposed activities are authorised, and RDL plants will be impacted, compensating for the loss of SCC must occur through rescue and relocation initiatives to suitable habitat surrounding the disturbance footprint in accordance with an approved Rescue and Relocation Plan.

Activities which are likely to negatively affect the flora of conservation concern within and around the study area include, but are not limited to, the following:

- Placement of infrastructure within floral SCC habitat;
- Destruction, removal or harvesting of floral SCC during construction and operational activities; and
- Potentially poorly implemented and monitored rescue and relocation of SCC that will be affected by the proposed project, leading to unsuccessful rescue efforts and loss of SCC individuals.

Prior to mitigation measures implemented, impact significance on floral SCC varies between **Very low** for activities pertaining to the PV 1 Panels and Additional surface infrastructure, **Medium-Low** for the PV 2 Panels, and **Low** for the High-Voltage Line. With mitigation measures implemented, the direct and indirect impacts on the floral SCC for the study area can mostly be reduced to **Very low** significance ratings for activities pertaining to the PV 1 Panels and Additional surface infrastructure, **Medium-Low** for the PV 2 Panels, and **Low** to **Very low for the** High-Voltage Line.

5.3.3 Impact on CBAs, ESAs, Threatened Vegetation and Protected Areas

The proposed development will impact on both Optimal and Irreplaceable CBAs, as well as a portion of the remaining extent of the listed vulnerable Eastern Highveld Grassland ecosystem. The impacts on the Optimal CBA will be insignificant as only the High Voltage Line intersects this CBA, and it is possible to appropriately mitigate loss of vegetation. Both the Irreplaceable CBA and threatened ecosystem will be more significantly impacted by the PV 2 Solar Panels (loss of approximately 53 ha of Irreplaceable CBA and 50 ha of the threatened ecosystem). Any loss of CBAs and threatened ecosystems stemming from activities pertaining to the Solar PV 2 Panels has the potential to impact on the ability of the relevant conservation authorities to meet specified biodiversity conservation targets. The guidelines from Mpumalanga Tourism and Parks Agency (MTPA), as per the Mpumalanga Biodiversity Sector Plan (MBSP) handbook (2014) are as follows: In general, Irreplaceable sites must be avoided in terms of



the mitigation hierarchy. Since it has been determined that avoidance is not possible alternative measures to minimise the impact should be sought with mention of rehabilitation and support of biodiversity in the operational phase of the development. Mitigation could include restricting vegetation clearance underneath the PV panels to only what is necessary for the supporting structures and internal roads. This will limit initial overall loss of vegetation but with the habitat being fragmented for several decades, the CBA status will be lost and conservation targets may be compromised.

5.3.4 Probable Latent Impacts

Even with extensive mitigation, latent impacts on the receiving floral ecological environment are deemed likely. The following points highlight the key latent impacts that have been identified:

- Destruction of ecologically intact, irreplaceable floral habitat (Irreplaceable and Optimal CBAs and threatened ecosystem);
- Permanent loss of niche floral habitat;
- Permanent loss of and altered floral species diversity;
- Edge effects such as further habitat fragmentation and AIP proliferation;
- The ongoing loss of SCC/protected floral species and suitable habitat for such species; and
- Disturbed areas are not rehabilitated to an ecologically functioning state with resulting significant loss of floral habitat, species diversity and SCC/protected floral species likely to be permanent.

5.3.5 Cumulative Impacts

The proposed project could further impact on the floral habitat and diversity as well as floral SCC through fragmentation of habitat of increased biodiversity importance and sensitivity – this is relevant to the Wetland Habitat Unit and the Eastern Highveld Grassland Habitat Unit.

AIP spread can potentially become severe if AIPs are not monitored, especially along linear developments that typically serve as a corridor for spread of AIPs. These species can spread to adjacent natural areas and even be transported downstream along the Wetland Habitat Unit, thus impacting on the indigenous biodiversity of the region.



5.4 Integrated Impact Mitigation

The table below highlights the key, general integrated mitigation measures that are applicable to the proposed development to suitably manage and mitigate the ecological impacts that are associated with all phases of the proposed development.

Provided that all management and mitigation measures are implemented, as stipulated in this report, the overall risk to floral diversity, habitat and SCC can be mitigated and/or minimised.

Table 5: A summary of the mitigatory requirements for floral resources.

Project phase	Pre-construction Phase
Impact Summary	Loss of floral habitat, species and SCC
Proposed mitigation and management measures:	
Floral Habitat and Diversity	
<ul style="list-style-type: none"> - Minimise loss of indigenous vegetation and primary grassland where possible through adequate planning and, where necessary, by incorporating the sensitivity of the biodiversity report as well as other specialist studies; - It must be ensured that, as far as possible, all proposed infrastructure, including temporary infrastructure, are placed outside of sensitive habitat units, i.e., Wetland Habitat Unit and Eastern Highveld Grassland Habitat Unit not in the authorised footprint; - Access roads should be kept to existing roads to reduce fragmentation of existing natural habitat; and - It is recommended that prior to the commencement of construction activities that the entire construction servitude be fenced off and clearly demarcated. 	
Floral SCC	
<ul style="list-style-type: none"> - Due to the potential for Red Data Listed plant species to occur within the study area and the proposed footprint area, it is recommended that another walkdown of the footprint area take place prior to vegetation clearing - especially October and November for the species triggered by the online screening tool, with November to January typically likely to be most suitable for detecting most SCC that was not found during the February 2021 assessment (on condition that rainfall was adequate). This walkdown must coincide with the flowering period of all potentially occurring SCC and should be conducted by a suitably qualified specialist. The best mitigation to limit impacts on these species is therefore avoidance. However, if the proposed activities are authorised, and RDL plants will be impacted, compensating for the loss of SCC must occur through rescue and relocation initiatives to suitable habitat surrounding the disturbance footprint in accordance with an approved Rescue and Relocation Plan; - For Schedule 11 Protected Species as per the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA), a walkdown of the footprint area is recommended prior to the construction phase where all individuals are marked for relocation (preferred) or destruction. Permit applications will be required from the Mpumalanga Tourism and Parks Agency (MTPA). Geophytes (such as <i>Gladiolus crassifolius</i>) and succulents (such as <i>Aloe bergeriana</i>) are good candidates for rescue and relocation initiatives. Where possible, propagules of such species must also be harvested and propagated in a plant nursery to use in rehabilitation activities during the operational and maintenance phase of the project in the event that some of the mature plants do not transplant successfully; and - The relocation of Schedule 11 Protected Plants and potentially occurring RDL plant species must take place prior to the commencement of the construction phase. Good record-keeping will be necessary to record this process and to document all successes and failures associated with the relocation. The relocation site will need to be fenced-off (or somehow barricaded) and monitoring of relocated / transplanted species will be essential until it is evident that the species have successfully established. 	



Project phase	Construction Phase
Impact Summary	Loss of floral habitat, species and SCC
Proposed mitigation and management measures:	
Development footprint	
<ul style="list-style-type: none"> - It is recommended that all construction personnel be educated in environmental awareness; - The construction footprint must be kept as small as possible in order to minimise impact on the surrounding environment (edge effect management). The approved footprint area must be demarcated to avoid unnecessary clearing and destruction of natural vegetation. The High-Voltage Line should not result in clearance of Wetland Habitat or of the Eastern Highveld Grassland – the servitude for maintenance activities must be kept outside of these habitat units as far as possible; - Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved development footprint; - All areas of increased ecological sensitivity (i.e., Wetland Habitat Unit and the Eastern Highveld Grassland Habitat Unit) that are outside of the authorised footprint areas should be designated as No-Go areas and be off limits to all unauthorised construction vehicles and personnel; - Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities; - Planning of temporary roads and access routes should take the site sensitivity plan into consideration. If possible, such roads should be constructed outside of the sensitive habitat and planned in a manner that will not lead to habitat fragmentation. It is recommended that existing roads be utilised; - No dumping of litter, rubble or cleared vegetation on site should be allowed. Infrastructure and rubble removed as a result of the construction activities should be disposed of at an appropriate registered dump site away from the development footprint. No temporary dump sites should be allowed in areas with natural vegetation. Waste disposal containers and bins should be provided during the construction phase for all construction rubble and general waste. Vegetation cuttings must be carefully collected and disposed of at a separate waste facility; - If any spills occur, they must be cleaned up immediately to avoid soil contamination which has the potential to hinder floral rehabilitation down the line. Spill kits should be kept on-site within workshops. Alternatively, use of such at the Halfgewonnen Colliery for minor breakdowns should be considered. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised, preventing the ingress of hydrocarbons into the topsoil; and - Upon completion of construction activities, it must be ensured that no bare areas remain, and that indigenous species be used to revegetate the disturbed area. 	
Edge effect Management	
<ul style="list-style-type: none"> - To limit edge effect impacts to the surrounding natural habitat, the below must be followed: <ul style="list-style-type: none"> • Demarcating all footprint areas during construction activities; • No construction rubble to be disposed of outside of demarcated areas, and should be taken to a registered waste disposal facility; • All soils compacted as a result of construction activities should be ripped, profiled and reseeded; • Suppress dust to mitigate the impact of dust on flora within a close proximity of construction activities – any chemicals used for this purpose must not be permitted to enter wetlands; • Minimise the risk of erosion by limiting the extent of disturbed vegetation and exposed soil. All exposed soil must be protected for the duration of the construction phase with a suitable geotextile (e.g., Geojute or hessian sheeting) in order to prevent erosion and sedimentation of the wetlands; and • Manage the spread of AIP species which may affect remaining natural habitat within surrounding areas. 	
Floral SCC	
<ul style="list-style-type: none"> - Any unauthorised collection of floral material must be prohibited; - Monitoring of any rescued and relocated floral SCC must commence during the construction phase; - Harvesting of protected floral species by construction personnel should be strictly prohibited; and - Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC outside of the proposed development footprint area. 	
Fire	
<ul style="list-style-type: none"> - No illicit fires must be allowed during the construction of the proposed development. 	
Rehabilitation	
<ul style="list-style-type: none"> - Any areas that have been left bare as a result of the construction activities should be rehabilitated using indigenous species. 	



