



SCIENTIFIC TERRESTRIAL SERVICES

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

Prepared for



July 2021

Executive Summary

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Report Reference: STS 210002



SAS Environmental Group of Companies

EXECUTIVE SUMMARY

Scientific Terrestrial Services CC (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”.

The study area is associated with both linear developments and surface infrastructure. The Applicant (Dreamworks Haven Investments Pty Ltd) proposes to develop the Halfgewonnen Solar PV Facilities, which will generate approximately 80 Mega Watts (MW) of power for distribution into the National Grid, specifically for the benefit of mining and farming communities located closer to the proposed development. The surface infrastructure will include the PV 1 (anticipated 34 Ha) and PV 2 Panels (anticipated 88 Ha), BESS, Laydown Areas, Main Substation, O&M Building, Reference Pyranometer & Temperature Sensor, Site Offices, Weather Stations. Linear developments for the project include the Main Pipelines running between the Solar Panels, as well as a High-Voltage Line (± 6.2 km) that is recommended to connect the Main Substation to the Ysterkop substation.

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 Scientific Aquatic Services CC (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.

The field assessment was undertaken during summer (3rd to the 5th of February 2021). The field assessment aimed to determine the ecological status of the study area and to “ground-truth” the results of the desktop assessment.

Conservation significance of the study area from a desktop research perspective

The study area is located in the Grassland Biome and Mesic Highveld Grassland Bioregion. The vegetation type associated with the study area is the Eastern Highveld Grassland (Gm12) vegetation type, which is listed as Endangered (EN) in Mucina and Rutherford (2006) but listed as Vulnerable (VU) in the updated 2018 Final Vegetation Map of South Africa, Lesotho, and Swaziland. According to the National Threatened Ecosystems (2011) (GN 1002), the vegetation type is also classified as a listed threatened ecosystem. The ecosystem is classified as endemic with an Area of Occupancy (AOO) of 174 ha and an Extent of Occurrence (EOO) 22980.816 ha. It has an estimated percentage of decline of 0.5% per year (based on data from 1990 – 2014).

The study area intersects an Irreplaceable Critical Biodiversity Area (CBA) (Mpumalanga Biodiversity Sector Plan, 2019). More specifically, the western portions of Solar PV Panel 2 occur within the Irreplaceable CBA. A small section of the central section of the High-Voltage Line also crosses through the Irreplaceable CBA. A small section of the central portion of the High-Voltage Line crosses through an Optimal CBA. The remaining linear development and surface infrastructure do not occur within this CBA category.

The Terrestrial Biodiversity Theme Sensitivity, as produced by the National Web Based Environmental Screening Tool, indicates that the entire study area is considered to have a **Very High sensitivity**. The



triggered sensitivity features include a CBA 1 and CBA 2 (corresponding to the Mpumalanga Biodiversity Sector Plan, 2019), Focus Areas for land-based protected areas expansion (likely to be provincial) and a Vulnerable ecosystem (i.e., Eastern Highveld Grassland).

For the Animal Species Theme, much of the study area is considered to have a **Medium Sensitivity** (recent occurrence records for threatened and/or rare endemic species are included in the high sensitivity level) due to suitable habitat for the mammals *Hydrictis maculicollis* (Spotted-necked Otter, VU) and *Ourebia ouebi ouebi* (Oribi, EN).

For the Plant Species Theme, much of the study area is considered to have a **Medium Sensitivity** (model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level) due to habitat for the two vulnerable (VU) threatened plants species (for which their identities cannot be made known to the public domain), as well as *Pachycarpus suaveolens* (VU). Several sections also occur in **Low Sensitivity** areas where no RDL plant taxa are anticipated to occur due to unsuitable habitat conditions.

Habitat Summary (ground-truthed results)

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:** 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;
- **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.

From a floral perspective, 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.

The most sensitive habitats for faunal communities within the study area were the Eastern Highveld Grassland and the Wetland Habitat, which are considered to be of **Moderately High Faunal Sensitivity** while the Secondary Grassland habitat was considered to be of **Moderately Low Faunal Sensitivity**. Lastly the Degraded and Transformed habitat were of **Low Faunal Sensitivity**. The Wetland and Eastern highveld Grassland (being representative of the reference vegetation) provides valuable breeding and foraging resources for invertebrates, reptiles and small mammals, whereas the Secondary Grassland habitat, though containing some indigenous vegetation, is impacted by AIPs and no longer represents the reference vegetation. As a result, suitable resources for faunal utilisation in this habitat, are more limited than in the Eastern Highveld Grassland and Wetland Habitat.

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.”

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.”



High and medium low impacts from development in the study area, are anticipated for fauna, particularly in the Eastern Highveld Grassland as the absence of any large-scale human disturbances and limited alien plant invasion has ensured this habitat unit retaining most of its natural, reference vegetation and thus provides a rich diversity of flora (faunal habitat and forage) to support fauna. Availability of reference vegetation and Wetland Habitat suggests that there is suitable native habitat remaining for fauna adapted to these ecosystems, including several SCC. Since habitat loss threatens many faunal species due to mining expansion, this portion of undeveloped land serves as an important refuge and breeding site for fauna remaining in the study area. It therefore has a degree of irreplaceability, and as such, the field assessment therefore verifies that this habitat unit, is located within an Irreplaceable CBA.

Species of Conservation Concern (SCC)

Floral SCC:

Placement of development infrastructure such as the Solar PV 2 Panels is anticipated to have an unfavourable impact on floral Species of Conservation Concern (SCC) on a local extent only, even if mitigation measures are implemented, although impacts can be reduced with mitigation. Schedule 11 Protected Species Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA) such as *Aloe bergeriana*, *Crinum* species, *Eucomis autumnalis*, *Gladiolus crassifolius* and *Gladiolus eliotii* were recorded within the proposed footprint of the PV 1 (small sections) and 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.

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. 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.

Faunal SCC:

No faunal SCC were observed during the field assessment; however, based on online and literary databases, there is a reasonable possibility that five faunal SCC may occupy the study area. These species are: *Metisella meninx* (Marsh Sylph), *Leptailurus serval* (Serval) and *Pyxicephalus adspersus* (Giant Bullfrog), *Ourebia ourebi* (Oribi) and *Poecilogale albinucha* (Striped Weasel). Of the abovementioned SCC, three have suitable habitat to breed and forage within the study area, mostly within the Wetland and Eastern highveld Grassland habitat. The large degree of agriculture in the eastern portions of the study area will reduce the favourability of Transformed and Degraded and Secondary Grassland habitat for these species. However, the Eastern highveld Grassland and Wetland habitat will support these species and offer suitable breeding opportunities for *Metisella meninx* (Marsh Sylph), *Leptailurus serval* (Serval) and *Pyxicephalus adspersus* (Giant Bullfrog). The Department of Forestry, Fisheries and the Environment (DFFE) screening tool indicates that the study area has high potential to support the faunal SCC *Hydrictis maculicollis* (Spotted-necked Otter) and *Ourebia ourebi* (Oribi).

It is anticipated that development will have a medium low to high impact on faunal habitat and diversity and SCC in the Eastern Highveld Grassland, considering the possibility that the abovementioned SCC will most likely inhabit this unit as a result of the high food and habitat availability in this habitat unit.



Development impacts, with or without mitigation, on SCC are therefore anticipated to be **Medium-Low to High** in the Eastern highveld Grassland. Suitable habitat is present even in the Secondary Grassland and Degraded and Transformed Habitat for SCC, yet the degraded nature of these habitats reduces the impacts in these units. Unmanaged and managed developments are anticipated to have **Low** impacts on SCC in these units.

Impact and Concluding Statement

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.

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.**

From a faunal perspective, the proposed development has the potential to result in **High to Very Low** impacts on faunal communities that currently occupy the study area. The most significant impacts are anticipated to occur through the development of the PV 2 facility, of which large portions fall within the Eastern Highveld Grassland. Should development activities go unmanaged impacts are anticipated to be **High and Medium High** in this unit. With mitigation impacts can be reduced to **Medium Low** and **Very Low** levels. Impacts to the remaining faunal habitat, diversity and SCC within the Wetland, Degraded and Transformed and Secondary Grassland are anticipated to incur **Very Low to Low** level impacts.

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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July 2021

Part A: Background Information

Prepared by: Scientific Terrestrial Services CC
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Report Reference: STS 210002



SAS Environmental Group of Companies

DOCUMENT GUIDE

The table below provides a guide to the reporting of biodiversity impacts as they relate to 1) Government Notice No. 320 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on **Terrestrial Biodiversity** as published in Government Gazette 43110 dated 20 March 2020, and 2) Government Notice No. 1150 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on **Terrestrial Plant and Animal Species** as published in Government Gazette 43855 dated 30 October 2020.

Theme-Specific Requirements as per Government Notice No. 320 Terrestrial Biodiversity Theme – Very High Sensitivity Rating as per Screening Tool Output		
No.	SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS	Section in report/Notes
2	Terrestrial Biodiversity Specialist Assessment	
2.1	The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.	Part A – C: Cover Page Part A: Appendix E
2.2	The assessment must be undertaken on the preferred site and within the proposed development footprint.	Part A: Section 1
2.3	The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:	
2.3.1	A description of the ecological drivers or processes of the system and how the proposed development will impact these;	Part B: Section 3 (flora) Part C: Section 3 (fauna)
2.3.2	Ecological functioning and ecological processes (e.g., fire, migration, pollination, etc.) that operate within the preferred site;	Part B: Section 3 (flora) Part C: Section 3 (fauna)
2.3.3	The ecological corridors that the proposed development would impede including migration and movement of flora and fauna;	Part A: Section 3 (desktop analysis) Part B: Section 3 (flora) Part C: Section 3 (fauna)
2.3.4	The description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Area (FEPA) sub catchments;	Part A: Section 3 (desktop analysis) Part B: Section 3 (flora) Part C: Section 3 (fauna) <i>*For descriptions on the presence of FEPAs, please refer to the Freshwater Biodiversity Assessment (SAS 220163, 2021)</i>
2.3.5	A description of terrestrial biodiversity and ecosystems on the preferred site, including: <ul style="list-style-type: none"> a) main vegetation types; b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified; c) ecological connectivity, habitat fragmentation, ecological processes and fine scale habitats; and d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified; 	Part A: Section 3 (desktop analysis) Part B: Section 3 (flora) Part C: Section 3 (fauna)
2.3.6	The assessment must identify any alternative development footprints within the preferred site which would be of a “low” sensitivity as identified by the screening tool and verified through the site sensitivity verification; and	Section 5.3.6
2.3.7	The assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:	
2.3.7.1	Terrestrial Critical Biodiversity Areas (CBAs), including: <ul style="list-style-type: none"> a) <i>the reasons why an area has been identified as a CBA;</i> b) <i>an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;</i> 	Part A: Section 3 (desktop analysis) Part B: Section 3.2 , 5.3.3 Part C: Section 3



