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

Prepared for

CABANGA environmental

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EXECUTIVE SUMMARY

Based on the findings of the avifaunal assessment, it is the opinion of the ecologists that from an avifaunal perspective, the proposed development will have high to medium low impacts on the receiving environment prior to the implementation of mitigation measures. With mitigation impacts can be reduced to medium high and very low levels in most cases. Development within portions of Eastern Highveld Grassland will result in medium high to high impacts scores as primary grassland habitat with the potential to support several SCC will be transformed. This habitat unit provides suitable breeding habitat for two SCC, while foraging habitat for several more SCC was observed within the study area. All mitigation measures and recommendations presented in this report should be adhered to as to ensure the avifaunal ecology within the proposed development areas along with the surrounding habitat is protected or adequately rehabilitated, where necessary, in order to minimise the deviations in levels of ecosystem functions and processes.

Scientific Terrestrial Services (STS) was appointed to conduct an Avifauna 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 project is associated with both linear developments (Main Pipelines and a High-Voltage Line), as well as surface infrastructure that includes the Solar PV Panels, Buildings, the Main Substation and Battery Storage with an associated corridor.

The study area is located within the Mpumalanga Province and falls in the Gert Sibande District Municipality. The project will be connected to the national electrical grid at the Ysterkop sub-station by means of a powerline. The town Hendrina is located 20 km north-east of the study area and the town of Bethal is situated 25 km south of the study area. The proposed powerline transverses the Olifants River at an existing river crossing. For a depiction of the study area, refer to **Figures 1, 2 and 3**.

Specific outcomes required from this report include the following:

- To conduct an avifaunal Species of Conservation Concern (SCC) and determine suitable habitat for these species;
- To identify and consider all sensitive landscapes and possible habitat for such species; and
- To determine the environmental impacts that the proposed development may have on the ecology associated with the study area, with emphasis on avifauna SCC and to develop mitigation and management measures in terms of avifaunal SCC for all phases of the development.

AVIFAUNAL ASSESSMENT

- Habitat for several SCC, including: *Circus maurus* (Black Harrier), *Falco vespertinus* (Red-footed Falcon), *Falco amurensis* (Amur Falcon), *Circus ranivorus* (African Marsh-Harrier), *Glareola nordmanni* (Black-winged Pratincole), *Circus macrourus* (Pallid Harrier), *Ciconia abdimii* (Abdim's Stork), *Geronticus calvus* (Southern Bald Ibis), *Heteromirafra ruddi* (Rudd's Lark), *Mycteria ibis* (Yellow-billed Stork), *Sagittarius serpentarius* (Secretarybird) and *Falco biarmicus* (Lanner Falcon) was noted within the study area;
- Breeding habitat for *Tyto capensis* (African Grass Owl) and *Eupodotis caerulescens* (Blue Korhaan) was observed within the study area;
- The largely homogeneous nature of the landscape, except for varying degrees of habitat integrity provides intermediate and moderately high habitat suitability and habitat availability yet, the homogeneity of the habitat structure limits niche habitats and thus species diversity;
- During the field assessment only a single species of Special Interest (*Falco amurensis* (Amur Falcon)) was observed within the study area;
- The proposed activities will lead to the transformation of sensitive Eastern highveld Grassland to an extent that it will no longer be suitable for most avifauna. Migrations to adjacent habitat

will likely occur decreasing species richness within the study area and increasing competition for resources in the surrounding habitat, reducing avian abundances. It is unlikely that avian diversity will return to baseline levels; and

- The proposed development is thus deemed likely to pose a threat to avifaunal SCC within the study area, yet, regional impacts are not anticipated if mitigation measures set out within this report are adhered to as the study area is not considered an isolated or last remaining area of importance for feeding, breeding or roosting of the abovementioned SCC. Habitat for such species does exist in the surrounding areas. Cognisance must be given to the fact that continued habitat loss will have notable knock-on impacts to these species as suitable foraging and breeding grounds continue to be lost.

AVIFAUNAL IMPACT ASSESSMENT:

The findings of the impact assessment indicate the significance of the impact before mitigation occurs and the likely impact if effective management and mitigation takes place. In the consideration of mitigation, it is assumed that a high level of mitigation will take place. From the impact assessment it is evident that prior to mitigation, the impacts on avifaunal SCC are of high to low significance levels, with higher impact significance activities occurring as a result of the establishment of the PV 2 panels within the Eastern Highveld Grassland. This activity will likely result in a decrease in avian richness and abundance of SCC within the study area. If effective mitigation takes place, all impacts may be reduced to lower significance levels.

Sensitivity

From an avifaunal ecological perspective, the study area has portions of valuable habitat within the Eastern Highveld Grassland and the Wetland Habitats. The remainder of the study area is considered to be of intermediate to low sensitivity, mainly as a result historic and current agricultural activities occurring within the central and eastern portions of the study area and the largely homogenous nature of the vegetation within the study area. The western portion of the study area is sensitive for avifauna, providing valuable foraging and breeding habitat for avifaunal SCC. The surrounding landscape is a mosaic of agricultural, mining and natural areas absent of high density human settlements and thus expected to retain an rich abundance and diversity of birds, particularly as a result of the Floodplain to the south-west of the study area. The proposed activities, notably the establishment of PV 2 Panels, will alter the landscape to an extent where it will no longer be suitable for SCC to forage or breed within. Effective mitigation can reduce the potential impacts anticipated to lower levels.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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(NEMBA)), and the associated Alien and Invasive Species (A&IS) Regulations, 2014].

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 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;
Corridor	A dispersal route or a physical connection of suitable habitats linking previously unconnected regions.
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.
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.
Ecological Support Area (ESA)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
Endangered	Organisms in danger of extinction if causal factors continue to operate.
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.
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.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
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.
Least Threatened	Least threatened ecosystems are still largely intact.
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 (Red Data), The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland and the IUCN (International Union for the Conservation of Nature) listed threatened species as well as protected species of relevance to the project. Refer to **Appendix B and F** for further details.
Special Interest	Species with <5% of their global range falling within South Africa, many of which were recorded in previous assessments. The small regional populations of these species render them susceptible to regional extinction. However, they are not considered conservation priorities

LIST OF ACRONYMS

AIP	Alien Invasive Plant
BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resource Act
CBA	Critical Biodiversity Area
CR	Critically Endangered
DEFF	Department of Environment, Forestry and Fisheries
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EN	Endangered
ESA	Ecological Support Area
GIS	Geographic Information System
GPS	Global Positioning System
Ha	Hectares
IBA	Important Bird Area
IEM	Integrated Environmental Management
IUCN	International Union for the Conservation of Nature
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential for Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MFD	Mean Frost Days
MTPA	Mpumalanga Tourism and Park Agency
NBA	National Biodiversity Assessment (2011)
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NPAES	National Protected Areas Expansion Strategy
NT	Near Threatened
OHPL	Overhead powerline
PES	Present Ecological State
POC	Probability of Occurrence
PV	Photovoltaic
QDS	Quarter Degree Square (1:50,000 topographical mapping references)
RDL	Red Data List
SABAP 2	Southern African Bird Atlas 2
SACAD	South Africa Conservation Areas Database
SANBI	South African National Biodiversity Institute
SAPAD	South Africa Protected Area Database
SCC	Species of Conservation Concern
SI	Special Interest
STS	Scientific Terrestrial Services CC
TOPS	Threatened or Protected Species
TSP	Threatened Species Programme
VU	Vulnerable

1. INTRODUCTION

Scientific Terrestrial Services (STS) was appointed to conduct an Avifauna 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 project is associated with both linear developments (Main Pipelines and a High-Voltage Line), as well as surface infrastructure that includes the Solar PV Panels, Buildings, the Main Substation and Battery Storage. For further project descriptions, refer to Section 1.1.

The study area is located within the Mpumalanga Province and falls in the Gert Sibande District Municipality. 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 proposed powerline transverses the Olifants River at an existing bridge. For a depiction of the study area, refer to **Figures 1 and 2**.

This report, after consideration and the description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP), regulatory authorities and developing proponent, by means of the presentation of results and recommendations, as to the ecological viability of the proposed development activities.

1.1 Project Description

The Applicant (Dreamworks Haven Investments Pty Ltd) proposes to develop the Halfgewonnen Solar Photovoltaic (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 the proposed development.

The proposed Halfgewonnen Solar PV Project comprises of two components:

1. Solar PV 1 will generate approximately 20 MW and will address the electricity requirements for the immediately surrounding and adjacent mines, until these mines are decommissioned, after which, if no consumers are identified in the immediate vicinity, PV1 will be connected to the National Grid. Construction is expected to take

approximately 10 months. The total development footprint will be approximately 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 approximately 88 Ha.