Project phase	Operational, Maintenance and Decommissioning Phases
Impact Summary	Loss of floral habitat, species and SCC
Proposed mitigation and management measures:	
Development footprint	
<ul style="list-style-type: none"> - No additional habitat is to be disturbed during the operational phase of the development; - No vehicles are allowed to indiscriminately drive through sensitive habitat and natural areas; - Upon completion of construction activities and decommissioning of temporary access roads or infrastructure, all impacted and disturbed areas should be ripped, reprofiled and reseeded with indigenous species from the region that will assist to stabilise soils as soon as possible; - Where formal landscaped gardens are envisioned, use should be made of indigenous species; and - No dumping of litter or garden refuse must be allowed on-site. As such it is advised that vegetation cuttings from landscaped areas be carefully collected and disposed of at a separate waste facility. 	
Floral SCC	
<ul style="list-style-type: none"> - Monitoring of rescued and relocated floral SCC should continue during the operational and maintenance phase until it is evident that the species have successfully established; - No collection of floral SCC or medicinal floral species within the study area or adjacent natural habitat must be allowed during the operational phase of the Halfgewonnen Solar PV Project; and - Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC or suitable habitat for such species outside of the proposed development footprint. 	
Rehabilitation	
<ul style="list-style-type: none"> - All infrastructure footprints that will be decommissioned should be rehabilitated in accordance with a rehabilitation plan compiled by a suitable specialist; - All rehabilitated areas should be rehabilitated to a point where natural processes will allow the ecological functioning and biodiversity of the area to be re-instated as per the post-closure land-use objective; and - Rehabilitation efforts must be implemented for a period of at least five years after decommissioning. 	

6 CONCLUSION

Based on the results of the field investigation of February 2021, four broad habitat units were distinguished for the study area: Degraded and Transformed Habitat Unit, Eastern Highveld Grassland Habitat Unit, Secondary Grassland Habitat Unit, and Wetland Habitat Unit.

The data gathered during the site visit indicate that the Degraded and Transformed Habitat Unit is of **Low Sensitivity**, the Secondary Grassland Habitat Unit (where historically cultivated) of **Moderately Low Sensitivity**, the Degraded Wetland Habitat Unit and Secondary Grassland Habitat Unit (not historically cultivated, but fragmented and impacted by edge effects) of **Intermediate Sensitivity**, and the Intact Wetland Habitat and Eastern Highveld Grassland Habitat Unit of **Moderately High Sensitivity**. The proposed Solar PV project activities will impact on these habitat units to varying degrees and is discussed in more detail throughout the report.

Prior to mitigation measures implemented, impact significance on floral habitat and diversity varies between **Low and Very low** for activities pertaining to the PV 1 Panels, **Medium-High** and **Medium-Low** for the PV 2 Panels, **Low** for additional infrastructure, and **Medium-Low** for the High-Voltage Line. With mitigation measures implemented, the direct and indirect impacts on the floral habitat and diversity for the study area can mostly be reduced to **Low and Very low** for activities pertaining to the PV 1 Panels, **Medium-Low** and **Low** for the PV



2 Panels, **Low** to **Very low** (additional infrastructure), and **Low** to **Very low** (High-Voltage Line).

Prior to mitigation measures implemented, impact significance on floral SCC varies between **Very low** for activities pertaining to the PV 1 Panels and Additional surface infrastructure, **Medium-Low** for the PV 2 Panels, and **Low** for the High-Voltage Line. With mitigation measures implemented, the direct and indirect impacts on the floral SCC for the study area can mostly be reduced to **Very low** significance ratings for activities pertaining to the PV 1 Panels and Additional surface infrastructure, **Medium-Low** for the PV 2 Panels, and **Low** to **Very low for the** High-Voltage Line.

It is the opinion of the ecologists that this study provides the relevant information required to implement Integrated Environmental Management (IEM) and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.



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APPENDIX A: Floral Method of Assessment

Floral Species of Conservation Concern Assessment

Prior to the site visit, a record of floral SCC and their habitat requirements was developed for the study area, which includes consulting the National Web-based Environmental Screening Tool. Because not all SCC have been included in the Screening Tool layers (e.g., NT and DD taxa), it remains important for the specialist to be on the lookout for additional SCC. For this study, two primary sources were consulted and are described below.

The National Web-Based Environmental Screening Tool

The Screening Tool was accessed to obtain a list of potentially occurring species of conservation concern for the study area. Each of the themes in the Screening Tool consists of theme-specific spatial datasets which have been assigned a sensitivity level namely, “*low*”, “*medium*”, “*high*” and “*very high*” sensitivity. The four levels of sensitivity are derived and identified in different ways, e.g., for **confirmed** areas of occupied habitat for SCC a Very High and High Sensitivity is assigned and for areas of suitable habitat where SCC may occur based on spatial models only, a Medium Sensitivity is assigned. The different sensitivity ratings pertaining to the Plant [and Animal] Protocols are described below⁹:

- **Very High:** Habitat for species that are endemic to South Africa, where all the known occurrences of that species are within an area of 10 km² are considered Critical Habitat, as all remaining habitat is irreplaceable. Typically, these include species that qualify under Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) D criteria of the IUCN or species listed as Critically/ Extremely Rare under South Africa’s National Red List Criteria. For each species reliant on a Critical Habitat, all remaining suitable habitat has been manually mapped at a fine scale.
- **High:** Recent occurrence records for all threatened (CR, EN, VU) and/or rare endemic species are included in the high sensitivity level. Spatial polygons of suitable habitat have been produced for each species by intersecting recently collected occurrence records (those collected since the year 2000) that have a spatial confidence level of less than 250 m with segments of remaining natural habitat.
- **Medium:** Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. Two types of spatial models have been included. The first is a simple rule-based habitat suitability model where habitat attributes such as vegetation type and altitude are selected for all areas where a species has been recorded to occur. The second is a species distribution model which uses species occurrence records combined with multiple environmental variables to quantify and predict areas of suitable habitat. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed. A probability threshold of 75% for suitable habitat has been used to convert the modelled probability surface and reduce it into a single spatial area which defines areas that fall within the medium sensitivity level.
- **Low:** Areas where no SCC are known or expected to occur.

⁹ More details on the use of the Screening Tool for Species of Conservation Concern can be found in the below resources:

- South African National Biodiversity Institute (SANBI). 2020. Draft Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.0.
- The National Web based Environmental Screening Tool website:
<https://screening.environment.gov.za/screeningtool/#/pages/welcome>



BRAHMS Online Website

The Botanical Database of Southern Africa (BODATSA) is accessed to obtain plant names and floristic details (<http://posa.sanbi.org/>) for species of conservation concern within a selected boundary;

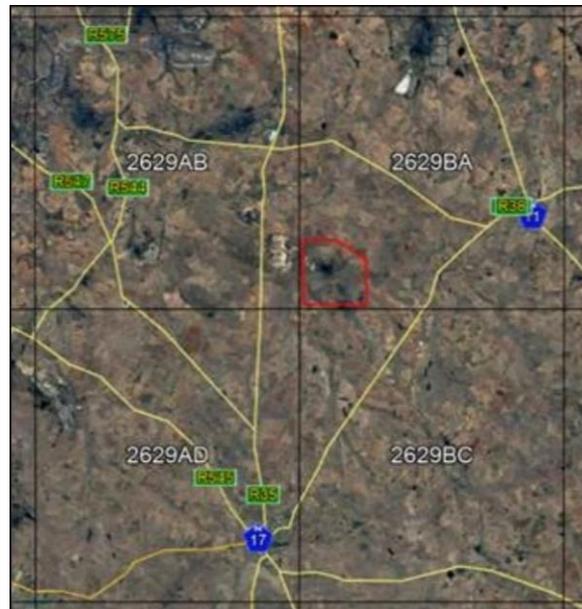
- This website provides access to South African plant names (taxa), specimens (herbarium sheets) and observations of plants made in the field (botanical records). Data is obtained from the Botanical Database of Southern Africa (BODATSA), which contains records from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH).
- Information on habitat requirements etc. is obtained from the SANBI Red List of South African Plants website (<http://redlist.sanbi.org/>).
- Typically, data is extracted for the Quarter Degree Square (QDS) in which the study area is situated but where it is deemed appropriate, a larger area can be included.