	<ul style="list-style-type: none"> c) <i>the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);</i> d) <i>the impact on ecosystem threat status;</i> e) <i>the impact on explicit subtypes in the vegetation;</i> f) <i>the impact on overall species and ecosystem diversity of the site; and</i> g) <i>the impact on any changes to threat status of populations of species of conservation concern in the CBA;</i> 	
2.3.7.2	<p>Terrestrial Ecological Support Areas (ESAs), including:</p> <ul style="list-style-type: none"> a) <i>the impact on the ecological processes that operate within or across the site;</i> b) <i>the extent the proposed development will impact on the functionality of the ESA; and</i> c) <i>loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;</i> 	
2.3.7.3	<p>Protected areas as defined by the National Environmental Management Protected Areas Act, 2004 including-</p> <ul style="list-style-type: none"> a) <i>an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;</i> 	<p>Part A: Section 3 (desktop analysis)</p> <p>However, not applicable as no protected areas or areas of conservation concern are within 10 km of the proposed project,</p>
2.3.7.4	<p>Priority areas for protected area expansion, including-</p> <ul style="list-style-type: none"> a) <i>the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;</i> 	Part A: Section 3 (desktop analysis)
2.3.7.5	<p>SWSAs including:</p> <ul style="list-style-type: none"> a) <i>the impact(s) on the terrestrial habitat of a SWSA; and</i> b) <i>the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses);</i> 	Not Applicable. No SWSAs within the study area.
2.3.7.6	<p>FEPA sub catchments, including-</p> <ul style="list-style-type: none"> a) <i>the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;</i> 	<i>*For descriptions on the presence of FEPAs, please refer to the Freshwater Biodiversity Assessment (SAS 220163, 2021)</i>
2.3.7.7	<p>Indigenous forests, including:</p> <ul style="list-style-type: none"> a) <i>impact on the ecological integrity of the forest; and</i> b) <i>percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.</i> 	Not Applicable. No indigenous forests within the study area.
2.4	The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report.	
	<p>Part B: Results of the Floral Assessment as well as conclusions on Terrestrial Biodiversity as it relates to vegetation communities.</p> <p>Part C: Results of the Faunal Assessment as well as conclusions on Terrestrial Biodiversity as it relates to faunal communities.</p>	
3	Terrestrial Biodiversity Specialist Assessment Report	
3.1	The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:	
3.1.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Part A: Appendix E
3.1.2	A signed statement of independence by the specialist;	Part A: Appendix E
3.1.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Part B: Section 1.2 (flora) Part C: Section 1.3 (fauna)
3.1.4	A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Part A: Appendix C Part B: Section 2 (flora) Part B: Appendix A (flora) Part C: Section 2 (fauna) Part C: Appendix A (fauna)



3.1.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Part B: Section 1.2 (flora) Part C: Section 1.3 (fauna)
3.1.6	A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Part B: Section 4 (flora) Part C: Section 4 (fauna)
	Impact Assessment Requirements 3.1.7 Additional environmental impacts expected from the proposed development; 3.1.8 Any direct, indirect and cumulative impacts of the proposed development; 3.1.9 The degree to which impacts and risks can be mitigated; 3.1.10 The degree to which the impacts and risks can be reversed; 3.1.11 The degree to which the impacts and risks can cause loss of irreplaceable resources; 3.1.12 Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Part B: Section 5 (flora) Part C: Section 5 (fauna)
3.1.13	A motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a “low” terrestrial biodiversity sensitivity and that were not considered appropriate;	Part A: Section 1.1 Part B: Section 5 Part C: Section 5
3.1.14	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Part A: Executive summary Part B: Section 6 (flora) Part C: Section 6 (fauna)
3.1.15	Any conditions to which this statement is subjected.	Part B: Section 5.4 (flora) Part C: Section 5.4 (fauna)
3.2	The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.	This report is submitted to the EAP and applicant and will be appended to the EIA / EMP by the EAP in due course as part of the application process
3.3	A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	



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GLOSSARY OF TERMS

Most definitions are based on terms and concepts elaborated by Richardson *et al.* (2011), Hui and Richardson (2017) and Wilson *et al.* (2017), with consideration to their applicability in the South African context, especially South African legislation [notably the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), and the associated Alien and Invasive Species Regulations, 2020].

Alien species (syn. exotic species; non-native species)	A species that is present in a region outside its natural range due to human actions (intentional or accidental) that have enabled it to overcome biogeographic barriers.
Biodiversity Management Plan	A plan aimed at ensuring the long-term survival in nature of an indigenous species, a migratory species, or an ecosystem, published in terms of the Biodiversity Act. Norms and standards to guide the development of Biodiversity Management Plans for Species have been developed. At the time of writing, norms and standards for Biodiversity Management Plans for Ecosystems were in the process of being developed.
Biodiversity priority areas	Features in the landscape or seascape that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services. They include the following categories, most of which are identified based on systematic biodiversity planning principles and methods: protected areas, Critically Endangered and Endangered ecosystems, Critical Biodiversity Areas and Ecological Support Areas, Freshwater Ecosystem Priority Areas, high water yield areas, flagship free-flowing rivers, priority estuaries, study areas for land-based protected area expansion, and study areas for offshore protection. Marine ecosystem priority areas and coastal ecosystem priority areas have yet to be identified but will be included in future. The different categories are not mutually exclusive and, in some cases, overlap, often because a particular area or site is important for more than one reason. They should be complementary, with overlaps reinforcing the importance of an area.
Biological diversity or Biodiversity (as per the definition in NEMBA)	The variability among living organisms from all sources including, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.
Biome - as per Mucina and Rutherford (2006); after Low and Rebelo (1998).	A broad ecological spatial unit representing major life zones of large natural areas – defined mainly by vegetation structure, climate, and major large-scale disturbance factors (such as fires).
Bioregion (as per the definition in NEMBA)	A geographic region which has in terms of section 40(1) been determined as a bioregion for the purposes of this Act;
Critical Biodiversity Area (CBA)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation, and ridges.
Critically Endangered (CR) (IUCN Red List category)	Applied to both species/taxa and ecosystems: 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. Critically Endangered ecosystem types are at an extremely high risk of collapse. Most of the ecosystem type has been severely or moderately modified from its natural state. The ecosystem type is likely to have lost much of its natural structure and functioning, and species associated with the ecosystem may have been lost. Critically endangered species are those considered to be at extremely high risk of extinction.
Corridor	A dispersal route or a physical connection of suitable habitats linking previously unconnected regions.
Degradation	The many human-caused processes that drive the decline or loss in biodiversity, ecosystem functions or ecosystem services in any terrestrial and associated aquatic ecosystems.
Disturbance	A temporal change, either regular or irregular (uncertain), in the environmental conditions that can trigger population fluctuations and secondary succession. Disturbance is an important driver of biological invasions.



Driver (ecological)	A driver is any natural or human-induced factor that directly or indirectly causes a change in ecosystem. A direct driver clearly influences ecosystem processes, where indirect driver influences ecosystem processes through altering one or more direct drivers.
Ecoregion	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Endangered (EN) (Red List category)	Applied to both species/taxa and ecosystems: 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. Endangered ecosystem types are at a very high risk of collapse. Endangered species are those considered to be at very high risk of extinction.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g., southern Africa), national (South Africa), provincial, regional, or even within a particular mountain range.
Ecological Support Area (ESA)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
Ground-truth	Ground truth is a term used in various fields to refer to information provided by direct observation (i.e., empirical evidence) as opposed to information provided by inference.
Habitat (as per the definition in NEMBA)	A place where a species or ecological community naturally occurs.
Important Bird and Biodiversity Area (IBA)	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
Indigenous vegetation (as per the definition in NEMA)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Invader weeds and plants (as per Section 80(1) of the MNCA)	Declared invader weeds and plants are provided in Schedule 13 of the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998).
Invasive species	Alien species that sustain self-replacing populations over several life cycles, produce reproductive offspring, often in very large numbers at considerable distances from the parent and/or site of introduction, and have the potential to spread over long distances.
Listed alien species	All alien species that are regulated in South Africa under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004), Alien and Invasive Species Regulations, 2020.
Least Threatened	Least threatened ecosystems are still largely intact.
Native species (syn. indigenous species)	Species that are found within their natural range where they have evolved without human intervention (intentional or accidental). Also includes species that have expanded their range as a result of human modification of the environment that does not directly impact dispersal (e.g., species are still native if they increase their range as a result of watered gardens but are alien if they increase their range as a result of spread along human-created corridors linking previously separate biogeographic regions).
Red Data listed (RDL) species	According to the Red List of South African plants (http://redlist.sanbi.org/) and the International Union for Conservation of Nature (IUCN), organisms that fall into the Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
Species of Conservation Concern (SCC)	The term SCC in the context of this report refers to all RDL and IUCN listed threatened species as well as protected species of relevance to the project.



Threatened ecosystem	An ecosystem that has been classified as Critically Endangered, Endangered or Vulnerable, based on an analysis of ecosystem threat status. A threatened ecosystem has lost or is losing vital aspects of its structure, function, or composition. The Biodiversity Act allows the Minister of Environmental Affairs or a provincial MEC for Environmental Affairs to publish a list of threatened ecosystems. To date, threatened ecosystems have been listed only in the terrestrial environment. In cases where no list has yet been published by the Minister, such as for all aquatic ecosystems, the ecosystem threat status assessment in the NBA can be used as an interim list in planning and decision making. Also see Ecosystem threat status.
Threatened species	A species that has been classified as Critically Endangered, Endangered or Vulnerable, based on a conservation assessment (Red List), using a standard set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.
Vulnerable (VU) (Red List category)	Applied to both species/taxa and ecosystems: 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. An ecosystem type is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for VU and is then considered to be at a high risk of collapse.
Weeds	A plant is a weed ' <i>if, in any specified geographical area, its populations grow entirely or predominantly in situations markedly disturbed by man (without, of course, being deliberately cultivated plants)</i> ' (Baker 1965); in cultural terms, weeds are plants (not necessarily alien) that grow in sites where they are not wanted and that have detectable economic or environmental impacts (Pyšek et al. 2004).



LIST OF ACRONYMS

AIP	Alien and Invasive Plant
AOO	Area of Occupancy
BGIS	Biodiversity Geographic Information Systems
BODATSA	Botanical Database of Southern Africa
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CR	Critically Endangered
CVB	Channelled-Valley Bottom
DDD	Data Deficient - Insufficient Information
DDT	Data Deficient - Taxonomically Problematic
DFFE	Department of Forestry, Fisheries, and the Environment
DMRE	Department of Mineral Resources and Energy
EAP	Environmental Assessment Practitioner
E-GIS	Environmental Geographical Information Systems
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EN	Endangered
EOO	Extent of Occurrence
ESA	Ecological Support Area
EW	Extinct in the Wild
GN	Government Notice
Ha	Hectares
HGM	Hydrogeomorphic
IBA	Important Bird and Biodiversity Area
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature
LC	Least Concern
MAP	Mean annual precipitation
MAPE	Mean Annual Potential Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MBSP	Mpumalanga Biodiversity Sector Plan
MFD	Mean Frost Days
MNCA	Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998)
MTPA	Mpumalanga Tourism and Parks Agency
MW	Mega Watts
NBA	National Biodiversity Assessment
NE	Not Evaluated
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004)
New POSA	New Plants of southern Africa
NPAES	National Protected Area Expansion Strategy
NT	Near Threatened
NTBA	Not Yet Been Assessed
NWA	National Water Act, 1998 (Act No. 36 of 1998)
P	Protected
POC	Potential of Occurrence
PV	Photovoltaic
QDS	Quarter Degree Square
RDL	Red Data Listed
REIPPP	Renewable Energy Independent Power Producer Procurement Programme
SABAP 2	South African Bird Atlas Project 2
SACAD	South African Conservation Areas Database
SACNASP	Professional member of the South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute



SanParks	South African National Parks
SAPAD	South African Protected Areas Database
SAPIA	Southern African Plant Invaders Atlas
SAS	Scientific Aquatic Services
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services
TOPS	Threatened or Protected Species
UCVB	Unchannelled-Valley Bottom
VEGMAP	National Vegetation Map Project
VU	Vulnerable



1 INTRODUCTION

Scientific Terrestrial Services CC (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 within the study area. The study area is 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 further project descriptions, refer to Section 1.1 of this report.