Surface developments will thus include the PV 1 (approximately 34 Ha) and PV 2 Panels (approximately 88 Ha), the Main Substation (± 0.3 Ha), additional Buildings (± 0.3 Ha), and the Battery Storage area (± 3.3 Ha). 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.**

1.2 Project Scope

Specific outcomes in terms of this report are outlined below:

- To provide a desktop study with all relevant information as presented by South African National Biodiversity Institute's (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org), including the National Threatened Ecosystem Database (2011), the The Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA) and the Environmental Geographical Information Systems (E-GIS) databases (https://egis.environment.gov.za/), The National Environmental Management: Biodiversity Act (Act No.10 of 2004) (NEMBA) Threatened or Protected Species (TOPS) list (NEMBA, Notice 389 of 2013), The International Union for Conservation of Nature (IUCN) Red List of Threatened Species; and The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland, to gain background information on the physical habitat and potential floral and faunal ecology associated with the study area;
- To identify and consider all sensitive landscapes and possible habitat for such species; and
- To determine the environmental impacts that the proposed development may have on the ecology associated with the study area, with emphasis on avifauna SCC and to develop mitigation and management measures in terms of avifaunal SCC for all phases of the development.

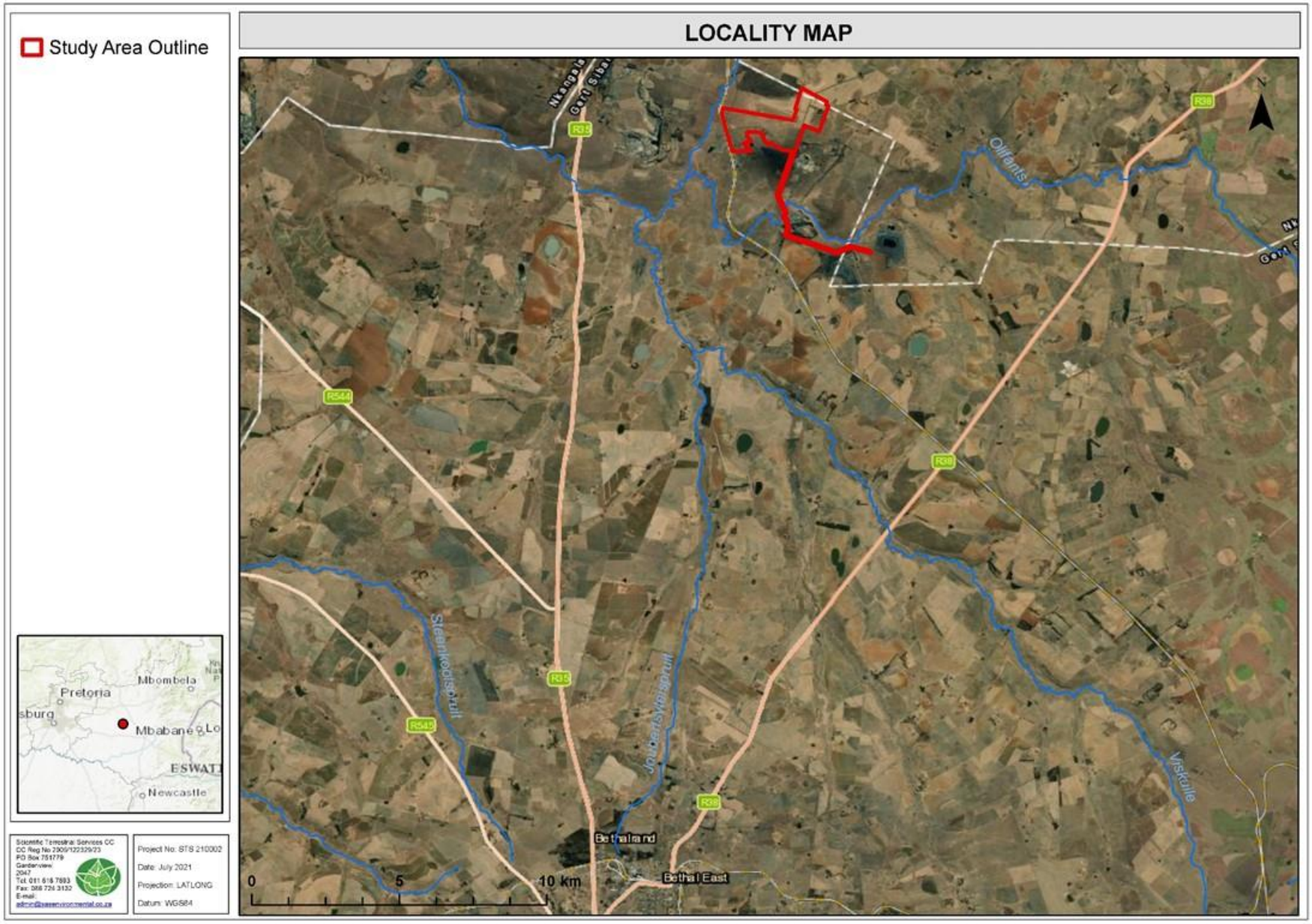

Figure 1: Digital satellite image depicting the study area in relation to surrounding area.