NEMBA TOPS Species

The National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEMBA) Threatened or Protected Species (TOPS) list (Government Gazette [GN] 29657, as amended in GN R1187 in Government Gazette 30568 of 2007 and again in GN 627 in Government Gazette 43386 of 2020) were taken into consideration.

MTPA Species Status Report

A list of threatened species for the QDS 2629BA, 2629AB, 2629BC and 2629AD was obtained from the Mpumalanga Tourism and Parks Agency (MTPA) due to the study area being very centrally located in these four QDS's (see below image). This list includes true recordings of species but does not provide exact localities due to the sensitive nature of such information.



Specially Protected and Protected Species

The Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA) provides a list of Protected Species (Schedule 11) (Section 69(1)(a) of the MNCA) and Specially Protected Species (Schedule 12) (Section 69(1)(b) of the MNCA) for the Mpumalanga Province. These species formed part of the SCC assessment.

Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

The Probability of Occurrence (POC) for each floral SCC is described:

- **“Confirmed”**: if observed during the survey;
- **“High”**: if within the species’ known distribution range and suitable habitat is available;
- **“Medium”**: if either within the known distribution range of the species or if suitable habitat is present; or
- **“Low”**: if the habitat is not suitable and falls outside the distribution range of the species.

Low POC	Medium POC	High POC	Confirmed
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The accuracy of the POC is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Floral Habitat Sensitivity

The floral habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral communities and provide an indication of the overall floristic ecological integrity, importance, and sensitivity of the habitat unit. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Floral SCC**: The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes**: The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region;
- **Conservation Status**: The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases. Whether the habitat is representative of a Critical Biodiversity Area or forms part of an Ecological Support Area is also taken into consideration;
- **Floral Diversity**: The recorded floral diversity compared to a suitable reference condition such as surrounding natural areas or available floristic databases; and
- **Habitat Integrity**: The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the floral habitat sensitivity class in which each habitat unit falls. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the habitat unit in question. To present the results use is made of spider diagrams to depict the significance of each aspect of floral ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:



Table A1: Floral habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimizing development potential.
≥3.5 <4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥4.5 ≤5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

Vegetation Surveys

When planning the timing of a floristic survey, it is important to remember that the primary objective is not an exhaustive species list but rather to ensure that sufficient data are collected to describe all the vegetation communities present in the area of interest, to optimise the detection of SCC and to assess habitat suitability for other potentially occurring SCC (SANBI, 2020).

The vegetation survey incorporates the subjective (or stratified) sampling method. Subjective sampling is a sampling technique in which the specialist relies on his or her own professional experience when choosing sample sites within the study area. This allows representative recordings of floral communities and optimal detection of SCC. Subjective sampling is used to consider different areas (or habitat units) which are identified within the main body of a habitat/study area.

One of the problems with random sampling, another popular sampling method, is that random samples may not cover all areas of a study area equally and thus increase the potential to miss floral SCC. Random sampling methods also tend to require more time in the field to locate the amount of SCC that can be detected using subjective sampling methods - In the context of an EIA where time constraints are often restrictive, priority needs to be given to collecting data in the shortest time possible without compromising the efficiency of locating SCC (SANBI, 2020).

Vegetation structure has been described following the guideline in Edwards (1983). Refer to Figure A1 below:



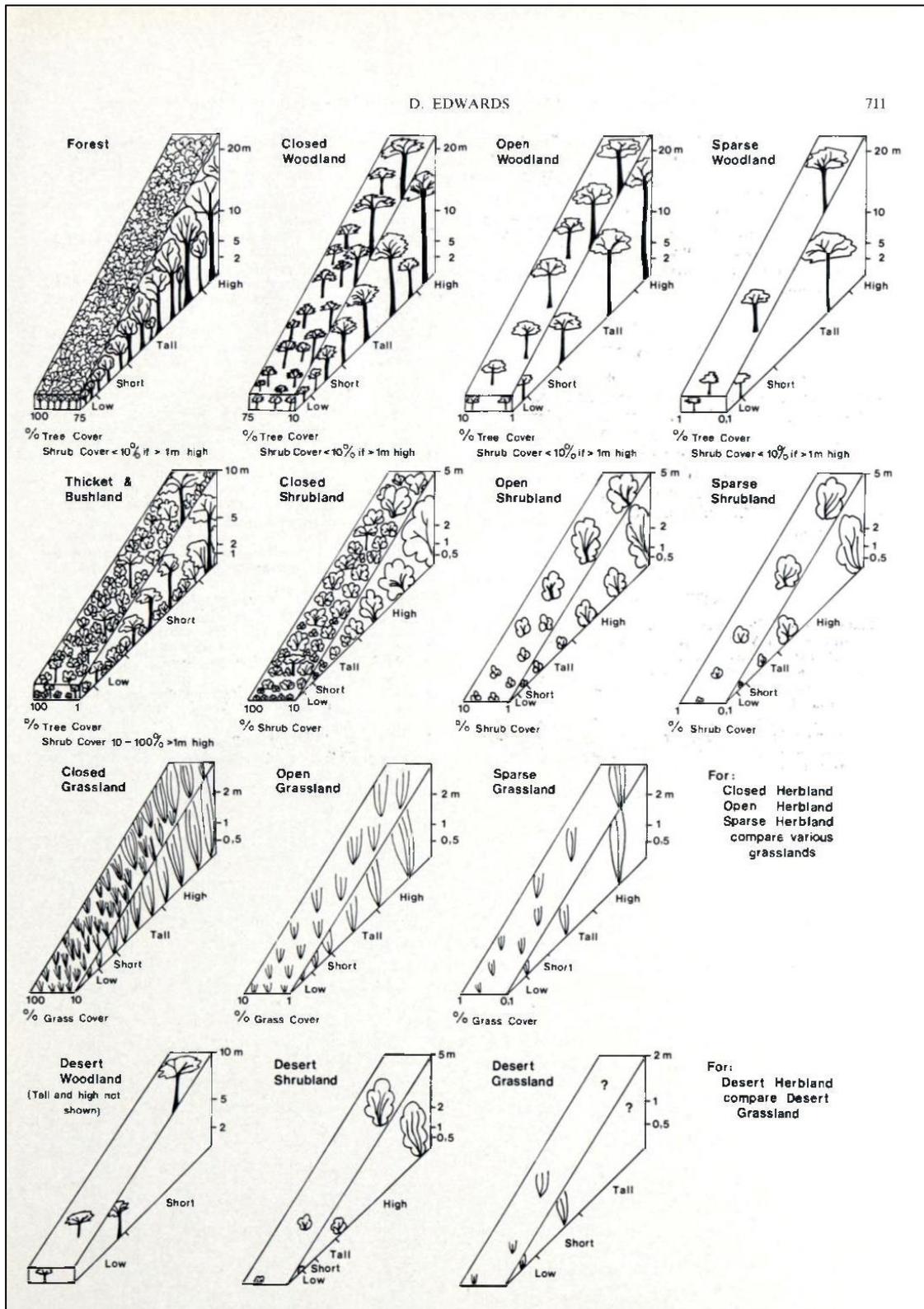


Figure A1: Diagrammatic representation of structural groups and formation classes. Only dominant growth forms are shown.



APPENDIX B: Floral SCC

South Africa uses the internationally endorsed [IUCN Red List Categories and Criteria](#) in the Red List of South African plants. This scientific system is designed to measure species' risk of extinction. The purpose of this system is to highlight those species that are most urgently in need of conservation action. Due to its strong focus on determining risk of extinction, the IUCN system does not highlight species that are at low risk of extinction but may nonetheless be of high conservation importance. Because the Red List of South African plants is used widely in South African conservation practices such as systematic conservation planning or protected area expansion, we use an amended system of categories designed to highlight those species that are at low risk of extinction but of conservation concern.