The study area is located within the Mpumalanga Province and falls in the Gert Sibande District Municipality. The study area is situated adjacent to the active mining areas of the Overlooked Colliery (south other side of the Olifants) and Halfgewonnen Colliery (in which Mining Right Area the project is proposed), with additional mining in the area including Middelkraal (west side of the Leeuwfonteinspruit), Forzando North (south-east, other side of the Olifants River) and Weltevreden (east, other side of the Olifants River). The greater landscape is further characterised largely by agricultural fields, with the remaining natural areas already fragmented.

The project will be connected to the national electrical grid at the Ysterkop sub-station by means of a powerline. The study area is approximately 4.6 km east of the R35, 18 km south-west of the N11, and approximately 6.7 km west of the R38. The town Hendrina is located 20 km north-east of the study area, the town of Bethal is situated 25 km south, and the town of Davel is approximately 25.8 km south-east of the study area. The Olifants River traverses the central portion of the study area. For a depiction of the study area, refer to Figures 1 and 2.

The purpose of this report (Part A) is to define the biodiversity of the study area from a desktop conservation database perspective. It is the objective of this desktop assessment to provide detailed information to guide the fieldwork components (discussed in Parts B and C) to ensure that all relevant ecological aspects are considered prior to performing the field assessments.

This report is not a standalone report and should be considered together with the outcome of the biodiversity assessments (floral assessment in Part B and the faunal assessment in Part C).



1.1 Project Description

The Applicant (Dreamworks Haven Investments Pty Ltd) proposes to develop the Halfgewonnen Solar PV Facilities, which will generate approximately 80 Mega Watts (MW) of power for distribution into the National Grid, specifically for the benefit of mining and farming communities located closer to the proposed development.

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 Scientific Aquatic Services CC (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.

The proposed Halfgewonnen Solar PV Project comprises two components:

1. **Solar PV 1** will generate approximately 20 MW and will initially address the electricity requirements for the immediately surrounding and adjacent mines until they are decommissioned. After the decommissioning of the mines, if no consumers can be identified in the immediate vicinity, Solar PV 1 will be connected to the National Grid. Construction is expected to take approximately ten months. The total development footprint will not exceed 34 Hectares (Ha).
2. **Solar PV 2** will generate approximately 60 MW, forming part of the Department of Mineral Resources and Energy (DMRE) Renewable Energy Independent Power Producer Procurement Programme (REIPPP). Construction is expected to take



approximately 12 months. The total development footprint is expected to comprise about 88 Ha.

Surface developments will thus include the PV 1 (anticipated 34 Ha) and PV 2 Panels (anticipated 88 Ha), BESS, Laydown Areas, Main Substation, O&M Building, Reference Pyranometer & Temperature Sensor, Site Offices, Weather Stations. Linear developments for the project include the Main Pipelines running between the Solar Panels, as well as a High-Voltage Line (± 6.2 km) that is recommended to connect the Main Substation to the Ysterkop substation.

For a depiction of the proposed layout, refer to Figure 3.



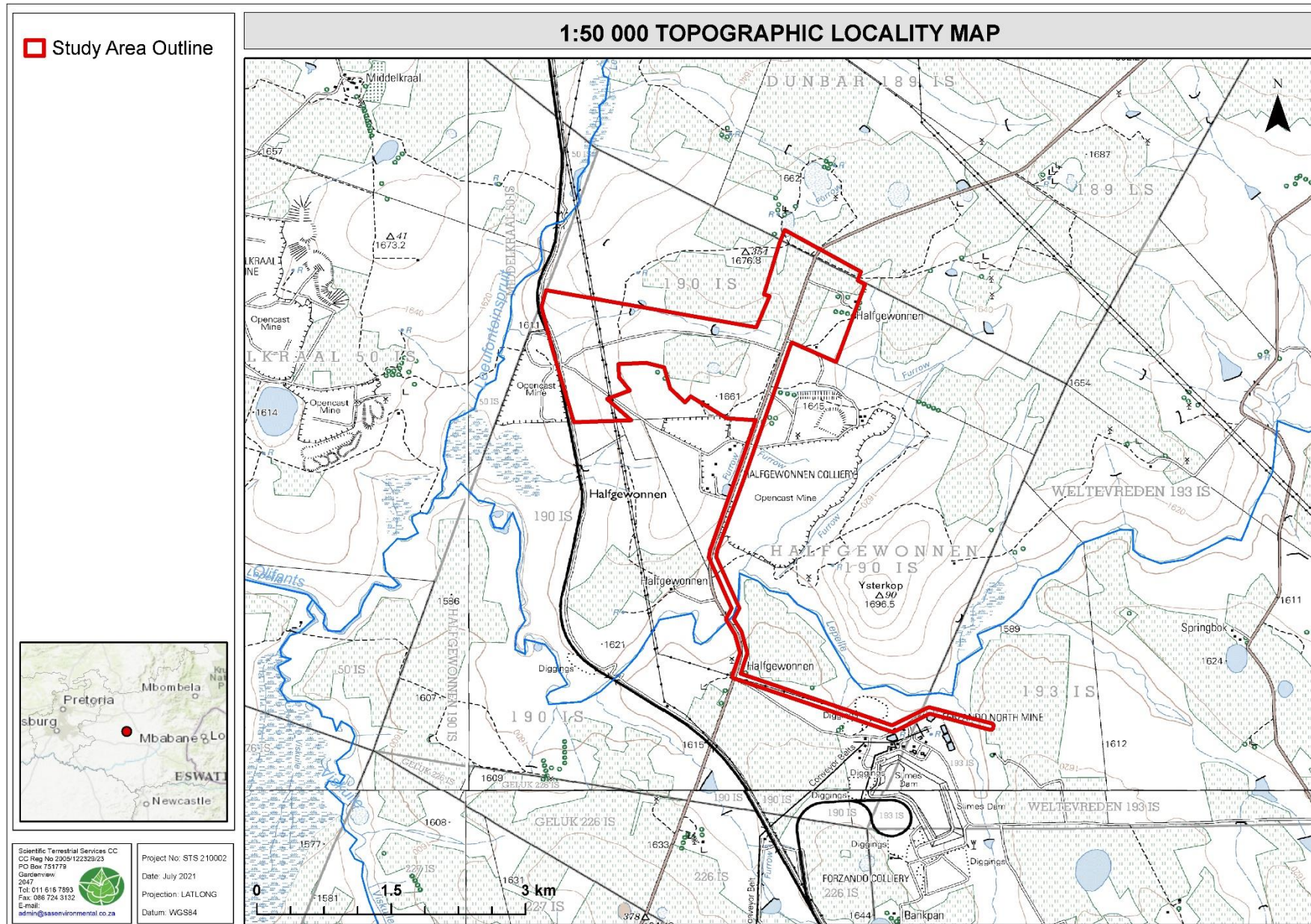


Figure 2. The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.



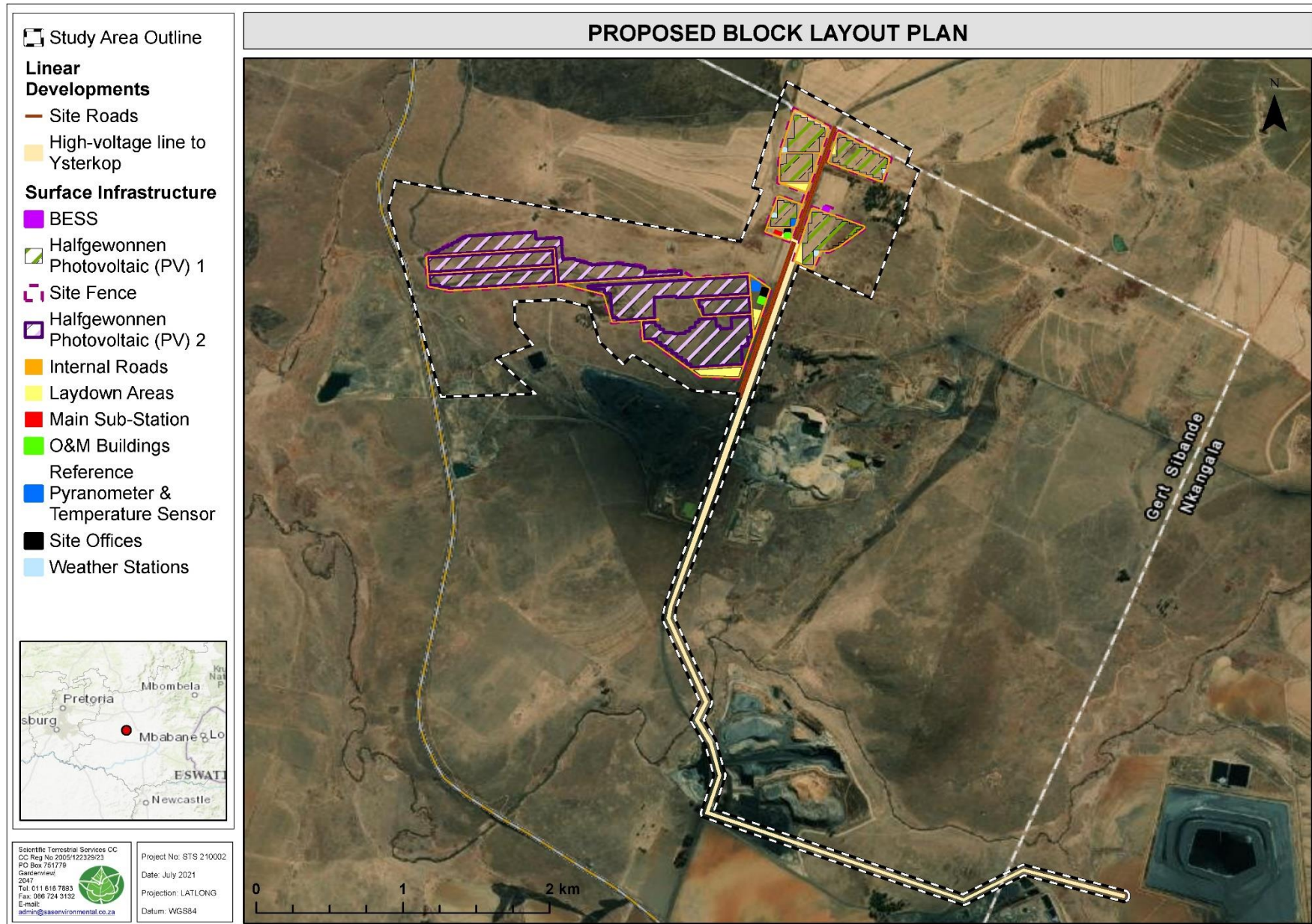


Figure 3: Proposed layout map provided by the EAP during the time of assessment.



1.2 Scope of Work

Specific outcomes in terms of Part A of the report are as follows:

- To compile a desktop assessment with all relevant information as presented by the South African National Biodiversity Institute's (SANBI) Biodiversity Geographic Information Systems (BGIS) website (<http://bgis.sanbi.org>) and the Department of Forestry, Fisheries and the Environment (DFFE) Environmental Geographical Information Systems (E-GIS) website (<https://egis.environment.gov.za/>). The desktop assessment aims to gain background information on the physical habitat and potential floral and faunal ecology associated with the study area;
- To state the indemnity and terms of use of this report (Appendix A) as well as to provide the details of the specialists who prepared the reports (Appendix E);
- To outline the legislative requirements that were considered for the assessment (Appendix B of this report); and
- To provide the methodologies followed relating to the impact assessment and development of the mitigation measures (Appendix C) that were applied in the floral and faunal assessments (Part B and Part C).