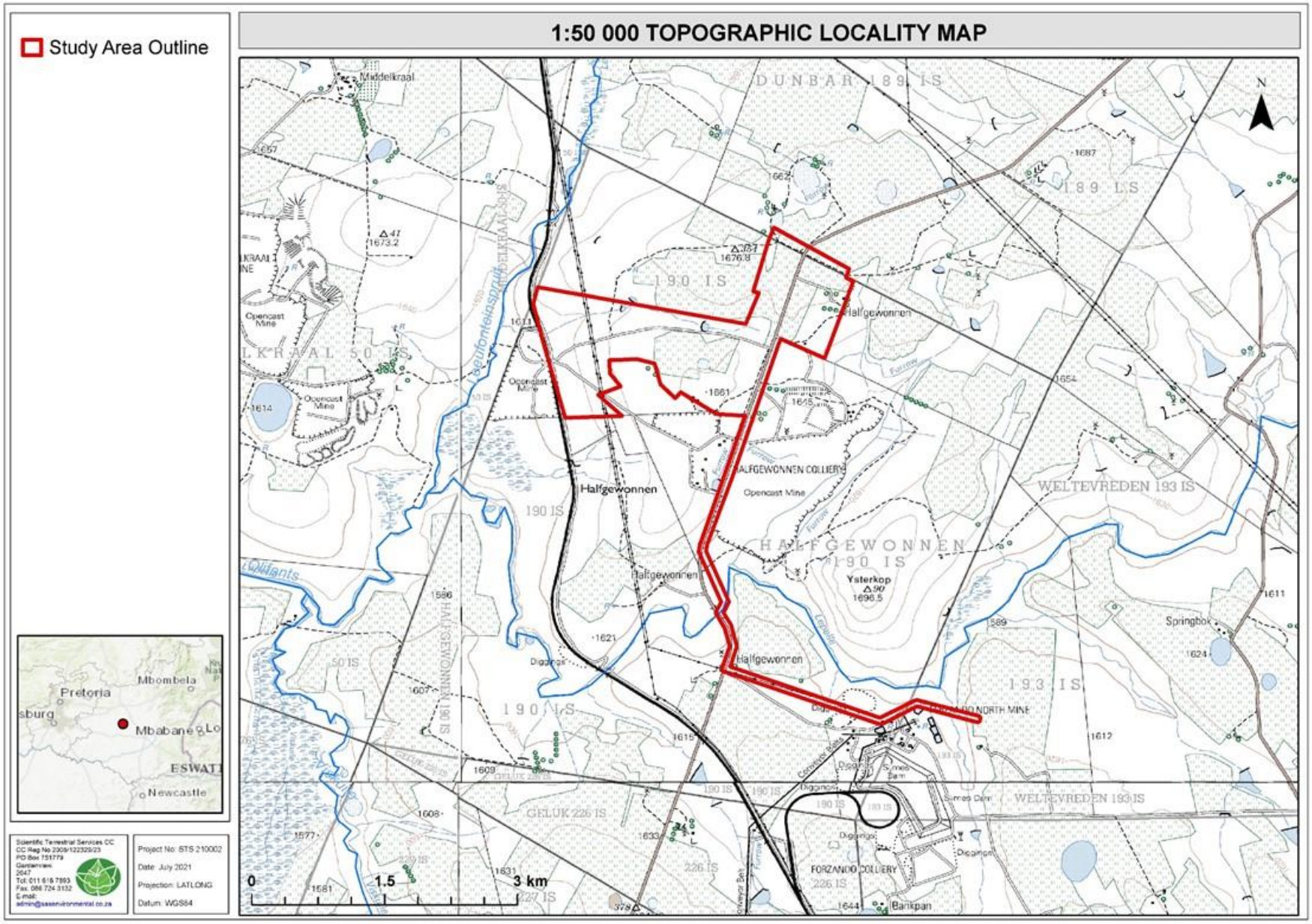

Figure 2: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

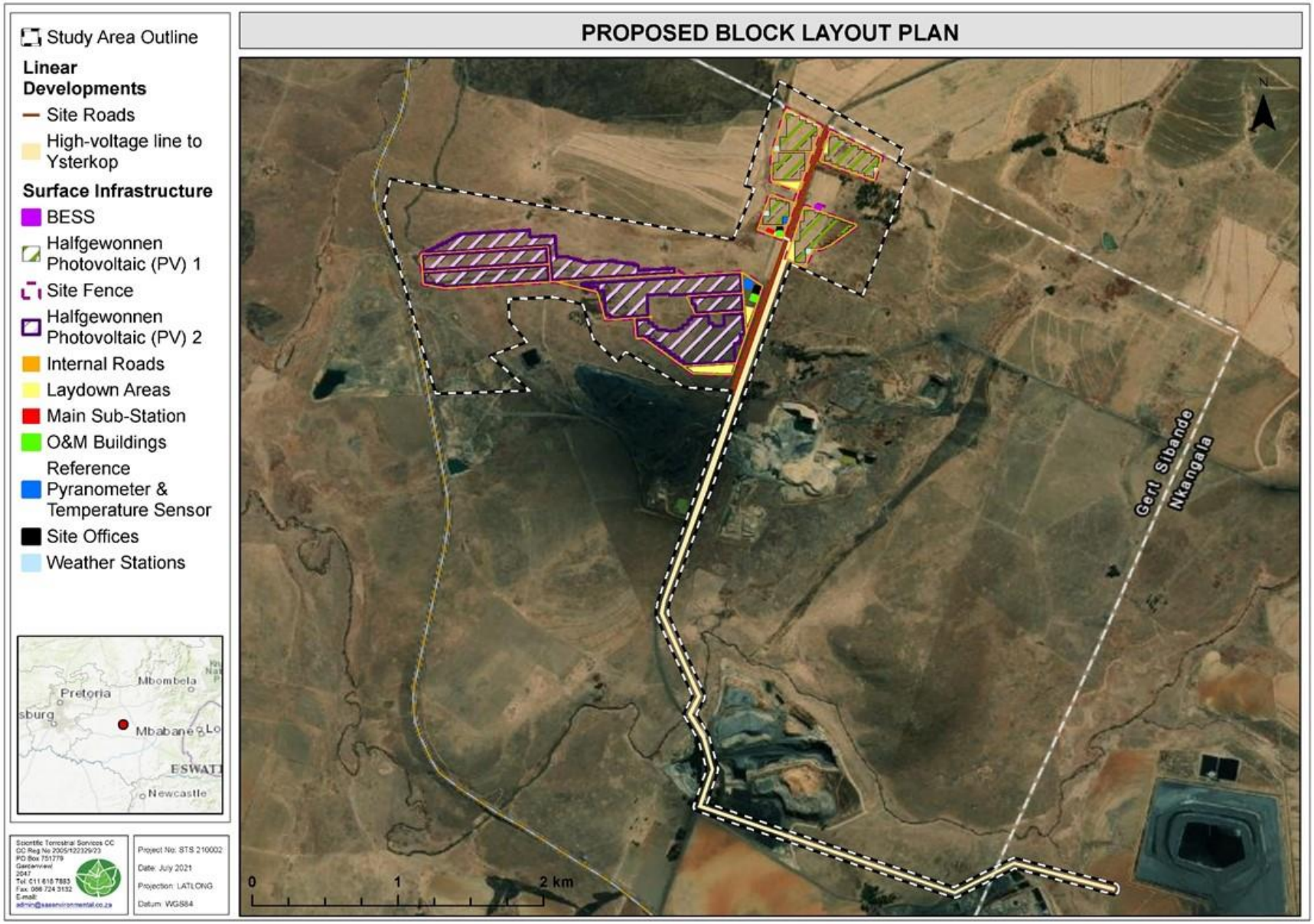

Figure 3: The proposed infrastructure layout within the study area.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The site investigation was restricted to the proposed study area. For the surface infrastructure, a buffer of 100 m was placed around the proposed footprint areas for investigation and ground-truthing. For the proposed High-Voltage Line, a buffer of 30 m was applied and ground truthed. A smaller buffer was deemed adequate due to the nature of the proposed development, i.e., linear infrastructure and it being a powerline. Where the 100 m or 30 m buffer extended into the neighbouring mines where access was not granted, the area was not ground truthed;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most avifaunal communities have been accurately assessed and considered;
- Due to the nature and habits of most avifaunal species and their often wide ranging habits or migration patterns, it is unlikely that all species would have been observed during a site assessment of limited duration. Therefore, site observations were compared with literature studies where necessary; and
- The data presented in this report are based on two field assessments, undertaken during summer (3rd to the 5th of February 2021) with an additional winter follow-up assessment (24th and 25th of June 2021). Furthermore, on-site data were significantly augmented with all available desktop data, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the study area.

1.4 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 in their temporal extent over which periods of suitable conditions (insect outbreaks, rain or fire) did not coincide with the field investigations, thus some aspects or observations may have been missed. STS CC and its staff reserve the right to, at their sole discretion, 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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2. ASSESSMENT APPROACH

2.1 General Approach

Field assessments were undertaken during summer (3rd to the 5th of February 2021) and winter (24th and 25th of June 2021), to determine the potential presence of SCC and general habitat characteristics within the study area and for temporal variation. A reconnaissance 'walkabout' was initially undertaken to determine the general habitat types found throughout the study area, following this, specific study sites that were selected which were considered to be representative of the habitats found within the area, with special emphasis being placed on areas that may potentially support breeding and foraging habitat for SCC. These areas were then walked on foot and all observed avifauna were recorded.

A detailed explanation of the method of assessment is provided in **Appendix B** of this report.

2.2 Sensitivity Mapping

All the ecological features of the study area were considered, and sensitive areas were assessed. A Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps. The sensitivity was utilised to guide the design and layout of the proposed construction and operational activities. Please refer to Section 5 and 6 of this report for further details.

3. RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics of the Study area

The following table contains data accessed as part of the desktop assessment. It is important to note, that although all data sources used provide useful and often verifiable high-quality data, the various databases do not always provide an entirely accurate indication of the study areas actual biodiversity characteristics.

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

<table>
<tr><th colspan="2">DETAILS OF THE STUDY AREA IN TERMS OF MUCINA & RUTHERFORD (SANBI, 2018)</th><th colspan="7">DESCRIPTION OF THE EASTERN HIGHVELD GRASSLAND ASSOCIATED WITH THE STUDY AREA (MUCINA & RUTHERFORD 2006)</th></tr>
<tr><td>Biome</td><td>The study area is situated within the Grassland Biome.</td><td rowspan="2">Distribution</td><td colspan="7" rowspan="2">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.</td></tr>
<tr><td>Bioregion</td><td>The study area is situated within the Mesic Highveld Grassland Bioregion.</td></tr>
<tr><td>Vegetation Type</td><td>The study area falls within the Eastern Highveld Grassland (Gm12) vegetation type.</td><td rowspan="3">Climate</td><td colspan="7">Strongly seasonal summer rainfall, with very dry winters.</td></tr>
<tr><td colspan="2">CONSERVATION DETAILS PERTAINING TO THE STUDY AREA (VARIOUS DATABASES)</td><td>MAP (mm)</td><td>MAT (°C)</td><td>MFD (days)</td><td>MAPE (mm)</td><td>MASMS (%)</td></tr>
<tr><td rowspan="4">National Threatened Ecosystems (2011) (GN 1002) (Figure 4)</td><td rowspan="4">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.

<u>Linear developments:</u>
The proposed High-Voltage Line to Ysterkop mainly falls outside of the remaining extent of the Eastern highveld Grassland where it runs along an existing road; however, along its southern extent, the High-Voltage Line crosses through this ecosystem. The Main Pipeline only crosses through the remaining extent of this ecosystem in patches, with the western portion of the pipeline falling within the largest potentially intact section of the vulnerable ecosystem.

<u>Surface Infrastructure:</u>
Of the surface infrastructure, only the Panels, Buildings and Main Substation fall within patches of the remaining extent of this ecosystem.