Definitions of the national Red List categories

Categories marked with ^N are non-IUCN, national Red List categories for species not in danger of extinction but considered of conservation concern. The IUCN equivalent of these categories is Least Concern (LC).

- **Extinct (EX)** A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.
- **Extinct in the Wild (EW)** A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.
- **Regionally Extinct (RE)** A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
- **Critically Endangered, Possibly Extinct (CR PE)** Possibly Extinct is a special tag associated with the category Critically Endangered, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered.
- **Critically Endangered (CR)** A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
- **Endangered (EN)** A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
- **Vulnerable (VU)** A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
- **Near Threatened (NT)** A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable and is therefore likely to become at risk of extinction in the near future.
- ^N**Critically Rare** A species is Critically Rare when it is known to occur at a single site but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
- ^N**Rare** A species is Rare when it meets at least one of four South African criteria for rarity but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows:
 - Restricted range: Extent of Occurrence (EOO) <500 km², OR
 - Habitat specialist: Species is restricted to a specialized microhabitat so that it has a very small Area of Occupancy (AOO), typically smaller than 20 km², OR
 - Low densities of individuals: Species always occurs as single individuals or very small subpopulations (typically fewer than 50 mature individuals) scattered over a wide area, OR
 - Small global population: Less than 10 000 mature individuals.
- **Least Concern (LC)** A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.



- **Data Deficient - Insufficient Information (DDD)** A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required, and that future research could show that a threatened classification is appropriate.
- **Data Deficient - Taxonomically Problematic (DDT)** A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
- **Not Evaluated (NE)** A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed and given a national Red List status. However, some species included in [Plants of southern Africa: an online checklist](#) are species that do not qualify for national listing because they are naturalized exotics, hybrids (natural or cultivated), or synonyms. These species are given the status Not Evaluated and the reasons why they have not been assessed are included in the assessment justification.

POC for RDL Floral SCC obtained from BODATSA, the Online National Environmental Screening Tool as well as from the MTPA Species Status Report

Table B1: Red Data Listed plant species recorded in the QDS 2629AB. Species list obtained from the new Plants of southern Africa (new POSA) online catalogue. Additional species were obtained from the National Web Based Screening Tool as well as the MTPA Species Status¹⁰ report for the QDS 2629BA, 2629AB, 2629BC and 2629AD. Information on species distributions and conservation status were derived from the Red List of South African Plants website (<http://redlist.sanbi.org/index.php>).

SCIENTIFIC NAME	POC	HABITAT AND DIAGNOSTIC CHARACTERISTICS	CONSERVATION STATUS
Species obtained from the new Plants of southern Africa (new POSA) online catalogue			
<i>Khadia carolinensis</i>	Medium	<p>Indigenous; South African endemic</p> <p><u>Provincial distribution:</u> Mpumalanga <u>Major habitats:</u> Steenkampsberg Montane Grassland, Eastern Highveld Grassland, Rand Highveld Grassland <u>Description:</u> Well-drained, sandy loam soils among rocky outcrops, or at the edges of sandstone sheets, Highveld Grassland, 1700 m.</p> <p><u>Suitable habitat within the study area:</u> Eastern Highveld Grassland Habitat Unit.</p> <p><u>Population trend:</u> Stable <u>Population size / info:</u> Coal reserves are found underneath the sandstones on which this species is found. Coal mining has had a small impact to date, but within the last five years many new applications for coal mining has been received. Should these applications be granted (and many more are likely to come in within the next few years), the habitat will be severely impacted by open cast mining. We estimate that up to 45% of the range (EOO) of this species could be destroyed within the next 10-20 years should the current applications go ahead.</p>	VU

¹⁰ Information provided by the Mpumalanga Tourism and Parks Agency on Thursday, 05 November 2020.



SCIENTIFIC NAME	POC	HABITAT AND DIAGNOSTIC CHARACTERISTICS	CONSERVATION STATUS
National Web based Environmental Screening Tool Results			
<i>Pachycarpus suaveolens</i>	Medium (burn frequency of the grassland might restrict its occurrence within the study area)	<p>Indigenous; Not endemic to South Africa</p> <p><u>Provincial distribution:</u> KwaZulu-Natal, Mpumalanga <u>Major habitats:</u> Soweto Highveld Grassland, Steenkampsberg Montane Grassland, Eastern Highveld Grassland, Rand Highveld Grassland <u>Description:</u> Short or annually burnt grasslands, 1400-2000 m.</p> <p><u>Suitable habitat within the study area:</u> Eastern Highveld Grassland Habitat Unit.</p> <p><u>Population trend:</u> Decreasing <u>Population size / info:</u> A minimum of a 25% decline over the past three generations (75 years) is suspected based on a number of studies that report: high volumes of plants traded in muthi markets; harvesters reporting that plants are becoming scarce; and overall decreases in the average size of bulbs traded. <i>Merwillia plumbea</i> (formerly <i>Scilla natalensis</i>) is a highly sought-after species that has been exploited over most of its range.</p>	VU
		<p>Indigenous; South African endemic</p> <p><u>Provincial distribution:</u> KwaZulu-Natal, Mpumalanga <u>Major habitats:</u> Long Tom Pass Montane Grassland, Steenkampsberg Montane Grassland, KaNgwane Montane Grassland, Wakkerstroom Montane Grassland, Eastern Highveld Grassland. <u>Description:</u> Wetlands or marshes in high altitude grassland that remain wet throughout the year or dry out for only a short period.</p> <p><u>Suitable habitat within the study area:</u> Intact Wetland Habitat</p> <p><u>Population trend:</u> Decreasing <u>Population size / info:</u> A widespread (EOO <19 940 km²), but rare (AOO <2000 km²) habitat specialist, estimated to remain at between six and ten locations and declining due to severe ongoing habitat loss and degradation. This species' habitat is becoming increasingly rare due to ongoing loss and degradation. The main threat is damming of streams feeding into wetlands as well as wetland drainage for agriculture. Due to widespread habitat loss and degradation, it is likely that only a few subpopulations remain, and decline is ongoing.</p>	
Sensitive species¹¹ 41	High (flowers in October – November so outside of the site assessment date)	<p>Indigenous; South African endemic</p> <p><u>Provincial distribution:</u> Free State, Gauteng, Mpumalanga, North West <u>Major habitats:</u> Ithala Quartzite Sourveld, Soweto Highveld Grassland, Frankfort Highveld Grassland, Steenkampsberg Montane Grassland, Sekhukhune Montane Grassland, Paulpietersburg Moist Grassland, Eastern Highveld</p>	VU

¹¹ As per the best practice guideline that accompanies the protocol and screening tool, please, remember that the name of the sensitive species may not appear in the final EIA report nor any of the specialist reports released into the public domain. It should be referred to as sensitive plant or sensitive animal and its threat status may be included, e.g., critically endangered sensitive plant or endangered sensitive animal.



SCIENTIFIC NAME	POC	HABITAT AND DIAGNOSTIC CHARACTERISTICS	CONSERVATION STATUS
		<p>Grassland, Rand Highveld Grassland, Western Highveld Sandy Grassland</p> <p><u>Description:</u> Undulating grasslands in damp areas. It occurs in rocky grassland in large colonies in eastern Gauteng and western Mpumalanga, in heavy clay soil associated with dolomitic limestone outcrops (Craib, 2002). The plants grow in full sun in damp depressions, near pans or on the edges of streams; grassland, riverbanks, vleis.</p> <p><u>Suitable habitat within the study area:</u> Intact Wetland Habitat</p> <p><u>Population trend:</u> Decreasing</p> <p><u>Population size / info:</u> EOO between 445 and 11 158 km² and suspected to occur at fewer than 10 locations. It has lost habitat to crop cultivation in the past. It is currently threatened by ongoing degradation and habitat loss due to overgrazing and urban development.</p>	
MTPA Species Status Report Results: Species with known records within 5 km of the study area			
<i>Eucomis autumnalis</i>	Confirmed	<p>FSA; Not endemic to South Africa</p> <p><u>Provincial distribution:</u> Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West.</p> <p><u>Major habitats:</u> Grassland.</p> <p><u>Description:</u> Damp, open grassland and sheltered places from the coast to 2450 m.</p> <p><u>Suitable habitat within the study area:</u> Intact Wetland Habitat</p> <p><u>Population trend:</u> Decreasing</p> <p><u>Population size / info:</u> Has experienced large population declines and is a very popular medicinal plant. Because of its very widespread distribution, however, it wasn't felt that the decline was sufficient to qualify as NT.</p>	<p>LC</p> <p>Provincial: Declining</p>
<i>Kniphofia albescens</i>	Medium	<p>Indigenous; South African endemic</p> <p><u>Provincial distribution:</u> KwaZulu-Natal, Mpumalanga</p> <p><u>Major habitats:</u> Terrestrial</p> <p><u>Description:</u> It grows on dense grassland mountain slopes, marshy places, from Natal to southern Transvaal, in altitudes between 1300 and 2000 m. It flowers January to May.</p> <p><u>Suitable habitat within the study area:</u> Intact Wetland Habitat and the Eastern Highveld Grassland Habitat Unit</p> <p><u>Population trend:</u> Stable</p> <p><u>Population size / info:</u> N/A</p>	LC
MTPA Species Status Report Results: Species with known records within 30 km of the study area			
<i>Boophone disticha</i>	High	<p>Indigenous; Not endemic to South Africa</p> <p><u>Provincial distribution:</u> Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West, Western Cape.</p> <p><u>Major habitats:</u> Terrestrial.</p> <p><u>Description:</u> Dry grassland and rocky areas.</p> <p><u>Suitable habitat within the study area:</u> Eastern Highveld Grassland Habitat Unit. Was recorded in grassland outside of the study area.</p> <p><u>Population trend:</u> Decreasing</p>	LC