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report (Part A):

- The biodiversity desktop assessment is confined to the study area and does not include detailed results of the adjacent properties, although ecological important or sensitive areas according to the desktop databases of surrounding areas have been included on the relevant maps;
- It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics within the study area at the scale required to inform an environmental process. However, this information is useful as background information to the study; and
- The field assessment was undertaken during summer (3rd to the 5th of February 2021) and aimed to determine the ecological status of the study area and to “ground-truth” the results of the desktop assessment. 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 Faunal and Floral ecology of the study area. These observations were used to compliment the results presented in Parts B and C.



1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

- The Constitution of the Republic of South Africa, 1996³;
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- Government Notice (GN) number R.1020: Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 September 2020 as it relates to the NEMBA;
- The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA);
- GN No. 320 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity as published in Government Gazette 43110 dated 20 March 2020;
- GN No. 1150 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant and Terrestrial Animal Species as published in Government Gazette 43855 dated 30 October 2020; and
- The Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA).

The details of each of the above, as they pertain to this study, are provided in Appendix B of this report.

2 ASSESSMENT APPROACH

Maps and digital satellite images were generated prior to the field assessment to determine broad habitats, vegetation types and potentially sensitive sites. The biodiversity desktop assessment is confined to the study area and does not include the neighbouring and adjacent properties, although the sensitivity of surrounding areas is included on the respective maps. Relevant databases and documentation that were considered during the assessment of the study area include⁴:

³ Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 1996'. It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

⁴ Datasets obtained from:

- SANBI BGIS (2020). The South African National Biodiversity Institute - Biodiversity GIS (BGIS) [online]. URL: <http://bgis.sanbi.org>; and
- Environmental Geographical Information Systems (E-GIS) website. URL: <https://egis.environment.gov.za/>



- 2010 National Protected Area Expansion Strategy (NPAES) (Government of South Africa, 2010; DEA & SANBI, 2009), including the below-listed vector datasets:
 - NPAES Focus Areas 2010: National Protected Areas Expansion Strategy: Focus areas for protected area expansion (South African National Parks (SanParks), 2010);
 - NPAES Formal: Polygons of formal protected national parks areas in South Africa (SANParks/SANBI, 2013); and
 - NPAES Protected Areas – Informal: Informal conservation areas in South Africa (SANParks/SANBI, 2012).
- The South African Conservation Areas Database, Quarter 1 (SACAD, 2021);
- The South African Protected Areas Database, Quarter 1 (SAPAD, 2021);
- The Mpumalanga Biodiversity Sector Plan (MBSP) – 2019 data set;
- The National Vegetation Map Project (VEGMAP), with the below vector dataset used for information on Biomes, Bioregions and Vegetation Type(s):
 - 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018a)
- The National List of Threatened Ecosystems 2011 (SANBI 2011; South Africa, 2011);
- From the National Biodiversity Assessment (NBA, 2018) Terrestrial Assessment project (Skowno et al., 2019):
 - 2018 Terrestrial ecosystem threat status and protection level - remaining extent (SANBI, 2018b); and
 - 2018 Terrestrial ecosystem threat status and protection level layer (SANBI, 2018c).
- The Important Bird and Biodiversity Areas (IBA) Programme and vector dataset (BirdLife South Africa, 2015; Marnewick et al., 2015a and 2015b), in conjunction with the South African Bird Atlas Project 2 (SABAP 2);
- The International Union for Conservation of Nature (IUCN); and
- The National Web-Based Environmental Screening Tool (accessed 2021).



3 RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics of the Study Area based on National and Provincial Datasets

The following section contains data accessed as part of the desktop assessment and are presented as a “dashboard” report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for improved assimilation of results by the reader to take place. Where required, further discussion and interpretation are provided.

As previously mentioned, **it is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics within the study area at the scale required to inform an environmental process. The field assessment aimed to determine the ecological status of the study area and to “ground-truth” the results of the desktop assessment - presented in Parts B and C.**

Table 1: Summary of the biodiversity characteristics associated with the study area [Quarter Degree Squares (QDS) 2629BA].

DETAILS OF THE STUDY AREA IN TERMS OF MUCINA & RUTHERFORD (SANBI, 2018c)		DESCRIPTION OF THE EASTERN HIGHVELD GRASSLAND ASSOCIATED WITH THE STUDY AREA (MUCINA & RUTHERFORD 2006)					
Biome	The study area is situated within the Grassland Biome .	Distribution	Mpumalanga and Gauteng Provinces: Plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief.				
Bioregion	The study area is situated within the Mesic Highveld Grassland Bioregion .						
Vegetation Type	The study area falls within the Eastern Highveld Grassland (Gm12) vegetation type.	Climate	Strongly seasonal summer rainfall, with very dry winters.				
CONSERVATION DETAILS PERTAINING TO THE STUDY AREA (VARIOUS DATABASES)			MAP (mm)	MAT (°C)	MFD (days)	MAPE (mm)	MASMS (%)
National Threatened Ecosystems (2011) (GN 1002)	The study area is partly within the remaining extent of a listed threatened ecosystem, namely the Eastern Highveld Grassland ecosystem, with a Vulnerable threat status.		726	14.7	32	1926	73
		Altitude (m)	1 520 – 1780, but also as low as 1300				



<p>(Figure 4)</p>	<p><u>Linear developments:</u> The proposed High-Voltage Line to Ysterkop mainly falls outside of the remaining extent where it runs along an existing road; however, along its southern extent, the High-Voltage Line crosses through this ecosystem. Several of the internal roads associated with both the Solar PV 1 and 2 Panels cross through sections of the remaining extent of this ecosystem.</p> <p><u>Surface Infrastructure:</u> Of the surface infrastructure, the following infrastructure partly falls within the threatened ecosystem: Laydown Areas associated with PV 2, the Main Substation, O&M Buildings associated with PV 2, Reference Pyranometer & Temperature Sensor associated with the PV 2 panels, site offices associated with PV 2, as well as small sections of the Solar PV 1 panels and the eastern and southern portions of the Solar PV 2 panels.</p> <p>According to the description in GN 102, the Eastern Highveld Grassland falls under Criterion A1, which identifies ecosystems that have undergone loss of natural habitat, impacting on their structure, function and composition. Loss of natural habitat includes outright loss, for example, the removal of natural habitat for cultivation, building of infrastructure, mining etc., as well as severe degradation. For this purpose, habitat is considered severely degraded if it would be unable to recover to a natural or near-natural state following the removal of the cause of the degradation (e.g., invasive aliens, over-grazing), even after very long time periods.</p>	<p>Conservation</p>	<p>Listed as Endangered (EN) in Mucina and Rutherford (2006) but listed as Vulnerable (VU) in the updated 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland.</p> <p>Target 24%. Only very small fraction conserved in statutory reserves (Nooitgedacht Dam and Jericho Dam Nature Reserves) and in private reserves (Holkransse, Kransbank, Morgenstond). Some 44% transformed primarily by cultivation, plantations, mines, urbanisation and by building of dams. Cultivation may have had a more extensive impact, indicated by land-cover data. No serious alien invasions are reported, but <i>Acacia mearnsii</i> can become dominant in disturbed sites. Erosion is very low</p>
		<p>Geology & Soils</p>	<p>Red to yellow sandy soils of the Ba and Bb land types found on shales and sandstones of the Madzaringwe Formation (Karoo Supergroup). Land types Bb (65%) and Ba (30%).</p>
		<p>Vegetation & landscape features (Dominant Floral Taxa in Appendix D)</p>	<p>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 (<i>Aristida</i>, <i>Digitaria</i>, <i>Eragrostis</i>, <i>Themeda</i>, <i>Tristachya</i> etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (<i>Senegalia caffra</i>, <i>Celtis africana</i>, <i>Diospyros lycioides subsp lycioides</i>, <i>Parinari capensis</i>, <i>Protea caffra</i>, <i>P. welwitschii</i> and <i>Searsia magalismontanum</i>).</p>
<p>National Biodiversity Assessment (2018) Figure 5</p>	<p>The study area occurs within the remaining extent of the Eastern Highveld Grassland (Vulnerable) (SANBI. 2018a), which is currently poorly protected (SANBI. 2018b).</p> <p>A small portion of the Solar PV 1 panels and larger sections of PV 2 occur in the vulnerable Eastern Highveld Grassland (and associated internal roads and fences). The rest of the surface infrastructure is within areas that have been significantly transformed and is not regarded by the NBA 2018 database to be areas representative of the Eastern Highveld Grassland. The proposed High-Voltage Line to Ysterkop mainly falls outside of the remaining extent where it runs along an existing road; however, along its southern extent, the High-Voltage Line crosses through this ecosystem.</p>	<p>STRATEGIC WATER SOURCE AREAS FOR SURFACE WATER (2017)</p>	
		<p>Surface water Strategic Water Source Areas (SWSAs) are defined as areas of land that supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size. They include transboundary areas that extend into Lesotho and Swaziland. The sub-national Water Source Areas (WSAs) are not nationally strategic as defined in the report but were included to provide a complete coverage.</p>	
		<p>Name & Criteria</p>	<p>The study area is not within 10 km of a Strategic Water Source Area.</p>



NATIONAL PROTECTED AND CONSERVATION AREAS – VARIOUS DATABASES	
<p>The ecosystem is classified as endemic with an Area of Occupancy (AOO) of 174 ha and an Extent of Occurrence (EOO) 22980.816 ha. It has an estimated percentage of decline of 0.5% per year (based on data from 1990 – 2014).</p> <p>Ecosystem types are categorised as “not protected”, “poorly protected”, “moderately protected” and “well protected” based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act, 2003 (Act No. 57 of 2003), and compared with the biodiversity target for that ecosystem type.</p> <p>The ecosystem protection level status is assigned using the following criteria:</p> <ol style="list-style-type: none"> i. If an ecosystem type has more than 100% of its biodiversity target protected in a formal protected area either A or B, it is classified as Well Protected; ii. When less than 100% of the biodiversity target is met in formal A or B protected areas it is classified it as Moderately Protected; iii. If less than 50% of the biodiversity target is met, it is classified it as Poorly Protected; and iv. If less than 5% it is Hardly Protected. 	<p>SAPAD (2021, Q1); SACAD (2021, Q1); NPAES (2010); and IBA (2015)</p> <p>The NPAES (2010), SACAD⁵ (2021, Q1) and SAPAD⁶ (2021, Q1) databases do not indicate any protected or conservation areas within 10 km of the study area.</p> <p>The Important Bird and Biodiversity Areas (IBA) database indicate the Amersfoort-Bethal-Carolina IBA within 10 km south-east of the study area (Figure 6). This IBA is bounded by the main roads connecting Ermelo, Amersfoort, Bethal, Hendrina and Carolina, and this area consists mostly of flat to undulating farmland.</p> <p><u>IBA trigger species:</u> The key species within this IBA is the globally threatened Botha’s Lark (<i>Spizocorys fringillaris</i>). Other globally threatened species are Blue Crane (<i>Anthropoides paradiseus</i>), Southern Bald Ibis (<i>Geronticus calvus</i>), Black Harrier (<i>Circus maurus</i>), Blue Korhaan (<i>Eupodotis caerulescens</i>), Black-winged Pratincole (<i>Glareola nordmanni</i>), Secretarybird (<i>Sagittarius serpentarius</i>), Martial Eagle (<i>Polemaetus bellicosus</i>) and Denham’s Bustard (<i>Neotis denhami</i>). Regionally threatened species are African Grass Owl (<i>Tyto capensis</i>), White-bellied Korhaan (<i>Eupodotis senegalensis</i>) and Lanner Falcon (<i>Falco biarmicus</i>). Biome- and range-restricted species are Botha’s Lark (<i>Spizocorys fringillaris</i>), Kurrichane Thrush (<i>Turdus libonyanus</i>) and Buff-streaked Chat (<i>Campicoloides bifasciatus</i>).</p>

⁵ **SACAD (2020):** The types of conservation areas that are currently included in the database are the following: 1. Biosphere reserves, 2. Ramsar sites, 3. Stewardship agreements (other than nature reserves and protected environments), 4. Botanical gardens, 5. Transfrontier conservation areas, 6. Transfrontier parks, 7. Military conservation areas and 8. Conservancies.