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.</td><td></td><td>726</td><td>14.7</td><td>32</td><td>1926</td><td>73</td></tr>
<tr><td>Altitude (m)</td><td colspan="7">1 520 – 1780, but also as low as 1300</td></tr>
<tr><td>Conservation</td><td colspan="7">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.

Target 24%. Only very small fraction conserved in statutory reserves (Nooitgedacht Dam and Jericho Dam Nature Reserves) and in private reserves (Holkranse, 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 Acacia mearnsii can become dominant in disturbed sites. Erosion is very low</td></tr>
<tr><td>Geology & Soils</td><td colspan="7">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%).</td></tr>
<tr><td>Vegetation & landscape features (Dominant Floral Taxa in Appendix D)</td><td colspan="7">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 (Aristida, Digitaria, Eragrostis, Themeda, Tristachya etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (Senegalia caffra, Celtis africana, Diospyros lycioides subsp lycioides, Parinari capensis, Protea caffra, P. welwitschii and Searsia magalismontanum).</td></tr>
</table>

<table>
<tr>
<td rowspan="5">National Biodiversity Assessment (2018) Figure 5</td>
<td rowspan="5">The study area falls within the remaining extent of the Eastern Highveld Grassland (Vulnerable) (SANBI. 2018a), which is currently poorly protected (SANBI. 2018b). The proposed infrastructure does not fall fully within the Eastern Highveld Grassland, with only sections of the Panels, Main Pipeline and High-Voltage Line falling within its remaining extent. The rest of the layout 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 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).

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.
The ecosystem protection level status is assigned using the following criteria:
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.</td>
<td colspan="2">STRATEGIC WATER SOURCE AREAS FOR SURFACE WATER (2017)</td>
</tr>
<tr>
<td colspan="2">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.</td>
</tr>
<tr>
<td>Name & Criteria</td>
<td>The study area is not within 10 km of a Strategic Water Source Area.</td>
</tr>
<tr>
<td colspan="2">NATIONAL PROTECTED AND CONSERVATION AREAS – VARIOUS DATABASES</td>
</tr>
<tr>
<td>IBA (2015);
NPAES (2010);
SAPAD (2021, Q1);
and
SACAD (2021, Q1)</td>
<td>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). Refer to section 3.2 of this report for more details.

The NPAES (2010), SACAD (2021, Q1) and SAPAD (2021, Q1) databases do not indicate any protected or conservation areas within 10 km of the study area.</td>
</tr>
</table>

<table>
<tr><th colspan="4">MPUMALANGA BIODIVERSITY SECTOR PLAN (2019) TERRESTRIAL DATABASE – Figure 7</th></tr>
<tr><td>CBA Irreplaceable</td><td>The study area is within an Irreplaceable Critical Biodiversity Area (CBA). More specifically, the western portions of the Panels and Main Pipeline falls within this Irreplaceable CBA. A small section within the central section of the High-Voltage Line also crosses through this CBA. The remaining infrastructure does not fall within this CBA category.

CBAs are areas of high biodiversity value and need to be maintained in a natural state. The CBA Irreplaceable category includes:
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.

<u>Development Constraints</u>:
- 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.</td><td>CBA Optimal</td><td>A small section of the central portion of the High-Voltage Line crosses through an Optimal CBA. The remaining infrastructure does not fall within this CBA category.

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.

<u>Development Constraints</u>:
- 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.</td></tr>
<tr><td>Heavily modified</td><td>Much of the proposed infrastructure are within Heavily Modified areas, including several portions of the Panels and Main Pipeline, the entire Battery Storage and Main Substation, 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.

<u>Development Constraints</u>:
- Permissible land-uses that are unlikely to compromise the biodiversity objective.</td><td>Other Natural Areas</td><td>Small sections of the proposed Panels and main Pipeline fall 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.

<u>Development Constraints</u>:
- Land-uses that may compromise the biodiversity objective and that are only permissible under certain conditions.</td></tr>
<tr><td>Moderately modified: Old Lands</td><td colspan="3">Small sections of the proposed Panels, Main Pipeline, High-Voltage Line and the proposed Buildings 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.

<u>Development Constraints</u>:
- Permissible land-uses that are unlikely to compromise the biodiversity objective.</td></tr>
</table>

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 *Tyto capensis* (African Grass Owl, **VU**) and *Sagittarius serpentarius* (Secretarybird VU). Other fauna which potentially occur within the study area as noted by the screening tool are mammals *Hydrictis maculicollis* (Spotted-necked Otter, **VU**) and *Ourebia ourebi* (Oribi, **EN**).
Avian Sensitivity	The Avian Sensitivity for the entire study area is considered **High**. The triggered features include high sensitivity features such as **wetlands**, **500m of a wetland** and w**ithin 500m of a river** and medium sensitivity **Croplands**.
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 Conservation Plan v2, 2013)**, 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.

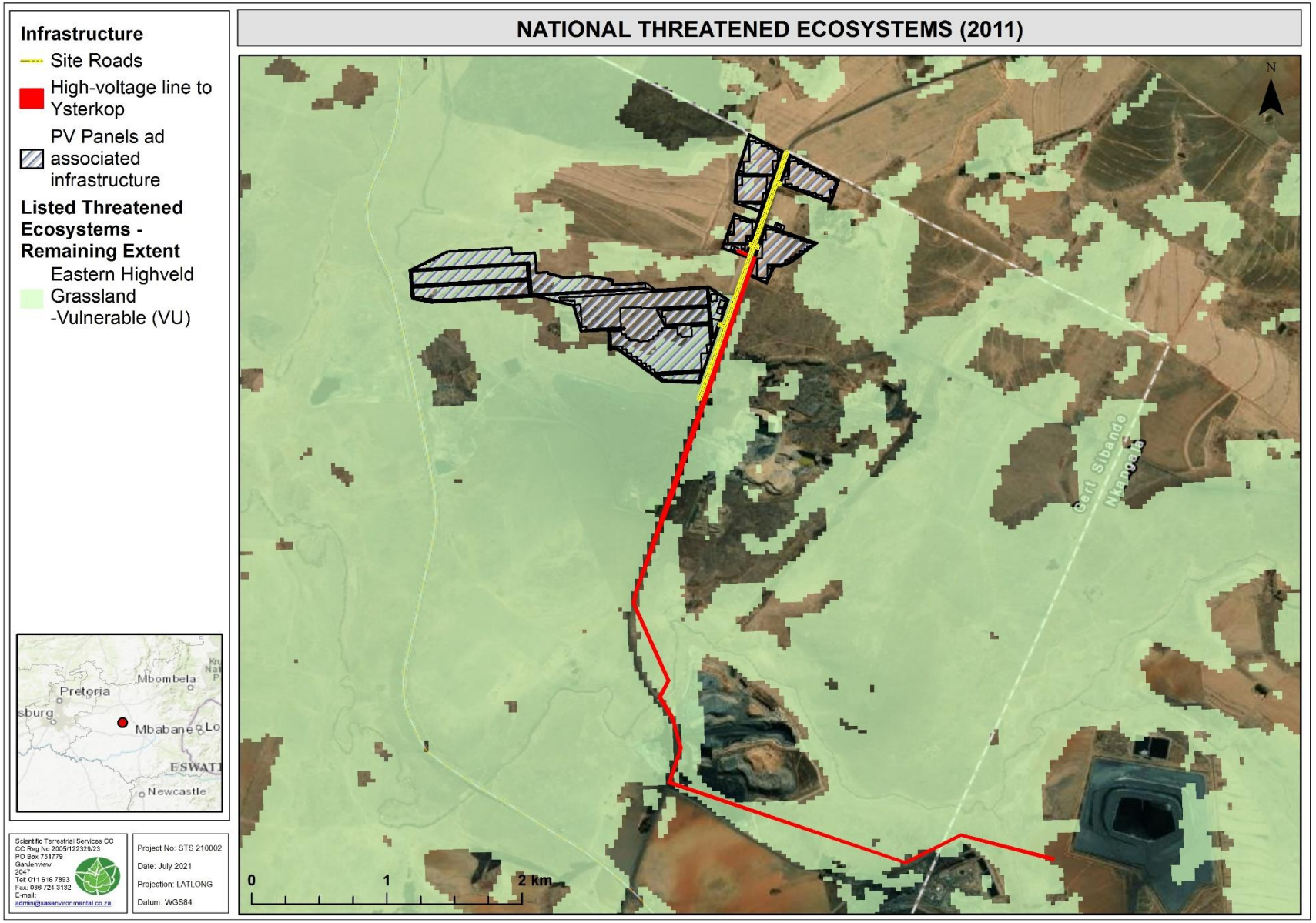


Figure 4: The proposed layout superimposed onto the listed Eastern Highveld Grassland threatened ecosystem (vulnerable) - according to the National Threatened Ecosystem database (2011).