SCIENTIFIC NAME	POC	HABITAT AND DIAGNOSTIC CHARACTERISTICS	CONSERVATION STATUS
		<u>Population size / info:</u> Species assessed as Declining in South Africa due to habitat loss in KwaZulu-Natal and Gauteng provinces and because trade volumes suggest unsustainable harvesting, especially because large, reproductive individuals are being removed. The species is, however, long-lived, widely distributed and can recolonize new sites due to its tumbleweed-like inflorescence.	
<i>Brachycorythis conica</i> subsp <i>transvaalensis</i>	High	Indigenous; South African endemic <u>Provincial distribution:</u> Gauteng, Limpopo, Mpumalanga. <u>Major habitats:</u> Gold Reef Mountain Bushveld, Waterberg Mountain Bushveld, Loskop Mountain Bushveld, Andesite Mountain Bushveld, Waterberg-Magaliesberg Summit Sourveld, Eastern Highveld Grassland, Rand Highveld Grassland, Carletonville Dolomite Grassland. <u>Description:</u> Short, open grassland and wooded grassland, on sandy gravel overlying dolomite, sometimes also on quartzite, 1 000-1 705 m. <u>Suitable habitat within the study area:</u> Eastern Highveld Grassland Habitat Unit. <u>Population trend:</u> Decreasing <u>Population size / info:</u> No known living subpopulations of this orchid are currently protected in any formal conservation area. As per SANBI's recommendations for the mitigation of habitat loss to threatened species (Driver et al. 2009) we recommend no further loss of habitat until such time as another viable subpopulation of this orchid can be found. Formal protection in terms of the National Environmental Management: Protected Areas Act (Act 57 of 2003) is recommended for the only currently known extant subpopulation.	CR
<i>Crinum bulbispermum</i>	High (<i>Crinum</i> species were encountered on site, but lacked the diagnostic characteristics to make a positive ID)	FSA; Not endemic to South Africa <u>Provincial distribution:</u> Free State, Gauteng, KwaZulu-Natal, Mpumalanga, Northern Cape, North West. <u>Major habitats:</u> Grassland, Savanna. <u>Description:</u> Near rivers, streams, seasonal pans and in damp depressions. <u>Suitable habitat within the study area:</u> Intact Wetland Habitat <u>Population trend:</u> Decreasing <u>Population size / info:</u> Localized declines in subpopulations have been observed for this species. It is a long-lived bulb and is regularly found in medicinal plant markets, harvesting is probably causing a continuing decline. However it is still common enough to obviate listing as NT.	LC Provincial: Declining
<i>Drimia elata</i> (previously <i>Drimia robusta</i>)	Medium	Indigenous; Not endemic to South Africa <u>Provincial distribution:</u> Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West. <u>Major habitats:</u> Terrestrial. <u>Description:</u> In grassland, often among rocks. <u>Suitable habitat within the study area:</u> Eastern Highveld Grassland Habitat Unit. <u>Population trend:</u> No information provided. <u>Population size / info:</u> No information provided.	DDT Muthi importance
<i>Gladiolus robertsoniae</i>	High	Indigenous; South African endemic	NT



SCIENTIFIC NAME	POC	HABITAT AND DIAGNOSTIC CHARACTERISTICS	CONSERVATION STATUS
	(flowers October – December, outside of site assessment date)	<p><u>Provincial distribution</u>: Free State, Gauteng, Mpumalanga. <u>Major habitats</u>: Grassland. <u>Description</u>: Moist highveld grasslands, found in wet, rocky sites, mostly dolerite outcrops. Corms are wedged in rock crevices. Restricted to seeps and streambanks where moisture is available at the end of the dry season.</p> <p><u>Suitable habitat within the study area</u>: Intact Wetland Habitat and the Eastern Highveld Grassland Habitat Unit</p> <p><u>Population trend</u>: Decreasing <u>Population size / info</u>: EOO 12 783 km², between 10 and 20 locations continue to decline due to ongoing habitat degradation as a result of mining and overgrazing by livestock. Subpopulations are large and not severely fragmented.</p>	
<i>Hypoxis hemerocallidea</i>	Confirmed	<p>Indigenous; Not endemic to South Africa</p> <p><u>Provincial distribution</u>: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, North West. <u>Major habitats</u>: Albany Thicket, Grassland, Indian Ocean Coastal Belt, Savanna <u>Description</u>: It occurs in a wide range of habitats, including sandy hills on the margins of dune forests, open, rocky grassland, dry, stony, grassy slopes, mountain slopes and plateaus. It appears to be drought and fire tolerant.</p> <p><u>Suitable habitat within the study area</u>: Eastern Highveld Grassland Habitat Unit.</p> <p><u>Population trend</u>: Decreasing <u>Population size / info</u>: This species is naturally widespread and abundant, and in spite of extensive volumes of wild harvesting, is still considered common across most of its range. Monitoring is however needed to gain a better understanding of the impact of harvesting on the risk of extinction of this species.</p>	LC
<i>Kniphofia typhoides</i>	Low (soils were not suitable)	<p>Indigenous; South African endemic</p> <p><u>Provincial distribution</u>: Gauteng, Limpopo, Mpumalanga, North West. <u>Major habitats</u>: Grassland. <u>Description</u>: Low lying wetlands and seasonally wet areas in climax Themeda triandra grasslands on heavy black clay soils, tends to disappear from degraded grasslands.</p> <p><u>Suitable habitat within the study area</u>: No suitable habitat</p> <p><u>Population trend</u>: Decreasing <u>Population size / info</u>: A survey of the range of this species by C. Craib reported extensive declines in the population in the last 30 years as a result of habitat loss to coal mining, overgrazing by cattle, urban expansion (especially in Gauteng), crop cultivation in the eastern North West Province and alien plant invasion in western Mpumalanga and North West Province. The full extent of the decline is unknown but is suspected to be over 25%.</p>	NT

CR = Critically Endangered; DDT = Data Deficient - Taxonomically Problematic; EN = Endangered; FSA = Flora of Southern Africa region; LC = Least Concern; VU = Vulnerable



NEMBA TOPS List for South Africa¹²

Table B2: TOPS list for South Africa – plant species.

NEMBA TOPS LIST (PLANT SPECIES)				
Scientific Name	Common Name	POC	Provincial Distribution	Conservation Status
<i>Adenia wilmsii</i>	No common name	Low	Provincial distribution: Mpumalanga Range: Lydenburg to Waterval Boven Description: Dolerite outcrops or red loam soil, in open woodland, 1300-1500 m.	EN; P
<i>Adenium swazicum</i>	Swaziland Impala Lily	Low	Range: Kruger National Park to Swaziland along the Lebombo Mountains and adjacent areas in south-western Mozambique.	VU
<i>Adenium swazicum</i>	Swaziland Impala Lily	Low	Provincial distribution: Mpumalanga	VU
<i>Aloe albida</i>	Grass Aloe	Low	Provincial distribution: Mpumalanga Range: Aloe albida has a restricted range in the mountains south of Barberton, Mpumalanga, extending to Malolotja in north-western Swaziland.	NT
<i>Aloe pillansii</i> (now <i>Alloidendron pillansii</i>)	False Quiver Tree	Low	Provincial distribution: Northern Cape Range: Richtersveld and southern Namibia.	EN
<i>Aloe simii</i>	No common name	Low	Provincial distribution: Mpumalanga Range: This species is endemic to a small area in the transition area between the Mpumalanga Lowveld and Escarpment, where it occurs from Sabie southwards to White River and around Nelspruit. Description: It occurs along drainage lines and in wetlands in open woodland and grassland, 600-1100 m.	EN; P
<i>Clivia mirabilis</i>	"Oorlogskloof Bush Lily	Low	Provincial distribution: Northern Cape, Western Cape	VU; P
<i>Diaphanathe millarii</i>	Tree Orchid	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal Range: East London and Durban.	VU
<i>Disa macrostachya</i>	No common name	Low	Provincial distribution: Northern Cape	EN; P
<i>Disa nubigena</i>	No common name	Low	Provincial distribution: Western Cape	Rare; P
<i>Disa physodes</i>	No common name	Low	Provincial distribution: Western Cape	CR; P
<i>Disa procera</i>	No common name	Low	Provincial distribution: Western Cape	EN; P
<i>Disa sabulosa</i>	No common name	Low	Provincial distribution: Western Cape	EN; P
<i>Encephalartos aemulans</i>	Ngotshe Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
<i>Encephalartos altensteinii</i>	Bread Palm	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
<i>Encephalartos arenarius</i>	Dune Cycad	Low	Provincial distribution: Eastern Cape	EN
<i>Encephalartos brevifoliolatus</i>	Escarpment Cycad	Low	Provincial distribution: Limpopo	EW
<i>Encephalartos caffer</i>	Breadfruit Tree	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
<i>Encephalartos cerinus</i>	Waxen Cycad	Low	Provincial distribution: KwaZulu-Natal	CR