⁶ **SAPAD (2020):** The definition of protected areas follows the definition of a protected area as defined in the National Environmental Management: Protected Areas Act, (Act 57 of 2003). Chapter 2 of the National Environmental Management: Protected Areas Act, 2003 sets out the “System of Protected Areas”, which consists of the following kinds of protected areas - 1. Special nature reserves; 2. National parks; 3. Nature reserves; 4. Protected environments (1-4 declared in terms of the National Environmental Management: Protected Areas Act, 2003); 5. World heritage sites declared in terms of the World Heritage Convention Act; 6. Marine protected areas declared in terms of the Marine Living Resources Act; 7. Specially protected forest areas, forest nature reserves, and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998); and 8. Mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970).



MPUMALANGA BIODIVERSITY SECTOR PLAN (2019) TERRESTRIAL DATABASE – Figure 7			
<p>CBA Irreplaceable</p>	<p>The study area intersects an Irreplaceable Critical Biodiversity Area (CBA). More specifically, the western portions and small section of the southern portion of the Solar PV Panel 2 and its associated internal roads and fence occurs within the Irreplaceable CBA. A small section of the central section of the High-Voltage Line also crosses through the Irreplaceable CBA. The remaining infrastructure does not occur within this CBA category.</p> <p>CBA's are areas of high biodiversity value and need to be maintained in a natural state. The CBA Irreplaceable category includes:</p> <ol style="list-style-type: none"> 1) Areas required to meet targets and with irreplaceability values of more than 80%; 2) Critical linkages or pinch-points in the landscape that must remain natural; and 3) Critically Endangered Ecosystems. <p><u>Development Constraints:</u></p> <ul style="list-style-type: none"> - Linear Structures (Pipelines, Canals, Powerlines): Land-uses that will compromise the biodiversity objective and are not permissible. - Other utilities: Land-uses that will compromise the biodiversity objective and are not permissible. 	<p>CBA Optimal</p>	<p>A small section of the central portion of the High-Voltage Line crosses through an Optimal CBA, with a small section (western extent) of the Solar PV Panel 2 also occurring in this CBA. The remaining linear development and surface infrastructure do not occur within this CBA category.</p> <p>The CBA Optimal Areas (previously called 'important and necessary' in the 2007 Mpumalanga Biodiversity Conservation Plan [MBCP]) are the areas optimally located to meet both the various biodiversity targets and other criteria defined in the analysis. Although these areas are not 'irreplaceable' they are the most efficient land configuration to meet all biodiversity targets and design criteria.</p> <p><u>Development Constraints:</u></p> <ul style="list-style-type: none"> - Linear Structures (Pipelines, Canals, Powerlines): Land-uses that may compromise the biodiversity objective and that are only permissible under certain conditions. - Other utilities: Land-uses that may compromise the biodiversity objective and that are only permissible under certain conditions.
<p>Heavily modified</p>	<p>Much of the study area occurs within Heavily Modified areas, including several portions of the proposed Solar PV 1 and Solar PV 2 Panels (with associated internal roads and fences), most of the proposed Laydown Areas, the Main Sub-Station, O&M Buildings, Reference Pyranometer & Temperature Sensor, Site Offices, several of the Weather Stations, as well as a large stretch of the High-Voltage Line. These are areas currently modified to such an extent that any valuable biodiversity and ecological functions have been lost.</p> <p><u>Development Constraints:</u></p> <ul style="list-style-type: none"> - Permissible land-uses that are unlikely to compromise the biodiversity objective. 	<p>Other Natural Areas</p>	<p>Small sections of the proposed Solar PV 2 Panels and associated internal roads and fences occur within Other Natural Areas. Several portions of the study area are situated in areas that have not been identified as priority areas in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions.</p> <p><u>Development Constraints:</u></p> <ul style="list-style-type: none"> - Land-uses that may compromise the biodiversity objective and that are only permissible under certain conditions.
<p>Moderately modified: Old Lands</p>	<p>Small sections of the proposed Solar PV 1 and 2 Panels and High-Voltage Line are within areas mapped as Moderately Modified (Old Lands). Old cultivated lands that have been allowed to recover (within the last 80 years), and support some natural vegetation. Although biodiversity pattern and ecological functioning may have been compromised, the areas may still play a role in supporting biodiversity and providing ecosystem services.</p> <p><u>Development Constraints:</u></p> <p>Permissible land-uses that are unlikely to compromise the biodiversity objective.</p>		



NATIONAL WEB-BASED ENVIRONMENTAL SCREENING TOOL (2020)	
The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the Environmental Authorisation process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	
Animal Species Figure 8	For the Animal Species theme, much of the study area is considered to have a Medium Sensitivity (recent occurrence records for threatened and/or rare endemic species are included in the high sensitivity level) due to suitable habitat for the mammals <i>Hydrictis maculicollis</i> (Spotted-necked Otter, VU) and <i>Ourebia ouebi ouebi</i> (Oribi, EN). The screening tool also identified the avifauna species <i>Tyto capensis</i> (African Grass Owl, VU).
Plant Species Figure 9	For the Plant Species theme, much of the study area is considered to have a Medium Sensitivity (model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level) due to habitat for the two vulnerable (VU) threatened plants species (for which their identities cannot be made known to the public domain), as well as <i>Pachycarpus suaveolens</i> (VU). Several sections also occur in Low Sensitivity areas where no RDL plant taxa are anticipated to occur due to unsuitable habitat conditions.
Terrestrial Sensitivity	The Terrestrial Sensitivity for the entire study area is considered to have a Very High sensitivity. The triggered sensitivity features include a Critical Biodiversity Area 1 (Mpumalanga Biodiversity Sector Plan, 2019), Critical Biodiversity Area 2, Focus Areas for land-based protected areas expansion (likely to be provincial) and a Vulnerable ecosystem (i.e., Eastern Highveld Grassland).

NBA = National Biodiversity Assessment; SAPAD = South African Protected Areas Database; SACAD = South African Conservation Areas Database; NPAES = National Protected Areas Expansion Strategy; IBA = Important Bird Area; MAP = Mean Annual Precipitation; MAT = Mean Annual Temperature; MAPE = Mean Annual Potential Evaporation; MFD = Mean Frost Days; MASMS = Mean Annual Soil Moisture Stress (% of days when evaporative demand was more than double the soil moisture supply); CBA = Critical Biodiversity Areas; ESA = Ecological Support Area.



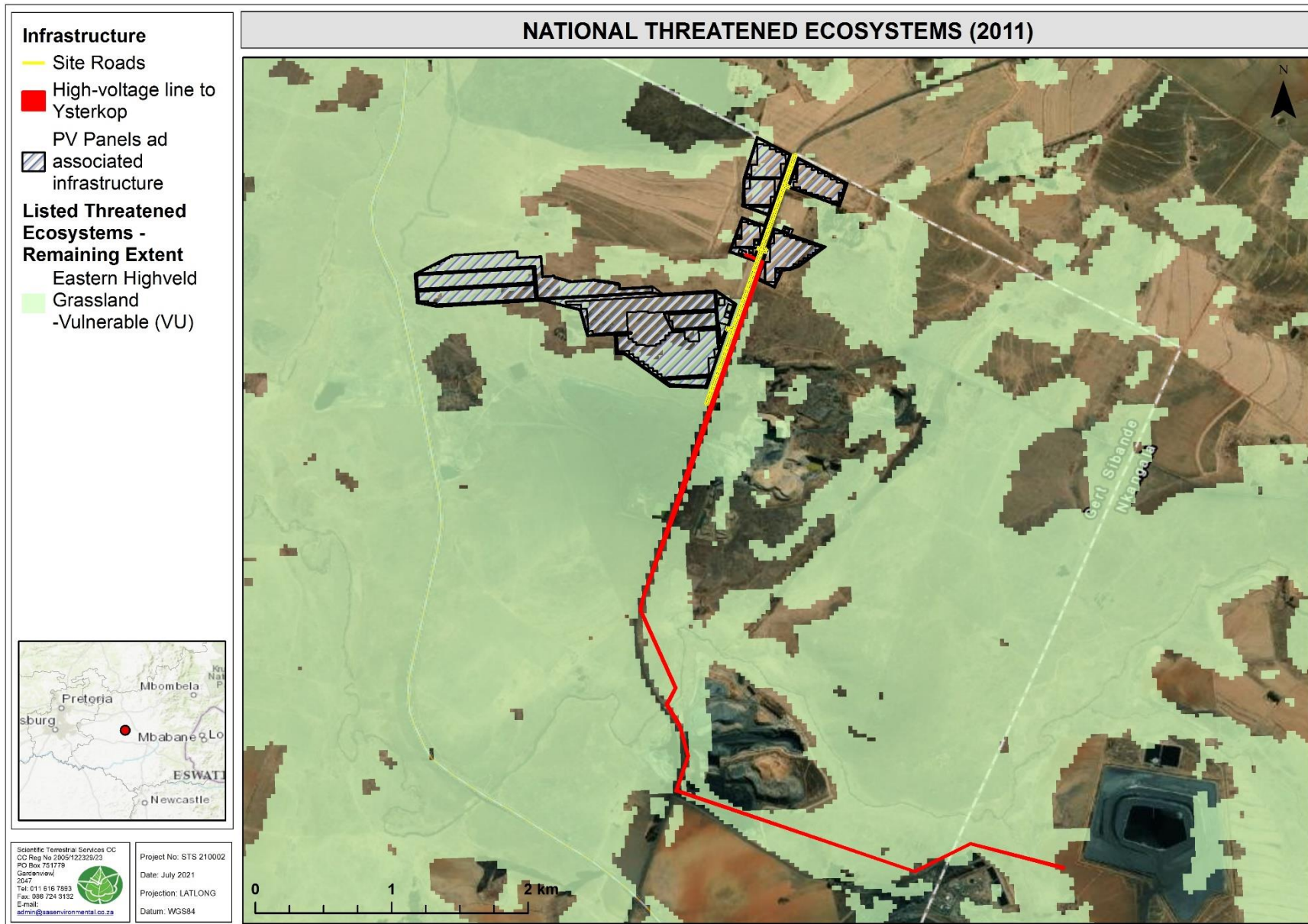


Figure 4: The proposed layout superimposed onto the listed Eastern Highveld Grassland threatened ecosystem (vulnerable) - according to the National Threatened Ecosystem database (2011).