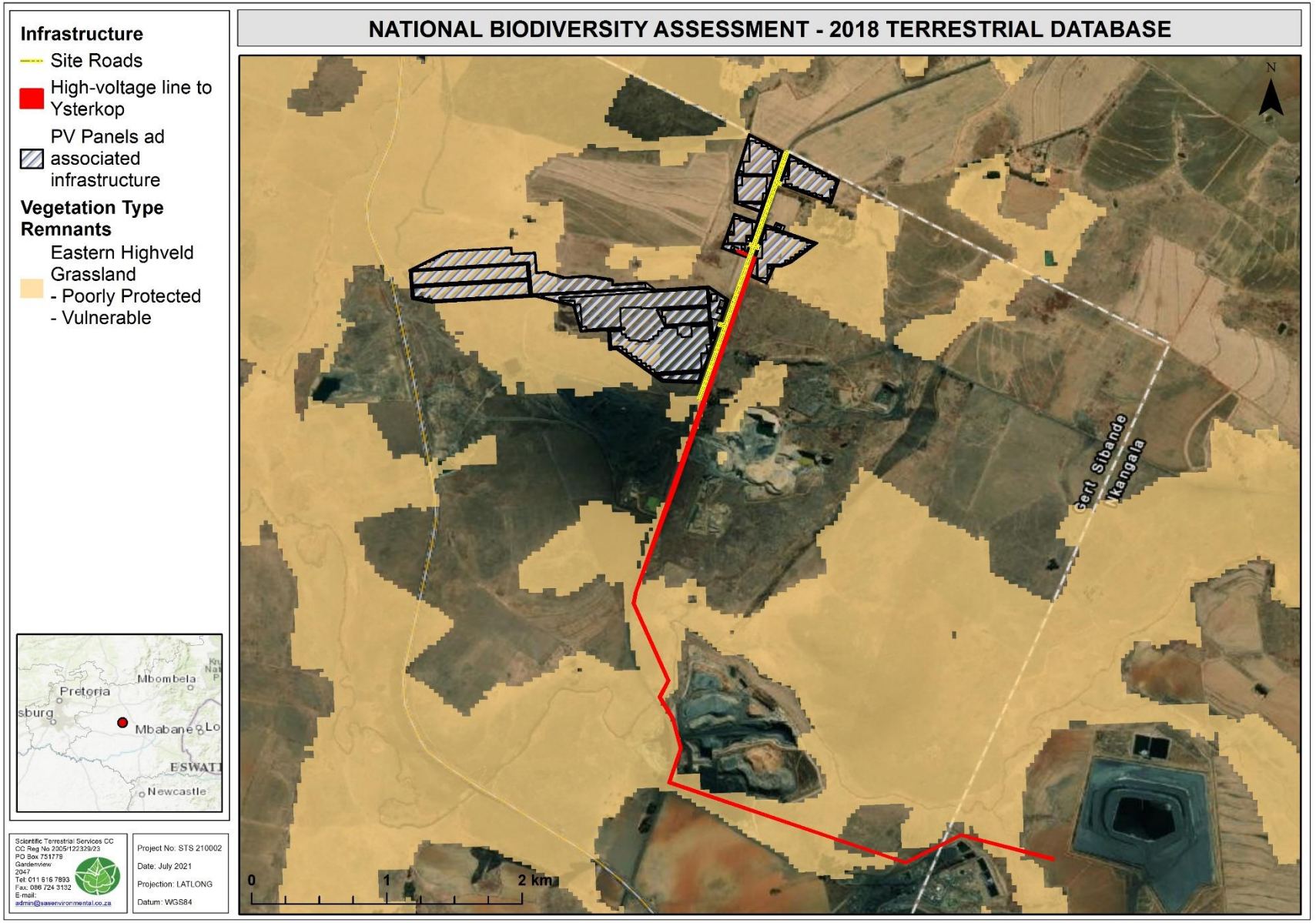


Figure 5: The proposed layout in relation to the remaining extent of the Eastern Highveld Grassland (VU), according to the National Biodiversity Assessment (NBA, 2018).

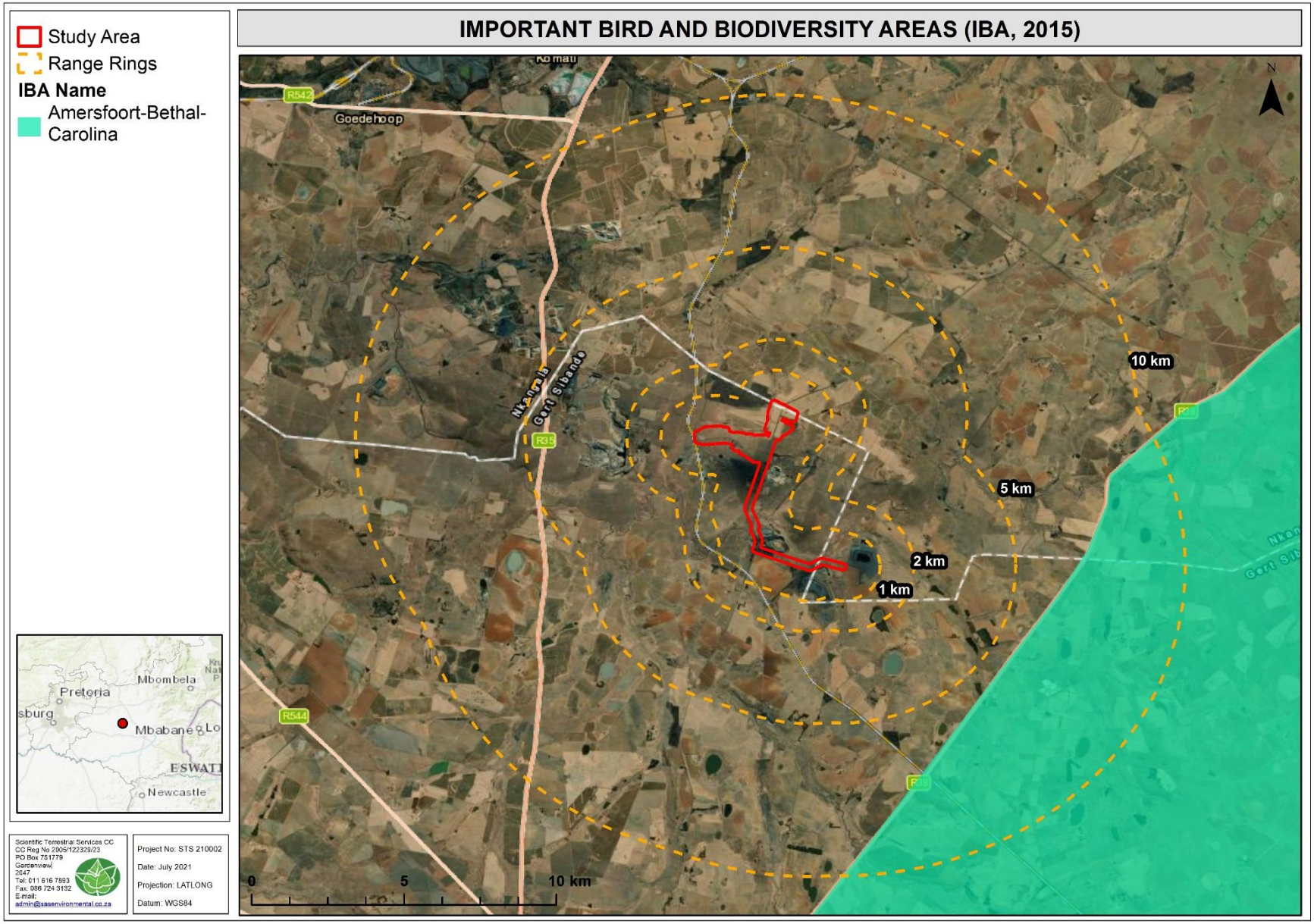


Figure 6: The study area in relation to the Amersfoort-Bethal-Carolina Important Bird and Biodiversity Area (IBA database of 2015).