¹² National Environmental Management: Biodiversity Act 10 of 2004 - Threatened or Protected Species Regulations, 2007. Government Notice R152 in Government Gazette 29657 dated 23 February 2007. Commencement date: 1 June 2007 [GN R150, Gazette no. 29657], as amended.



NEMBA TOPS LIST (PLANT SPECIES)				
Scientific Name	Common Name	POC	Provincial Distribution	Conservation Status
<i>Encephalartos cupidus</i>	Blyde River Cycad	Low	Provincial distribution: Limpopo, Mpumalanga Description: Grassland, on steep, rocky slopes or cliffs and sometimes near seepage areas bordering gallery forests.	CR
<i>Encephalartos dolomiticus</i>	Wolkberg Cycad	Low	Provincial distribution: Limpopo	CR
<i>Encephalartos dyerianus</i>	Lowveld Cycad	Low	Provincial distribution: Limpopo	CR; P
<i>Encephalartos eugene-maraisii</i>	Waterberg Cycad	Low	Provincial distribution: Limpopo	EN
<i>Encephalartos friderici-guilielmi</i>	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
<i>Encephalartos ghellinckii</i>	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
<i>Encephalartos heenanii</i>	Woolly Cycad	Low	Provincial distribution: Mpumalanga Description: Open areas of montane grasslands amidst scarp forest in deep valleys and ravines.	CR
<i>Encephalartos hirsutus</i>	Venda Cycad	Low	Provincial distribution: Limpopo	CR
<i>Encephalartos horridus</i>	Eastern Cape Blue Cycad	Low	Provincial distribution: Eastern Cape	EN
<i>Encephalartos humilis</i>	No common name	Low	Provincial distribution: Mpumalanga Description: Montane and mistbelt grassland, rocky sandstone slopes.	VU; P
<i>Encephalartos inopinus</i>	Lydenburg Cycad	Low	Provincial distribution: Limpopo	CR
<i>Encephalartos laevifolius</i>	Kaapsehoop Cycad	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga Description: Steep, rocky slopes in mistbelt grassland, 1300-1500 m.	CR
<i>Encephalartos lanatus</i>	No common name	Low	Provincial distribution: Gauteng and western Mpumalanga Description: Sheltered, wooded ravines in sandstone ridges, 1200-1500 m.	NT; P
<i>Encephalartos latifrons</i>	Albany Cycad	Low	Provincial distribution: Eastern Cape	CR
<i>Encephalartos lebomboensis</i>	Lebombo Cycad	Low	Provincial distribution: KwaZulu-Natal, Mpumalanga Description: Cliffs and rocky ravines in savanna and grassland.	EN
<i>Encephalartos lehmannii</i>	No common name	Low	Provincial distribution: Eastern Cape	NT; P
<i>Encephalartos longifolius</i>	No common name	Low	Provincial distribution: Eastern Cape	NT; P
<i>Encephalartos middelburgensis</i>	Middelburg Cycad	Low	Provincial distribution: Gauteng, Mpumalanga Description: Open grasslands and in sheltered valleys.	CR
<i>Encephalartos msinganus</i>	Msinga, Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
<i>Encephalartos natalensis</i>	Natal Giant Cycad	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
<i>Encephalartos ngoyanus</i>	Ngoye Dwarf Cycad	Low	Provincial distribution: KwaZulu-Natal	VU
<i>Encephalartos nubimontanus</i>	Blue Cycad	Low	Provincial distribution: Limpopo	EW
<i>Encephalartos paucidentatus</i>	No common name	Low	Provincial distribution: Mpumalanga Description: Forest, occurs on steep rocky slopes and alongside streams in deep gorges.	VU; P
<i>Encephalartos princeps</i>	No common name	Low	Provincial distribution: Eastern Cape	VU; P
<i>Encephalartos senticosus</i>	No common name	Low	Provincial distribution: KwaZulu-Natal	VU; P
<i>Encephalartos transvenosus</i>	Modjadje Cycad	Low	Provincial distribution: Limpopo	LC; P
<i>Encephalartos trispinosus</i>	No common name	Low	Provincial distribution: Eastern Cape	VU; P
<i>Encephalartos woodii</i>	Wood's Cycad	Low	Provincial distribution: KwaZulu-Natal	EW



NEMBA TOPS LIST (PLANT SPECIES)				
Scientific Name	Common Name	POC	Provincial Distribution	Conservation Status
<i>Euphorbia clivicola</i>	No common name	Low	Provincial distribution: Limpopo	CR; P
<i>Euphorbia meloformis</i>	No common name	Low	Provincial distribution: Eastern Cape	NT; P
<i>Euphorbia obesa</i>	No common name	Low	Provincial distribution: Eastern Cape	EN; P
<i>Harpagophytum procumbens</i>	Devil's Claw	Low	Provincial distribution: Free State, Limpopo, Northern Cape, North West	LC; P
<i>Harpagophytum zeyherii</i>	Devil's Claw	Low	Provincial distribution: Gauteng, Limpopo, Mpumalanga, North West	LC; P
<i>Hoodia currorii</i>	Ghaap	Low	Provincial distribution: Limpopo	P
<i>Hoodia gordonii</i>	Ghaap	Low	Provincial distribution: Free State, Northern Cape, Western Cape	DDD; P
<i>Jubaeopsis caffra</i>	Pondoland Coconut	Low	Provincial distribution: Eastern Cape	EN
<i>Merwillia plumbea</i>	Blue Squill	Low	Provincial distribution: KwaZulu-Natal, Mpumalanga Major habitats: Grassland Description: Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes. 300-2500 m.	NT
<i>Newtonia hildebrandtii</i> var. <i>hildebrandtii</i>	Lebombo Wattle	Low	Provincial distribution: KwaZulu-Natal	Now LC
<i>Protea odorata</i>	Swartland Sugarbush	Low	Provincial distribution: Western Cape	CR; P
<i>Siphonochilus aethiopicus</i>	Wild Ginger	Low	Provincial distribution: KwaZulu-Natal, Limpopo, Mpumalanga Range: Sporadically from the Letaba catchment in the Limpopo Lowveld to Swaziland. Extinct in KwaZulu-Natal. Widespread elsewhere in Africa. Description: Tall open or closed woodland, wooded grassland or bushveld.	CR
<i>Stangeria eriopus</i>	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
<i>Warburgia salutaris</i>	Pepper-bark Tree	Low	Provincial distribution: KwaZulu-Natal, Limpopo, Mpumalanga Range: North-eastern KwaZulu-Natal, Mpumalanga and Limpopo Province. Also occurs in Swaziland, Mozambique and Zimbabwe and Malawi. Description: Variable, including coastal, riverine, dune and montane forest as well as open woodland and thickets.	EN
<i>Zantedeschia jucunda</i>	Yellow Arum Lilly	Low	Provincial distribution: Limpopo	VU

CR = Critically Endangered, EN = Endangered, EW = Extinct in the Wild, NT = Near Threatened, VU = Vulnerable, P = Protected, POC = Probability of Occurrence.



Provincially Protected Flora

Table B3: Schedule 11 - Protected Plants (Section 69 (1) (a)) of the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA).