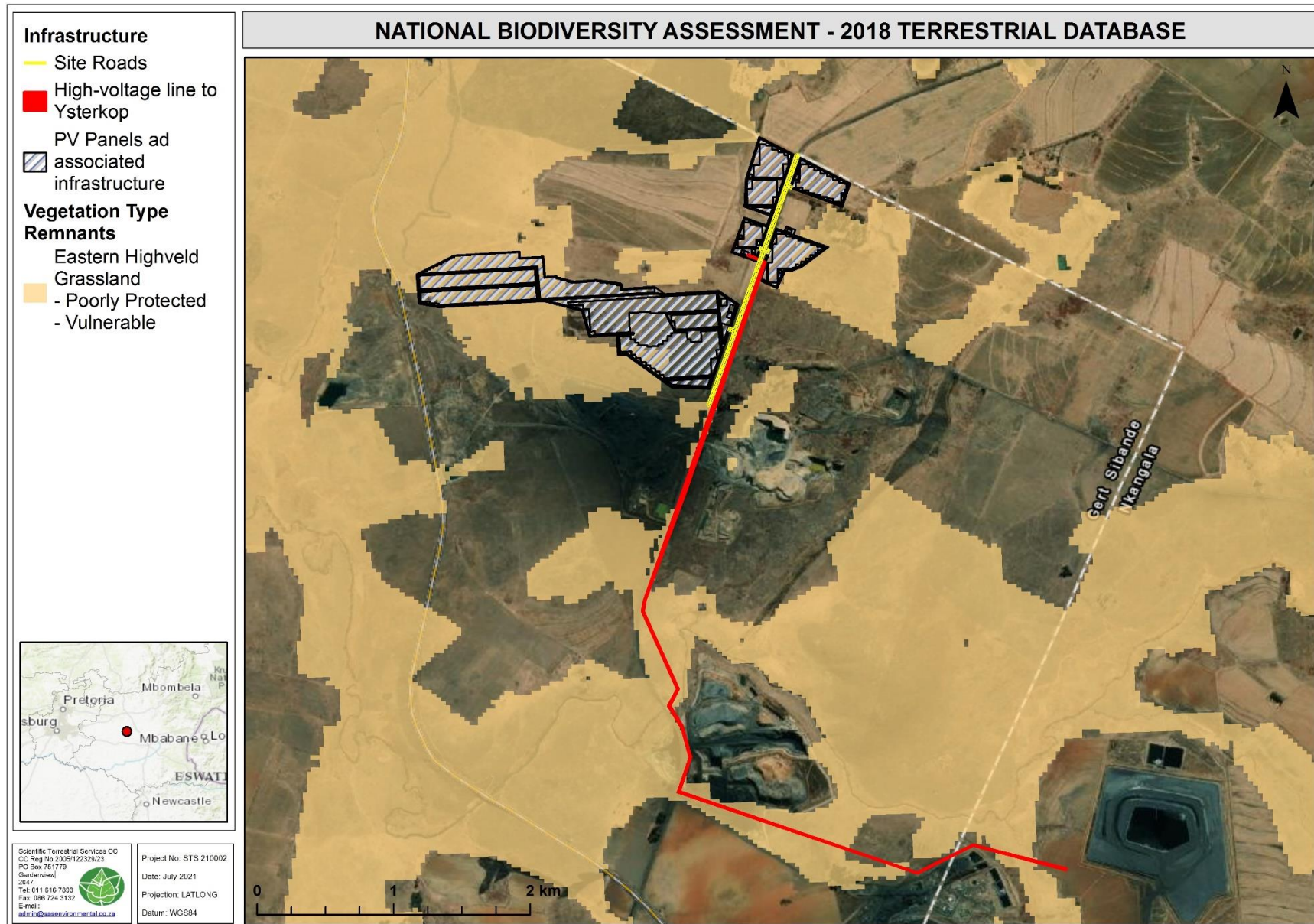


Figure 5. The proposed layout in relation to the remaining extent of the Eastern Highveld Grassland (VU), according to the National Biodiversity Assessment (NBA, 2018).



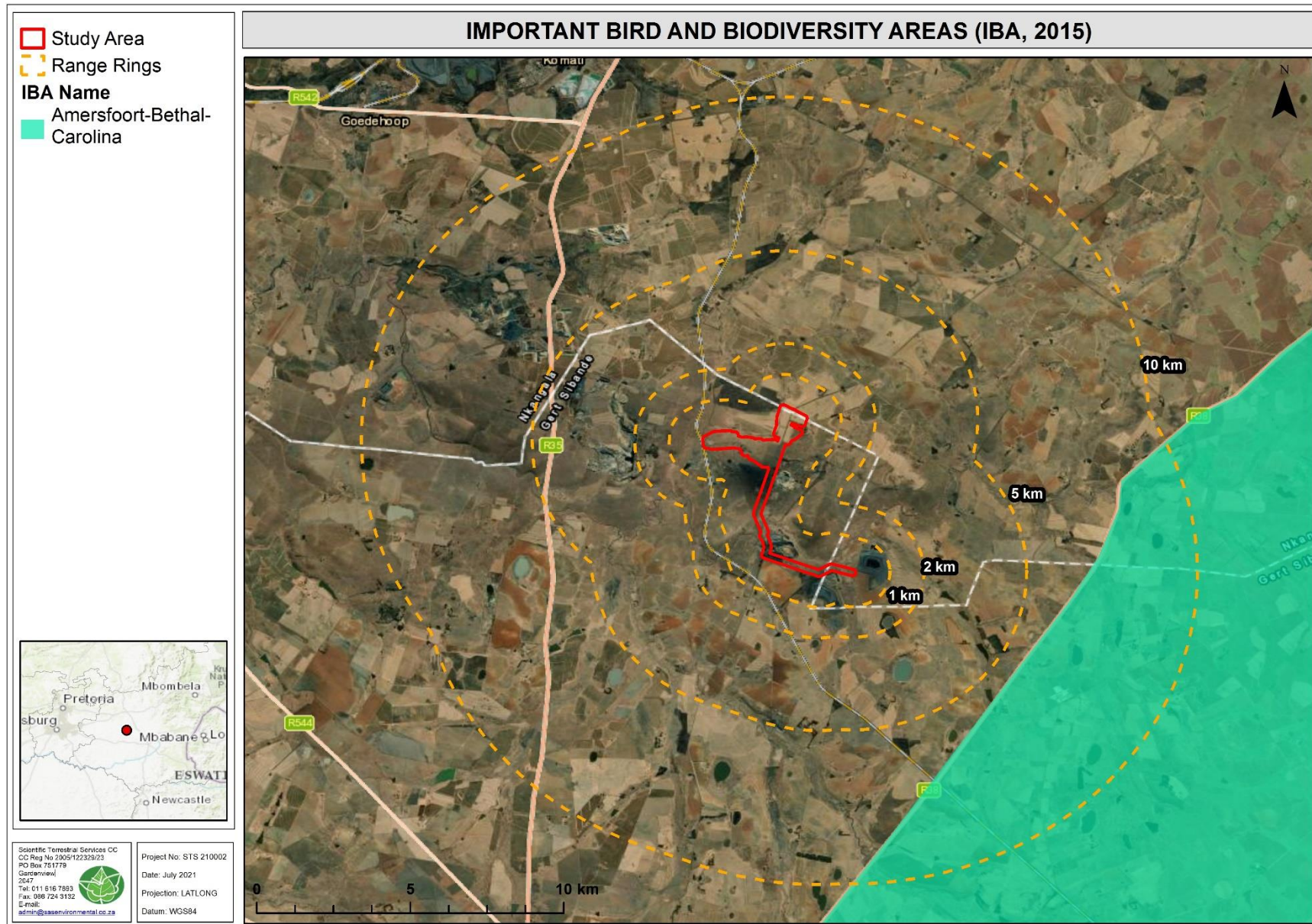


Figure 6. The study area in relation to the Amersfoort-Bethal-Carolina Important Bird and Biodiversity Area (IBA database of 2015).



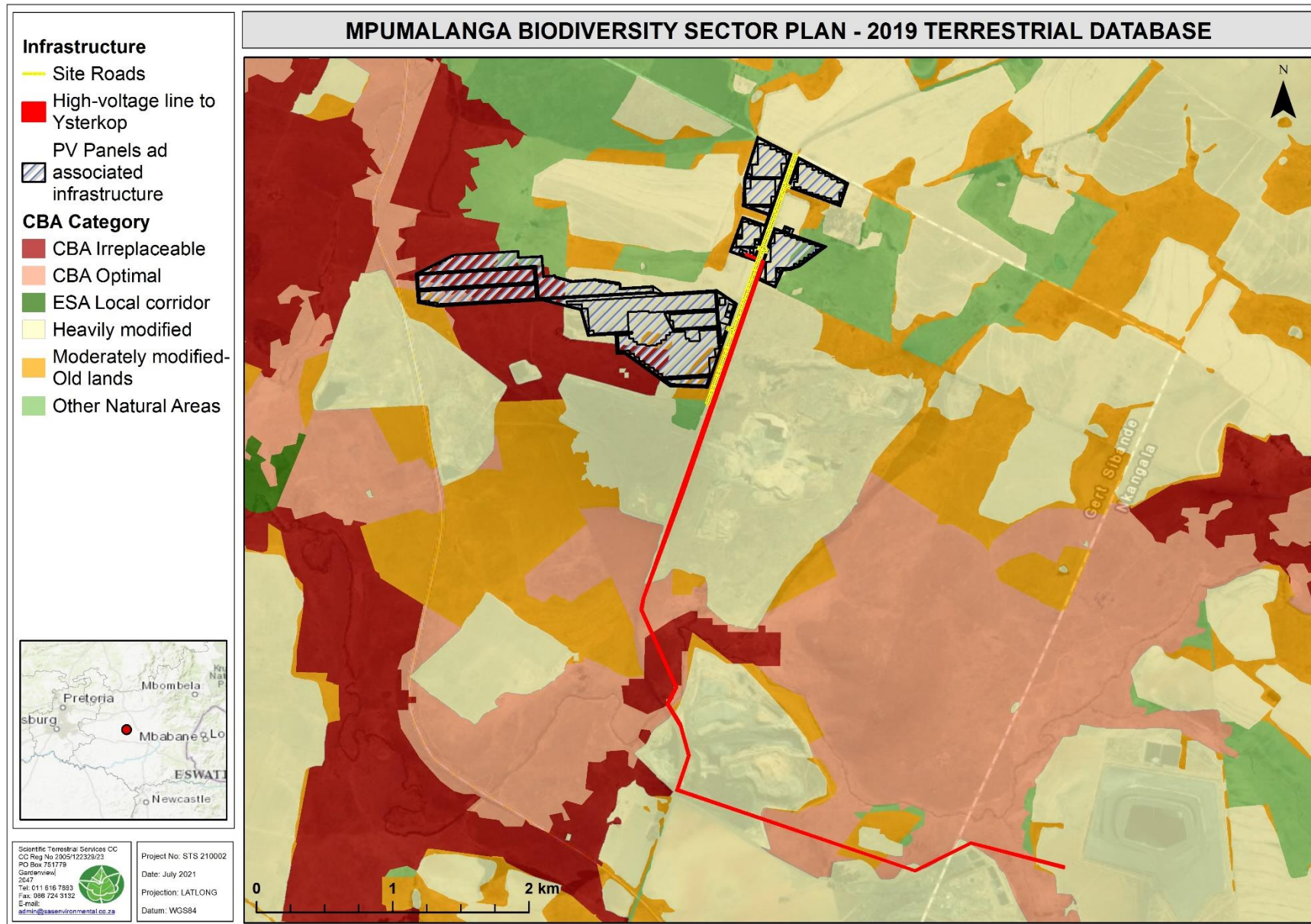


Figure 7. The study area in relation to the various CBA categories as indicated in the Mpumalanga Biodiversity Plan (2019).