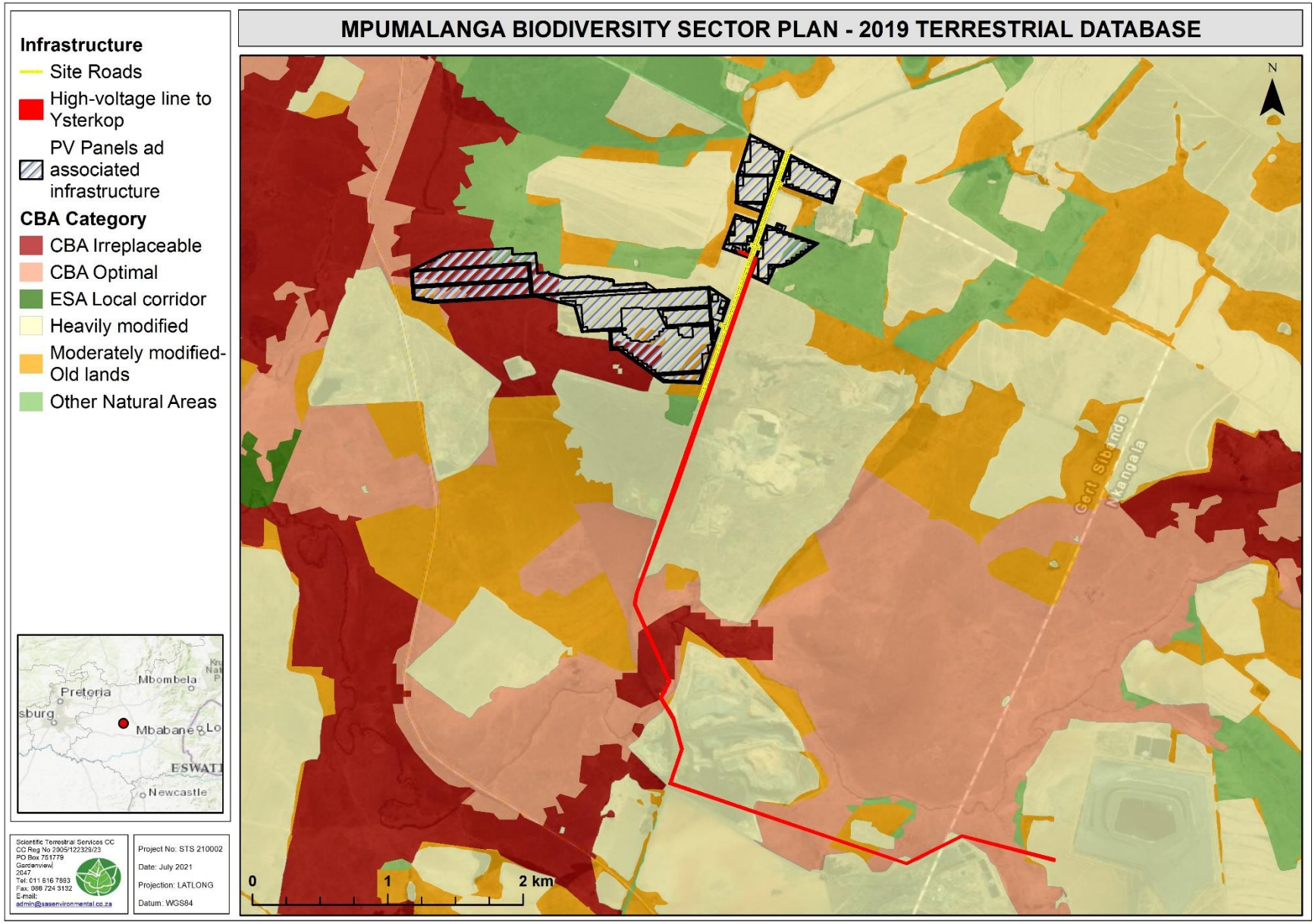


Figure 7: The study area in relation to the various CBA categories as indicated in the Mpumalanga Biodiversity Plan (2019).

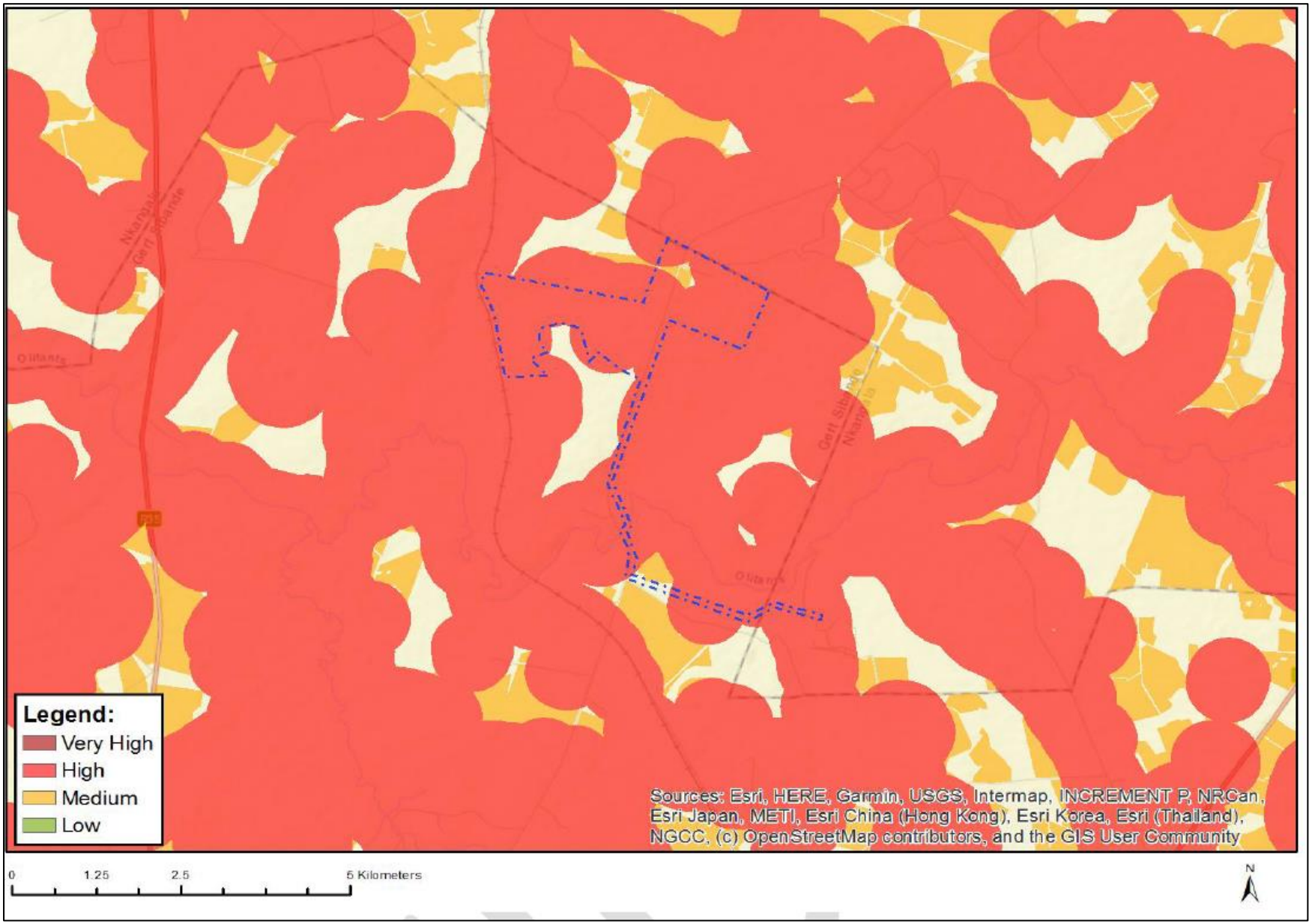


Figure 8. Avian Species Theme sensitivity map generated by the National Web based Screening Tool.

3.2 Important Bird and Biodiversity Areas (IBA)

The IBA database indicate the **Amersfoort-Bethal-Carolina IBA** within 10 km south-east of the study area (Figure 6). This IBA is confined by the main roads connecting Ermelo, Amersfoort, Bethal, Hendrina and Carolina, and this area consists mostly of flat to undulating farmland.

IBA trigger species: The key species within this IBA is the globally threatened Botha's Lark (*Spizocorys fringillaris*). Other globally threatened species are Blue Crane (*Anthropoides paradiseus*), Southern Bald Ibis (*Geronticus calvus*), Black Harrier (*Circus maurus*), Blue Korhaan (*Eupodotis caerulescens*), Black-winged Pratincole (*Glareola nordmanni*), Secretarybird (*Sagittarius serpentarius*), Martial Eagle (*Polemaetus bellicosus)* and Denham's Bustard (*Neotis denhami*). Regionally threatened species are African Grass Owl (*Tyto capensis*), White-bellied Korhaan (*Eupodotis senegalensis*) and Lanner Falcon (*Falco biarmicus*). Biome- and range-restricted species are Botha's Lark (*Spizocorys fringillaris*), Kurrichane Thrush (*Turdus libonyanus*) and Buff-streaked Chat (*Campicoloides bifasciatus*).