SCHEDULE 11 - PROTECTED PLANTS		
Common Name	Scientific Name	POC
All species of trees ferns, excluding the bracken fern	All species of the Genus: <i>Cyathea capensis</i> and <i>Cyathea dregei</i>	Low
All species of Cycads in Republic of South Africa and the seedling of the species of Cycads referred to in schedule 12	All species of the family Zamiaceae occurring in the Republic of South Africa and the seedlings of the species of <i>Encephalartos</i> referred to in Schedule 12	Low
All species of yellow wood	<i>Podocarpus</i> spp.	Low
All species of arum lilies	<i>Zantedeschia</i> spp.	Low
"Volstruiskom"	<i>Schizobasis intricata</i> (now <i>Drimia intricata</i>)	Medium
"Knoklimop"	<i>Bowiea volubilis</i>	Low
All species of red-hot poker	<i>Kniphofia</i> spp.	Medium
All species of Aloes, excluding: (a) All species not occurring in Mpumalanga and (b) The following species: all species of haworthias all species of <i>Agapanthus</i> all species of squill	Aloe spp., excluding: (a) All species not occurring in Mpumalanga (b) The following species: <i>Haworthia</i> spp. <i>Agapanthus</i> spp. <i>Scilla</i> spp. Suitable habitat is available for <i>Aloe ecklonis</i> within the Moist Grassland Habitat Unit. This species can tolerate disturbed conditions. <i>Aloe bergeriana</i> was recorded on site within the Eastern Highveld Grassland Habitat Unit.	Confirmed
All species of pineapple flower	<i>Eucomis</i> spp. <i>Eucomis autumnalis</i> was recorded within the Intact Wetland Habitat Unit.	Confirmed
All species of <i>dracaena</i>	<i>Dracaena</i> spp.	Low
All species of paint brush	<i>Haemanthus</i> spp. and <i>Scadoxys</i> spp. <i>Boophane disticha</i>	Low
Cape poison bulb	Recorded just outside of the study area within the Eastern Highveld Grassland Habitat Unit	High
All species of <i>Clivia</i>	<i>Clivia</i> spp.	Low
All species of <i>Brunsvigia</i>	<i>Brunsvigia</i> spp.	Low
All species of <i>Crinum</i>	<i>Crinum</i> spp. Suitable habitat is available for three species in this genus, namely <i>Crinum bulbispermum</i> , <i>Crinum graminicola</i> and <i>Crinum macowanii</i> . Only <i>Crinum bulbispermum</i> has known locality records within the area and is likely to be the species encountered within the Wetland Habitat Unit on site.	Confirmed
Ground lily	<i>Ammocharis coranica</i>	Low
All species of fire lily	<i>Cyrtanthus</i> spp.	Medium
River lily	<i>Hesperantha coccinea</i>	Medium
All species of <i>Watsonia</i>	<i>Watsonia</i> spp. <i>Gladiolus</i> spp.	Low
all species of gladioli	Two species of Gladioli were recorded on site. <i>Gladiolus elliotii</i> was recorded within the Wetland Habitat Unit (suitable conditions available in the Eastern Highveld Grassland Habitat Unit) and <i>Gladiolus crassifolius</i> in the Eastern Highveld Grassland Habitat Unit. More species of Gladioli, such as <i>Gladiolus robertsoniae</i> , <i>Gladiolus permeabilis</i> , and <i>Gladiolus papilio</i> (known locality records within the area) are likely to be present due to suitable habitat.	Confirmed
Wild ginger	<i>Siphonochilus aethiopicus</i>	Low



SCHEDULE 11 - PROTECTED PLANTS		
Common Name	Scientific Name	POC
All species of orchids	All species of the family Orchidaceae	High
All species of the family Proteaceae	All species of the family Proteaceae	Low
All species of black stinkwood	<i>Ocotea spp.</i>	Low
Kiaat	<i>Pterocarpus angolensis</i>	Low
Tamboi	<i>Spirostachys africana</i>	Low
The following species of <i>Euphorbia</i> : <i>Euphorbia bernardii</i> and <i>Euphorbia grandialata</i>	The following species of euphorbias: <i>Euphorbia bernardii</i> and <i>Euphorbia grandialata</i>	Low
Common bersama	<i>Bersama tysoniana</i>	Low
Red ivory	<i>Berchemia zeyheri</i>	Low
Pepperbark tree	<i>Warburgia salutaris</i>	Low
All species of <i>Adenia</i>	<i>Adenia spp.</i>	Low
Bastard onion wood	<i>Cassipourea gerrardii</i>	Low
Assegai tree	<i>Curtisia dentata</i>	Low
All species of olive trees	All species of the Genus <i>Olea</i>	Low
All species of impala lilies	All species of the Genus <i>Adenium</i>	Low
Kudu lily	<i>Pachypodium saundersii</i>	Low
All species of <i>Brachystelma</i>	<i>Brachystelma spp.</i>	Medium
All species of <i>Ceropegia</i>	<i>Ceropegia spp.</i>	Low
All species of <i>Huerniopsis</i> and <i>Huernia</i>	<i>Huerniopsis</i> and <i>Huernia spp.</i>	Low
All species of <i>Duvalia</i>	<i>Duvalia spp.</i>	Low
All species of <i>Stapeliads</i>	<i>Stapelia spp.</i>	Low
All species of <i>Orbeanthus</i>	<i>Orbeanthus spp.</i>	Low
All species of <i>Orbeas</i>	<i>Orbea spp.</i>	Low
All species of <i>Orbeopsis</i>	<i>Orbeopsis spp.</i>	Low

Table B4: Schedule 12 - Specially Protected Plants (Section 69 (1) (b)) of the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA).

SCHEDULE 12 - SPECIALLY PROTECTED PLANTS		
Common Name	Scientific Name	POC
(a) All plants, excluding seedlings, of the following species of cycads within the genus <i>Encephalartos</i> : <i>dolomiticus</i> , <i>dyer</i> , <i>middleburg</i> , <i>eugene marais</i> , <i>heenan</i> , <i>inopinus</i> , <i>laevifolius</i> , <i>lanatus</i> , <i>lebombo</i> , <i>ngoyanus</i> , <i>paucidentatus</i> , <i>modjadje</i> and <i>villosus</i>	(a) All plants, excluding seedlings, of the following species of the Genus <i>Encephalartos</i> : <i>E. dolomiticus</i> , <i>E. dyerianus</i> , <i>E. middleburgensis</i> , <i>E. eugene maraissii</i> , <i>E. heenanii</i> , <i>E. inopinus</i> , <i>E. laevifolius</i> , <i>E. lanatus</i> , <i>E. transvenosus</i> and <i>E. villosus</i> and many species derived from the above species (b) All plants of the following species of the Genus <i>Encephalartos</i> : <i>E. cupids</i> and <i>E. humilus</i> (c) All plants of the Genus <i>Encephalartos</i> in their natural habitat	Low
(b) All plants of the following species of cycad within the <i>Encephalartos</i> genus: <i>cupidus</i> and <i>humilus</i>		
(c) all species of cycads in their natural habitat		



APPENDIX C: Floral Species List

Table C1: Dominant floral species encountered during the field assessment. Alien species identified during the field assessment are indicated with an asterisk (*). Species protected under the Mpumalanga Nature Conservation Act are emboldened. Species abundance is indicated in the below table, e.g., where a certain species was notably, and unexpectedly, more abundant within a habitat unit compared to other occurring species, they are indicated with “XX”.

Scientific name	Degraded and Transformed Habitat	Wetland: Transitioning to terrestrial habitat	Wetland: More frequently, to permanently, inundated habitat	Wetland: Degraded	EH Grassland: Prominent Rocky Outcrops	EH Grassland: Primary Grassland Habitat	Secondary Grassland
WOODY SPECIES							
<i>*Eucalyptus sp.</i>	X						
<i>*Persicaria limbata</i>			X				
<i>*Phytolacca octandra</i>	X						X
<i>*Salix babylonica</i>			X				
<i>Anthospermum rigidum</i> (likely subsp. <i>rigidum</i>)					X	X	
<i>Clutia cf. affinis</i>		X					X
<i>Diospyros austro-africana</i>					X		
<i>Diospyros lycioides</i>					X		
<i>Gomphocarpus fruticosus</i>	X	X		XX			
<i>Indigofera cf. filipes</i>					X		
<i>Lippia javanica</i>		X					
<i>Pearsonia cajanifolia</i>					X		
<i>Pearsonia sessilifolia</i>					X		
<i>Pollichia campestris</i>					X		
<i>Seriphium plumosum</i>		X		X		X	XX
<i>Ziziphus zeyheriana</i>					X	X	
FORB SPECIES							
<i>*Campuloclinium macrocephalum</i>		X	X			X	
<i>*Centella asiatica</i>		X	X				
<i>*Cirsium vulgare</i>		X	X				X
<i>*Cosmos bipinnatus</i>	X (and fences)						
<i>*Cuscuta campestris</i>		X		X			
<i>*Datura stramonium</i>	X						X
<i>*Erigeron sp.</i>	X	X	X	X			
<i>*Gomphrena celosioides</i>	X						X
<i>*Hibiscus trionum</i>	X	X					X
<i>*Hypochoeris radicata</i>		X		XX			