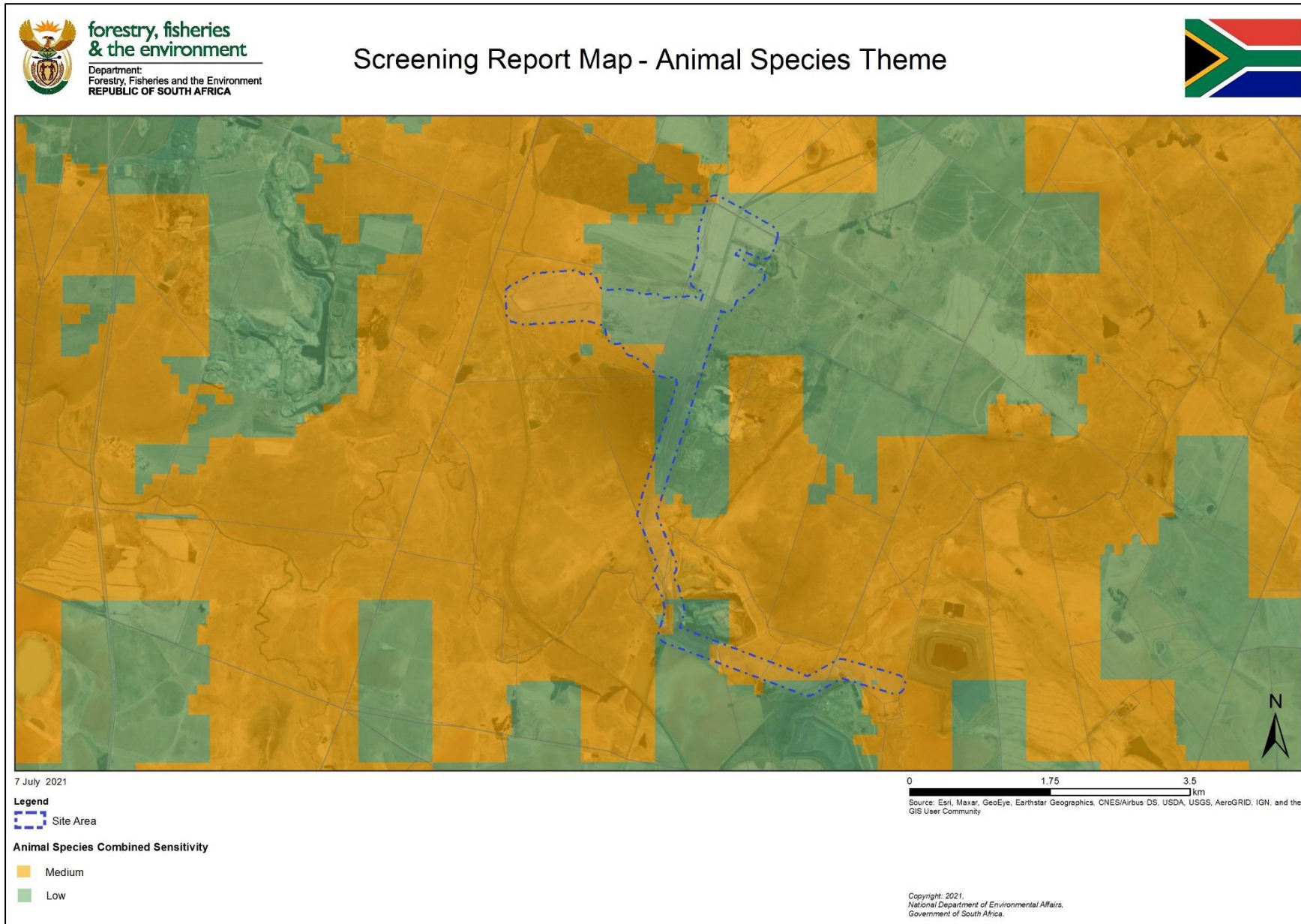


Figure 8. Animal Species Theme sensitivity map generated by the National Web-based Screening Tool.



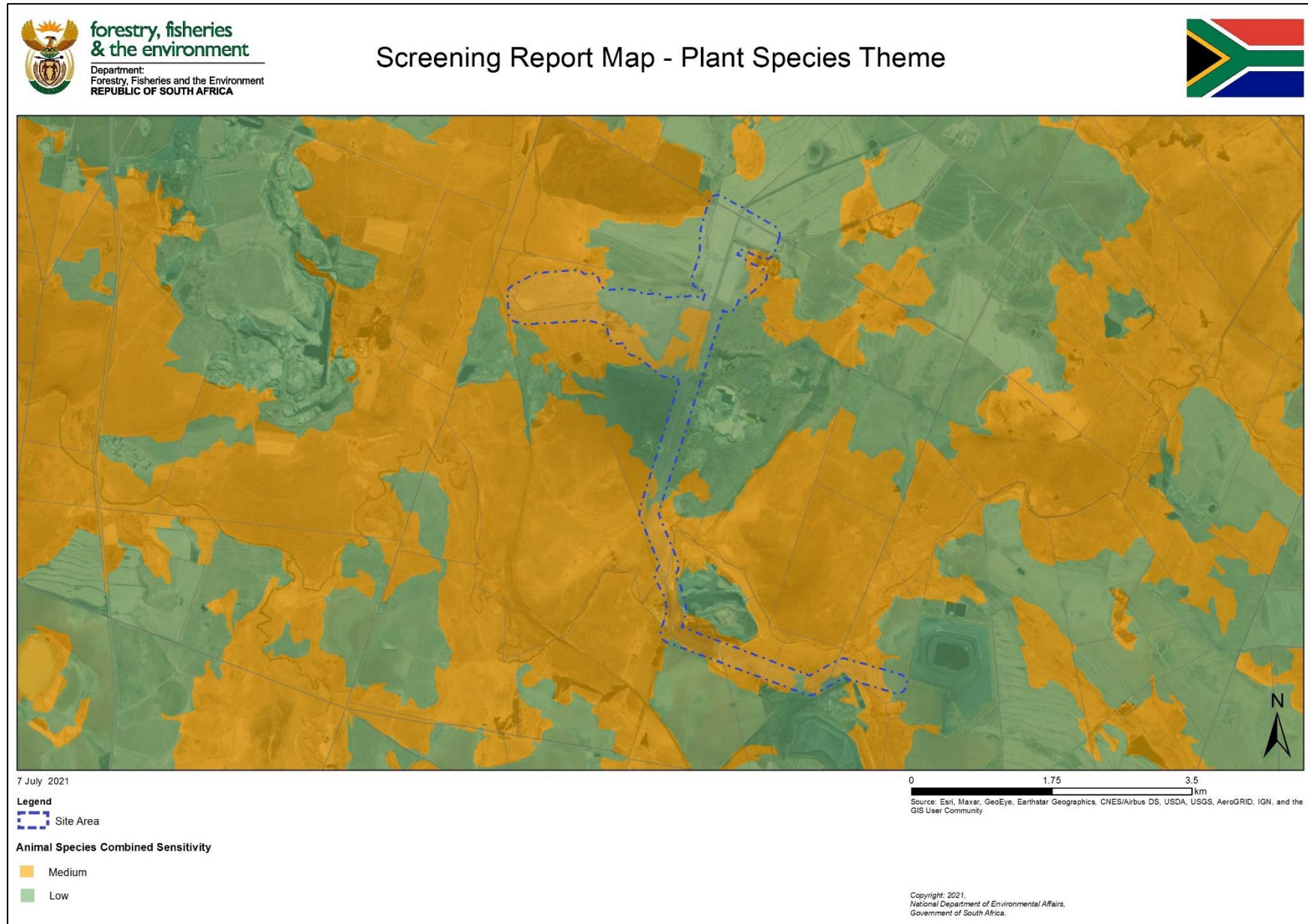


Figure 9. Plant Species Theme sensitivity map generated by the National Web-based Screening Tool.



4 STRUCTURE OF THE BIODIVERSITY REPORT

Part A of this report served to introduce the study area, as well as the general approach to the study. Part A also presents the results of general desktop information (i.e., data not yet ground-truthed) reviewed as part of the study, including the information generated by the relevant authorities as well as the context of the site in relation to the surrounding anthropogenic activities and ecological character.

Part B presents the results of the floral field assessment, data analyses and discussion of the results. Part B then presents the results of the impact assessment, where the impacts on floral ecology and biodiversity are discussed.

Part C presents the results of the faunal field assessment, data analyses and discussion of the results. Part C then presents the results of the impact assessment, where the impacts on faunal ecology and biodiversity are discussed.



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APPENDIX A: Indemnity and Terms of Use of this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by seasonality, time and budgetary constraints relevant to the type and level of investigation undertaken as well as the project program and STS CC and its staff, at their sole discretion, reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field or pertaining to this investigation.

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This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must refer to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.



APPENDIX B: Legislative Requirements

THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA, 1996

The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of Section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with Section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.

THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) (NEMA)

The National Environmental Management Act, 1998 (Act No.107 of 1998) (NEMA) and the associated Environmental Impact Assessment (EIA) Regulations (GN R326 as amended in 2017 and well as listing notices 1, 2 and 3 (GN R327, R325 and R324 of 2017), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, an environmental authorisation process needs to be followed and environmental authorisation obtained. This could follow either the Basic Assessment process or the Environmental Impact Assessment process depending on the nature of the activity and scale of the anticipated impacts.

THE NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT, 2004 (ACT NO. 10 OF 2004) (NEMBA)

The objectives of this act are (within the framework of NEMA) to provide for:

- The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- The use of indigenous biological resources in a sustainable manner;
- The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources;
- To give effect to ratify international agreements relating to biodiversity which are binding to the Republic;
- To provide for cooperative governance in biodiversity management and conservation; and
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources.

Furthermore, a person may not carry out a restricted activity involving either:

- a) A specimen of a listed threatened or protected species;
- b) Specimens of an alien species; or
- c) A specimen of a listed invasive species without a permit.



GOVERNMENT NOTICE NUMBER R.1020: ALIEN AND INVASIVE SPECIES REGULATIONS, 2020 (IN GOVERNMENT GAZETTE 43735), INCLUDING GOVERNMENT NOTICE NUMBER 1003: ALIEN AND INVASIVE SPECIES LISTS, 2020 (IN GOVERNMENT GAZETTE 43726) AS IT RELATES TO THE NEMBA

NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aims to:

- Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur,
- Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and
- Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.

Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004) as:

- (a) A species that is not an indigenous species; or
- (b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

Categories according to NEMBA (Alien and Invasive Species Regulations, 2020):

- **Category 1a:** Invasive species that require compulsory control;
- **Category 1b:** Invasive species that require control by means of an invasive species management programme;
- **Category 2:** Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and
- **Category 3:** Ornamentally used plants that may no longer be planted.

THE CONSERVATION OF AGRICULTURAL RESOURCES ACT, 1983 (ACT NO. 43 OF 1983) (CARA)

Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of AIP and weed species should take place throughout the construction and operation, phases in line with an approved AIP Management Plan.