3.3 Results of Desktop Avifaunal SCC Assessment

The following table of avifaunal SCC include species whose distribution ranges at some time have overlayed the study area. Records from SABAP 2 were obtained to determine if these species were recorded in SABAP 2 in the pentad 2310_2930 and their relative reporting rate. The table below provides a brief summary of the data.

Table 2: A summary of historic and current data obtained from SABAP2 (2610_2930 pentad).

Common Name	Scientific Name	Regional Status (Taylor *et al*, 2015)	Reporting Rate (%) SABAP 2 2610_2930 (11 cards)
Black Harrier	*Circus maurus*	EN	-
African Marsh-Harrier	*Circus ranivorus*	EN	-
Rudd's Lark	*Heteromirafra*	EN	-
Yellow-billed Stork	*Mycteria ibis*	EN	-
Denham's Bustard	*Neotis denhami*	VU	9
Southern Bald Ibis	*Geronticus calvus*	VU	-
White-bellied Korhaan	*Eupodotis senegalensis*	VU	-
African Grass Owl	*Tyto capensis*	VU	-
Yellow-breasted Pipit	*Anthus chloris*	VU	-
Secretarybird	*Sagittarius serpentarius*	VU	36
Blue Crane	*Anthropoides paradiseus*	NT	-

Red-footed Falcon	*Falco vespertinus*	NT	-
Pallid Harrier	*Circus macrourus*	NT	-
Black-winged Pratincole	*Glareola nordmanni*	NT	-
Abdim's Stork	*Ciconia abdimii*	NT	-
Lanner Falcon	*Falco biarmicus*	VU	9
Blue Korhaan	*Eupodotis caerulescens*	SI and P	36
Amur Falcon	*Falco amurensis*	SI	18

LC= Least Concern, NA= Not Assessed, NT= Near Threatened, VU= Vulnerable, EN= Endangered, SI=Species Interest and P=Protected in Provincial or National Legislation

4. AVIFAUNAL ASSESSMENT RESULTS

Four habitat units were identified during the site assessment of the study area, they are briefly discussed below. The habitat units are depicted in Figure 9 and 10 below. For birds vegetation structure, as opposed to actual floral species richness, is widely acknowledged as the primary determinant of bird communities (Skowno & Bond 2003; Wichmann et al. 2009; Burgess et al. 2011; Smith et al. 2017). A general grassland landscape existed throughout the study area, even the Wetland Habitat, although often denser with taller grasses, reeds or sedges, mimicked the Grassland Habitat to a large extent, yet this unit provides unique saturated characters. As limited diversity in vegetation structure exist it is not anticipated that the site will preserve a broad assemblage of birds but will be inhabit by mostly grassland specialists and generalist granivorous and insectivorous species. Avifaunal abundances and species richness decreased dramatically over the winter period.

Based on the results of the field investigations, 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 (intact mostly short grasslands with minimal alien vegetation and disturbances – meets the definition of primary grassland[1], providing valuable forage and a florally species rich grass, herb and forb layer);
- Secondary Grassland[2] Habitat Unit (stretches of grassland where floral communities display evidence of significant historic disturbance – in this case, historic cultivation. This unit comprised of taller more moribund vegetation with a more homogenous floral composition, reducing forage availability and habitat suitability); and
- Wetland Habitat Unit (some sections have vegetation that is still largely **intact**, comprising indigenous graminoids and forb species, with several sections where vegetation is **degraded**, i.e., where there is a clear dominance of alien forb species and a general lack of expected wetland graminoids. This unit provided valuable niche

[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."

habitat with a dense graminoid layer with rushes and reeds, preferable to many avian species).

For a breakdown of the floral communities and habitat and conservation sensitivities associated with them, refer to Section 3.2.1 – 3.2.4 of the floral report (STS 210002; Part B).

Section 4.1 summarises the field observations that were made during the site visit in February 2021 (summer) and June 2021 (winter), with regards to overall avifaunal diversity, food availability, habitat integrity, habitat availability, general comments and business case and conclusion.

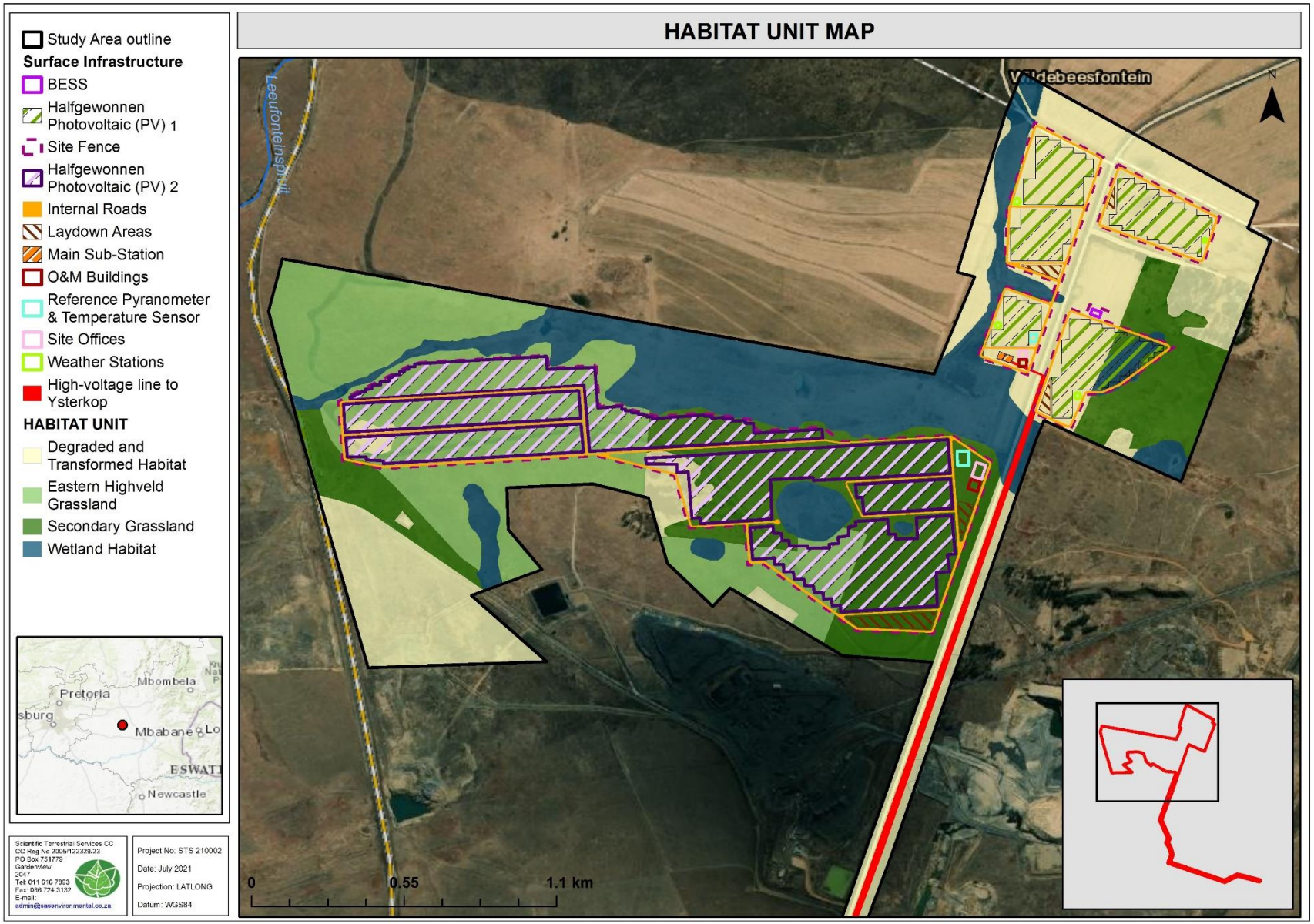


Figure 9: Habitat units encountered within the northern portion of the study area.