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<i>*Oenothera rosea</i>		X					
<i>*Oenothera tetraptera</i>	X						X
<i>*Oxalis corniculata</i>		X		X			
<i>*Plantago lanceolata</i>							
<i>*Plantago major</i>				X			
<i>*Raphanus raphanistrum</i>	X						
<i>*Richardia brasiliensis</i>	X			X			XX
<i>*Rumex acetosella</i>		X					
<i>*Schkuhria pinnata</i>							X
<i>*Solanum sisymbriifolium</i>	X						
<i>*Tagetes minuta</i>	XX						
<i>*Verbena bonariensis</i>	X	X	X	X			X
<i>Aponogeton junceus</i>			X				
<i>Berkheya cf. rigida</i>	X			X		X	
<i>Berkheya radula</i>		X	X				
<i>Berkheya setifera</i>		X		X		X	X
<i>Boophone disticha</i>						X	
<i>Chaenostoma (Sutera) sp.</i>		X			X	X	
<i>Chamaecrista comosa</i>				X			
<i>Chironia purpurascens</i>		X	X				
<i>Chlorophytum fasciculatum</i>						X	
<i>Cleome monophylla</i>	XX			X			X
<i>Commelina africana</i>		XX	X		X	X	X
<i>Convolvulus sagittatus</i>				X		X	X
<i>Cordylogyne globosa</i>		X	X				
<i>Crabbea acaulis</i>					X	X	
Crinum sp. (MNCA)		X	X				
<i>Cucumis zeyheri</i>		X				X	X
<i>Cyanotis speciosa</i>					X	X	
<i>Cycnium tubulosum</i>		X					
<i>Dianthus mooiensis</i>		X				X	
<i>Dicoma anomala</i>					X	X	
Eucomis autumnalis (MNCA)		X	X				
Gladiolus crassifolius (MNCA)						X	
Gladiolus elliotii (MNCA)				X		X	
<i>Haplocarpha scaposa</i>		X				X	



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<i>Hebenstretia angolensis</i>					X	X	
<i>Helichrysum aureonitens</i>		X					
<i>Helichrysum caespitium</i>							XX
<i>Helichrysum callicomum</i>					XX		
<i>Helichrysum nudifolium var. nudifolium</i>		X		X		X	X
<i>Helichrysum nudifolium var. pilosellum</i>		X					
<i>Helichrysum rugulosum</i>						X	
<i>Hermannia depressa</i>						X	X
<i>Hermannia transvaalensis</i>					X	X	X
<i>Hibiscus microcarpus</i>							X
<i>Hilliardiella elaeagnoides</i>						X	
<i>Hypericum aethiopicum</i>						X	
<i>Hypoxis hemerocallidea</i>						X	
<i>Hypoxis iridifolia</i>						X	
<i>Hypoxis rigidula</i>					X	X	
<i>Indigofera comosa</i>						X	
<i>Ipomoea magnusiana</i>					X		
<i>Ipomoea ommanneyi</i>					X		
<i>Kyphocarpa angustifolia</i>						X	X
<i>Ledebouria cooperi</i>		X			X		
<i>Ledebouria ovatifolia</i>						X	
<i>Leobordea eriantha</i>						X	
<i>Lobelia flaccida</i>		XX	X				
<i>Lobelia sonderiana</i>		X	X				
<i>Merremia palmata</i>						X	
<i>Monopsis decipiens</i>		X	X				
<i>Monsonia attenuata (compare Monsonia burkeana)</i>						X	
<i>Nemesia fruticans</i>						X	X
<i>Nerine angustifolia (MNCA)</i>		X	X				
<i>Nidorella anomala</i>		X					
<i>Nidorella hottentotica</i>		X		XX			
<i>Nidorella podocephala</i>		XX		X			X
<i>Ocimum sp.</i>					X		
<i>Oldenlandia herbacea</i>					X		
<i>Oocephala staehelinoides</i>					X		



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<i>Ornithogalum sp.</i>			X		X		
<i>Oxalis obliquifolia</i>	X	X		X			X
<i>Pelargonium luridum</i>		X				X	
<i>Pellaea calomelanos</i>					X		
<i>Pentanisia angustifolia</i>						X	
<i>Psammotropha mucronata</i>					X		
<i>Pseudognaphalium cf. oligandrum</i>	X	X		XX	X		
<i>Pulicaria scabra</i>			X				
<i>Rhynchosia minima</i>		X		X			X
<i>Rhynchosia monophylla</i>						X	
<i>Rhynchosia totta</i>					X	X	X
<i>Scabiosa columbaria</i>		X	X				
<i>Sebaea leiostyla</i>		XX	X	X			
<i>Selaginella dregei</i> (bryophyte?)							
<i>Selago</i> (previously <i>Walafrida</i>) <i>densiflora</i>				X			X
<i>Senecio sp.</i>		X		XX			X
<i>Solanum campylacanthum</i>	X						
<i>Striga elegans</i>						X	
<i>Tephrosia capensis</i>					X	X	
<i>Tephrosia elongata</i>						X	
<i>Trifolium africanum</i>		X					
<i>Ursinia nana</i>		X			X		
<i>Wahlenbergia sp.</i>		X					
<i>Zornia milneana</i>						X	X
SUCCULENT SPECIES							
<i>Aloe bergeriana</i> (MNCA)					X	XX	
<i>Crassula capitella</i> subsp. <i>thyrsoiflora</i>					X		
<i>Crassula vaginata</i>		X	X				
<i>Delosperma hirtum</i>	XX	X	X	X	X	X	X
<i>Euphorbia clavarioides</i>					X		
<i>Euphorbia striata</i>							X
GRAMINOID SPECIES							
* <i>Cortaderia jubata</i>	X						
* <i>Paspalum dilatatum</i>		X	X				



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<i>*Paspalum urvillei</i>	XX						
<i>Agrostis eriantha</i>			X				
<i>Andropogon eucomis</i>		X		X			
<i>Aristida congesta subsp. congesta</i>							X
<i>Aristida diffusa</i>					X		
<i>Aristida junciformis</i>		X					
<i>Arundinella nepalensis</i>			X				
<i>Bothriochloa sp.</i>		X					
<i>Bulbostylis hispidula</i>		X			X	X	X
<i>Calamagrostis epigejos</i>			X				
<i>Carex glomerabilis</i>		X	X				
<i>Cymbopogon sp.</i>		X					
<i>Cynodon dactylon</i>	XX	X		XX		X	XX
<i>Cyperus cf. denudatus</i>			X				
<i>Cyperus esculentus var. esculentus</i>	XX	X		X			X
<i>Cyperus marginatus</i>			X				
<i>Cyperus rupestris</i>					X		
<i>Cyperus semitrifidus</i>					X		
<i>Eleocharis dregeana</i>			X				
<i>Eragrostis cf. trichophora</i>							X
<i>Eragrostis chloromelas</i>	X	X			X	X	X
<i>Eragrostis gummiflua</i>		X		X	X	X	
<i>Eragrostis lehmanniana</i>	X	X				X	X
<i>Eragrostis plana</i>		X	X	X			
<i>Eragrostis racemosa</i>					X	X	
<i>Fuirena pubescens var. pubescens</i>			X				
<i>Harpochloa falx</i>							
<i>Helictotrichon turgidulum</i>		X					
<i>Hemarthria altissima</i>		X	X				



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<i>Heteropogon contortus</i>						X	X
<i>Hyparrhinia hirta</i>	XX						X
<i>Hyparrhinia tamba</i>	XX			X			
<i>Imperata cylindrica</i>			X				
<i>Juncus dregeanus</i>			X				
<i>Juncus effusus</i>			X				
<i>Kyllinga erecta</i>		XX	X	X			
<i>Leersia hexandra</i>			XX				
<i>Melinis repens</i>	X				X		X
<i>Panicum natalense</i>						X	
<i>Panicum schinzii</i>	X			X			
<i>Pogonarthria squarrosa</i>	X						X
<i>Schoenoplectus cf. paludicola</i>			X				
<i>Scirpoides burkei</i>		X	X				
<i>Setaria cf. pumila</i>		X	X				
<i>Sporobolus africanus</i>		X					
<i>Sporobolus pectinatus</i>					X		
<i>Themeda triandra</i>		X			X	X	
<i>Trichoneura grandiglumis</i>							X
<i>Tristachya leucothrix</i>						X	
<i>Typha capensis</i>	X		X				
<i>Urochloa mosambicensis</i>	X						