THE MPUMALANGA NATURE CONSERVATION ACT, 1998 (ACT NO. 10 OF 1998) (MNCA)

The Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA) provides for the protection of indigenous plants. Subject to the provisions of this Act, no person shall:

- Pick, be in possession of, sell, purchase, donate, receive as a gift, import into, export, or remove from the Province, or convey:
 - A specially protected plant; or
 - A protected plant.
- Pick any indigenous plant:
 - On a public road;
 - On land next to a public road within 100 m measured from the centre of the road;
 - Within an area bordering any natural watercourse, whether wet or dry, up to and within 50 m from the high watermark on either side of the natural watercourse; or
 - In a Provincial Park, a site of Ecological Importance or a Protected Natural Environment.

The below schedules were applicable for the floral and faunal assessments (Part B and C):

- Schedule 1: Specifically Protected Game (Section 4 (1) (a));
- Schedule 2: Protected Game (Section 4 (1) (b));



- Schedule 4: Protected Wild Animals (Section 4 (1) (d));
- Schedule 7: Invertebrates (Section 35 (1));
- Schedule 11: Protected Plants (Section 69 (1) (a)); and
- Schedule 12: Specifically Protected Plants (Section 69 (1) (b)).



APPENDIX C: Impact Assessment Methodology

In order for the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects, and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'⁷. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to Table 3. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance-rating matrix and are used to determine whether mitigation is necessary⁸.

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment considers the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act 1998 (Act No. 107 of 1998) in instances of uncertainty or lack of

⁷ The definition has been aligned with that used in the ISO 14001 Standard.

⁸ Some risks/impacts that have low significance will however still require mitigation.



information, by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table C1: Criteria for assessing significance of impacts.

LIKELIHOOD DESCRIPTORS

Probability of impact	RATING
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	RATING
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

CONSEQUENCE DESCRIPTORS

Severity of impact	RATING
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	RATING
Activity specific/ < 5 ha impacted / Linear developments affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear developments affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear developments affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear developments affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear developments affected > 3000m	5
Duration of impact	RATING
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5



Table C2: Significance Rating Matrix.

		CONSEQUENCE (Severity + Spatial Scope + Duration)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	2	4	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	3	6	9	12	16	20	24	28	32	36	40	44	48	52	56	60
	4	8	12	16	20	25	30	35	40	45	50	55	60	65	70	75
	5	10	15	20	24	30	36	42	48	54	60	66	72	78	84	90
	6	12	18	24	30	36	42	49	56	63	70	77	84	91	98	105
	7	14	21	28	35	42	48	56	64	72	80	88	96	104	112	120
	8	16	24	32	40	48	54	63	72	81	90	99	108	117	126	135
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160

Table C3: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Critically consider the viability of proposed projects Improve current management of existing projects significantly and immediately	Maintain current management
High	101-125	Comprehensively consider the viability of proposed projects Improve current management of existing projects significantly	Maintain current management
Medium-high	76-100	Consider the viability of proposed projects Improve current management of existing projects	Maintain current management
Medium-low	51-75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Low	26-50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Very low	1-25	Maintain current management and/or proposed project criteria and strive for continuous improvement	Maintain current management and/or proposed project criteria and strive for continuous improvement

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project’s area of influence* encompassing:
 - Primary project site and related facilities that the client and its contractors develops or controls;
 - Areas potentially impacted by cumulative impacts for any existing project or condition and other project-related developments; and
 - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
 - Pre-construction;
 - Construction; and
 - Operation.
 - If applicable, transboundary or global effects were assessed.



- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

Mitigation measure development

The following points present the key concepts considered in the development of mitigation measures for the proposed development.

- *Mitigation* and *performance improvement measures* and actions that address the risks and impacts⁹ are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation, or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation*.

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

⁹ Mitigation measures should address both positive and negative impacts



APPENDIX D: Vegetation Types

Eastern Highveld Grassland (Gm 12)



Figure D1: Gm 12 Eastern Highveld Grassland: Grasslands of the Warburton area (Mpumalanga) with species of *Berkheya* and *Ipomoea* prominent in the foreground. Image by T. Steyn.

Table D1: Floristic species of *The Eastern Highveld Grassland* (Mucina & Rutherford, 2012).

Plant Community	Species
Dominant and typical floristic species	
Woody Layer	
Low Shrubs	<i>Anthospermum rigidum</i> subsp. <i>pumilum</i> , <i>Seriphium plumosum</i> .
Forb layer	
Herbs	<i>Berkheya setifera</i> (d), <i>Haplocarpha scaposa</i> (d), <i>Justicia anagalloides</i> (d), <i>Pelargonium luridum</i> (d), <i>Acalypha angustata</i> , <i>Chamaecrista mimosoides</i> , <i>Dicoma anomala</i> , <i>Euryops gilfillanii</i> , <i>E. transvaalensis</i> subsp. <i>setilobus</i> , <i>Helichrysum aureonitens</i> , <i>H. caespitium</i> , <i>H. callicomum</i> , <i>H. oreophilum</i> , <i>H. rugulosum</i> , <i>Ipomoea crassipes</i> , <i>Pentanisia prunelloides</i> subsp. <i>latifolia</i> , <i>Selago densiflora</i> , <i>Senecio coronatus</i> , <i>Hilliardiella elaeagnoides</i> , <i>Wahlenbergia undulata</i> .
Geophytic herbs	<i>Gladiolus crassifolius</i> , <i>Haemanthus humilis</i> subsp. <i>hirsutus</i> , <i>Hypoxis rigidula</i> var. <i>pilosissima</i> , <i>Ledebouria ovatifolia</i> .
Succulent herbs	<i>Aloe ecklonis</i> .
Graminoid layer	
Graminoids	<i>Aristida aequiglumis</i> (d), <i>A. congesta</i> (d), <i>A. junciformis</i> subsp. <i>galpinii</i> (d), <i>Brachiaria serrata</i> (d), <i>Cynodon dactylon</i> (d), <i>Digitaria monodactyla</i> (d), <i>D. tricholaenoides</i> (d), <i>Elionurus muticus</i> (d), <i>Eragrostis chloromelas</i> (d), <i>E. curvula</i> (d), <i>E. plana</i> (d), <i>E. racemosa</i> (d), <i>E. sclerantha</i> (d), <i>Heteropogon contortus</i> (d), <i>Loudetia simplex</i> (d), <i>Microchloa caffra</i> (d), <i>Monocymbium cerasiiforme</i> (d), <i>Setaria sphacelata</i> (d), <i>Sporobolus africanus</i> (d), <i>S. pectinatus</i> (d), <i>Themeda triandra</i> (d), <i>Trachypogon spicatus</i> (d), <i>Tristachya leucothrix</i> (d), <i>T. rehmannii</i> (d), <i>Alloteropsis semialata</i> subsp. <i>eckloniana</i> , <i>Andropogon appendiculatus</i> , <i>A. schirensis</i> , <i>Bewisia biflora</i> , <i>Ctenium concinnum</i> , <i>Diheteropogon amplexans</i> , <i>Eragrostis capensis</i> , <i>E. gummiiflua</i> , <i>E. patentissima</i> , <i>Harporchloa falx</i> , <i>Panicum natalense</i> , <i>Rendlia altera</i> , <i>Schizachyrium sanguineum</i> , <i>Setaria nigrirostris</i> , <i>Urelytrum agropyroides</i> .



APPENDIX E: Details, Expertise And Curriculum Vitae of Specialists

1. (a) (i) Details of the specialist who prepared the report:

Christien Steyn	MSc Plant Science (University of Pretoria)
Daryl van der Merwe	MSc (Conservation Biology Candidate) (University of Cape Town)
Christopher Hooton	B.Tech Nature Conservation (Tshwane University of Technology)
Nelanie Cloete	MSc Botany and Environmental Management (University of Johannesburg)
Stephen van Staden	MSc Environmental Management (University of Johannesburg)

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Christien Steyn, declare that -

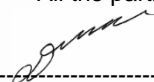
- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Daryl van der Merwe, declare that -

- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist



I, Christopher Hooton, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct.



Specialist Signature

I, Nelanie Cloete, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Stephen van Staden, declare that -

- I act as the independent **specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTIEN STEYN

PERSONAL DETAILS

Position in Company	Floral Ecologist
Joined SAS Environmental Group of Companies	2018

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Council for Natural Scientific Professions (SACNASP)
 Member of the South African Association of Botanists (SAAB)
 Member of the Botanical Society of South Africa (BotSoc)

EDUCATION

Qualifications

MSc (Plant Science) (University of Pretoria)	2017
BSc (Hons) Plant Science (Invasion Biology) (University of Pretoria)	2014
BSc Environmental Science (University of Pretoria)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Free State

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Terrestrial Ecological and Biodiversity Scoping Assessments
- Terrestrial Ecological and Biodiversity Screening Assessments
- Floral Assessments
- Input into Terrestrial Rehabilitation Plan design with the focus on the re-establishment of vegetation
- Floral Rescue and Relocation Plans
- Alien and Invasive Control Plan (AICP)
- Alien and Invasive Plant Identification and awareness training
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Desktop Studies, Mapping and Background Information Research

Training

- Advanced Grass Identification Course
- Practical Plant Identification, including Herbarium Usage and Protocols
- Vegetation Classification and Mapping: Use of Geographic Information System for understanding vegetation pattern and biodiversity conservation.
- Introduction to Statistics for Biologists: Applications of plant ecology principles in plant conservation, i.e., species distribution modelling, alien plant invasions, conservation planning
- Plant Functional Trait Course: Hands-on, field-based exploration of plant functional traits, along with experience in the usage of plant traits data in climate-change research and ecosystem ecology





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF DARYL VAN DER MERWE

PERSONAL DETAILS

Position in Company	Field Biologist, Member Terrestrial Ecology
Joined SAS Environmental Group of Companies	2019

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Environmental Observation Network (SAEON)

EDUCATION

Qualifications

MSc (Conservation Biology) (University of Cape Town)	2019
BSc (Hons) Plant Science (Ecology) (University of Pretoria)	2014
BSc Environmental Science (University of Pretoria)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, Free State, Western Cape and Northern Cape

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Faunal Assessments
- Invertebrate Assessments
- Invertebrate Monitoring
- Avifaunal Assessments
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF **CHRISTOPHER HOOTON**

PERSONAL DETAILS

Position in Company	Senior Scientist, Member Biodiversity Specialist
Joined SAS Environmental Group of Companies	2013

EDUCATION

Qualifications

BTech Nature Conservation (Tshwane University of Technology)	2013
National Diploma Nature Conservation (Tshwane University of Technology)	2008

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape, Free State
Africa - Zimbabwe, Sierra Leone

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Faunal Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF NELANIE CLOETE

PERSONAL DETAILS

Position in Company	Senior Scientist, Member Botanical Science and Terrestrial Ecology
Joined SAS Environmental Group of Companies	2011

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 400503/14)
 Member of the South African Association of Botanists (SAAB)
 Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group
 Member of the Grassland Society of South Africa (GSSA)
 Member of the Botanical Society of South Africa (BotSoc)
 Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2013
MSc Botany (University of Johannesburg)	2007
BSc (Hons) Botany (University of Johannesburg)	2005
BSc (Botany and Zoology) (Rand Afrikaans University)	2004

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Eastern Cape, Free State

Africa - Democratic Republic of the Congo (DRC)

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Plant species and Landscape Plan

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF **STEPHEN VAN STADEN**

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation
4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions



Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments