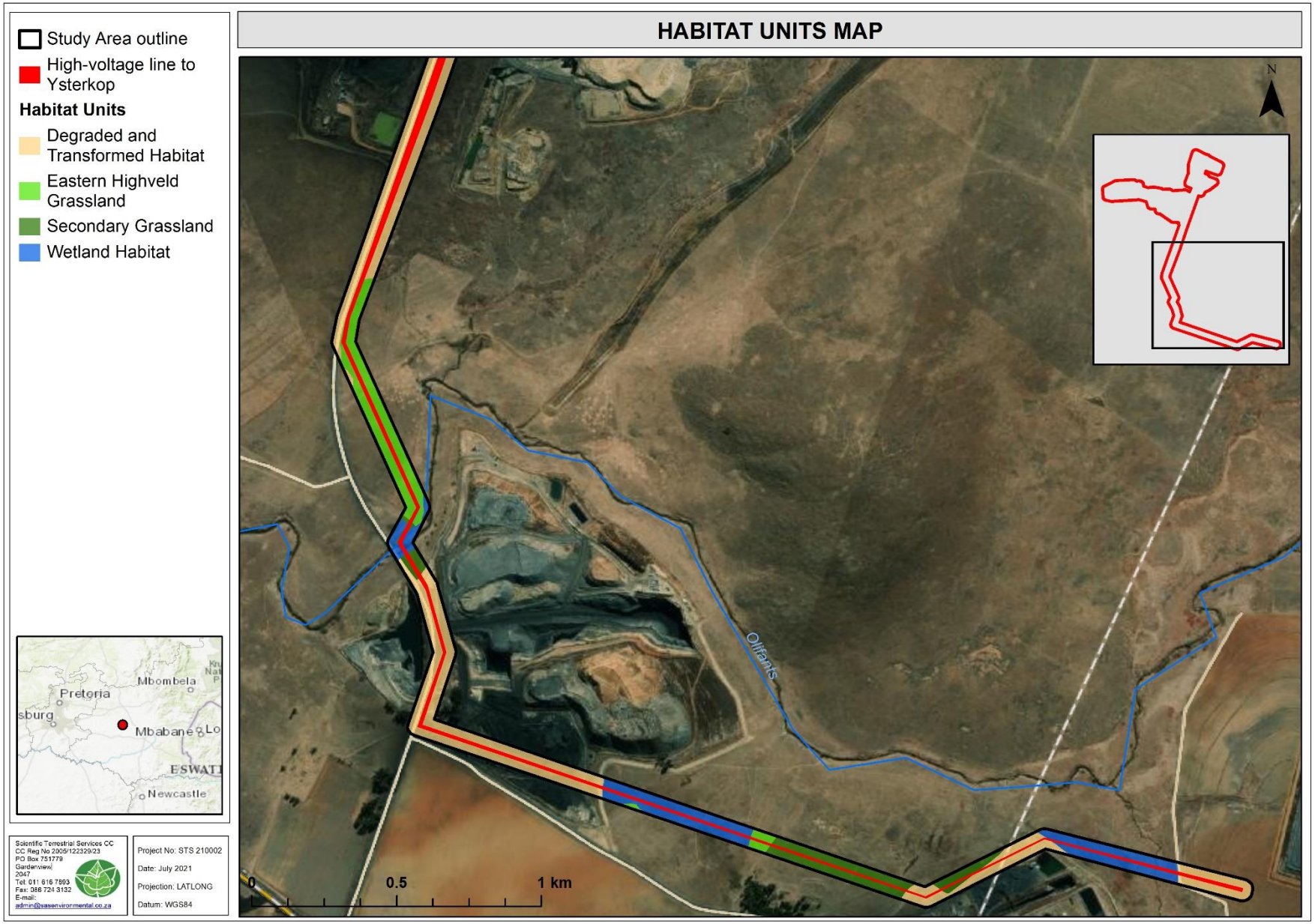


Figure 10: Habitat units encountered within the southern portions of the study area.

4.1 Summary of results for avifaunal species

Faunal Class: Avifaunal	Habitat Sensitivity:	Intermediate

Notes on photographs:
Top: Left and right – General habitat characteristics noted during the field investigation, dense Wetland Habitat, short open Eastern Highveld Grassland and Secondary Grassland Habitat.
Bottom: Left to right – *Asio capensis* (Marsh Owl), *Burhinus capensis* (Spotted Thick-knee), *Ardea melanocephala* (Black-headed Heron) and a *Falco amurensis* (Amur Falcon).

Photograph:

Faunal SCC/Endemics/TOPS/:

A single species considered regionally of Special Interest, the Amur Falcon (*Falco amurensis*) was observed foraging within the Eastern Highveld Grassland, utilizing existing Powerline Infrastructure to perch on. The study area is considered to have suitable breeding habitat for *Tyto capensis* (African Grass Owl) and *Eupodotis caerulescens* (Blue Korhaan). Several more SCC are deemed likely to utilise the study area for foraging, and include *Circus maurus* (Black Harrier), *Falco vespertinus* (Red-footed Falcon), *Circus ranivorus* (African Marsh-Harrier), *Glareola nordmanni* (Black-winged Pratincole), *Circus macrourus* (Pallid Harrier), *Geronticus calvus* (Southern Bald Ibis), *Ciconia abdimii* (Abdim's Stork), *Mycteria ibis* (Yellow-billed Stork), *Sagittarius serpentarius* (Secretarybird) and *Falco biarmicus* (Lanner Falcon). Possible habitat for *Heteromirafra ruddi* (Rudd's Lark) was observed within the study area but this species prefers higher altitude locations.

Avifaunal Diversity	The avifaunal diversity associated with the study area ranged from low to moderately high, mainly of common avifaunal with some more rare and reclusive birds observed. Since habitat structure is often considered the primary determinant of bird assemblages it is anticipated that the largely homogenous grassland structure of the study area will be mirrored by a relatively narrow assemblage of birds. Species within the study area include: Cape turtledove (*Streptopelia capicola*), *Microcarbo africanus* (Reed Cormorant), *Euplectes progne* (Long-tailed Widowbird), *Riparia cincta* (Banded Martin), *Euplectes orix* (Southern Red Bishop), *Ploceus velatus* (Southern Masked Weaver), *Macronyx capensis* (Cape Longclaw), *Charadrius tricollaris* (Three-banded Plover), Neddicky (*Cisticola fulvicapillus*), *Cisticola aberrans* (Lazy Cisticola), *Cisticola tinniens* (Levaillant's Cisticola), *Cisticola textrix* (Cloud Cisticola), *Cisticola ayresii* (Wing-snapping Cisticola), *Fulica cristata* (Red-knobbed Coot), *Saxicola torquatus* (African Stonechat), *Alopochen aegyptiaca* (Egyption Goose), *Plectropterus gambensis* (Spur-winged Goose), *Euplectes axillaris* (Fan-tailed Widowbird), *Lanius collaris* (Common Fiscal), *Burhinus capensis* (Spotted Thick-knee), *Ardea cinerea* (Grey Heron), *Ardea melanocephala* (Black-headed Heron), *Anas undulata* (Yellow-billed Duck), *Euplectes afer* (Yellow-crowned Bishop) and *Elanus caeruleus* (Black-shouldered Kite). Please refer to Appendix C for the full list of species identified on site.
Food Availability	The study area is considered to have a moderately high abundance of forage for avian species, particularly in the more florally species rich Eastern Highveld Grassland Habitat Unit. The broad grassland habitat unit offers sufficient food for the avian assemblage within the study area, with the interspersed wetland habitat promoting year-round access to water and an important niche habitat for numerous invertebrate prey. It is unlikely forage is a limiting factor within the largely natural habitats within the central and western portions of the study area. Where agricultural activities have occurred, within the Degraded and Transformed Habitat, lowered forage abundances are expected. The route which the proposed Powerline will transverse is largely undisturbed, with some portions transformed through mining. Forage suitability and availability here will be patchy and due to the nature of the activity is not anticipated to be compromised. Forage for granivores and birds that feed on invertebrates and vegetation was abundant in areas outside

	of the Degraded and Transformed Habitat. Insect abundances where moderately high providing a rich source of food for most passerines as fruiting vegetation appeared to occur in limited supply. Forage for large perch hunting raptors was noted in intermediate abundances, however, these species wide ranging habits will cover large areas and it is unlikely food will be a limiting factor for them. Larger raptor species, such as *Buteo rufofuscus* (Jackal Buzzard) and *Buteo vulpinus* (Steppe Buzzard) were observed in lower densities within the broader locality beyond the study area boundaries.
Habitat Integrity	The study area is largely natural in the west while the central and eastern portions have historically and are currently being exposed to agricultural activities, reducing the integrity of the study area. The study area is surrounded by a mosaic of agricultural areas, mining operations and more natural grassland portions reducing the intactness of the broader area. The absence of fire due to the surrounding agriculture and mine activities does subtract important ecological functions which are valuable to many grassland bird species as they create disturbances (naturally), promote floral heterogeneity, and cause structural changes to herbaceous vegetation.
Habitat Availability	Habitat availability is considered moderately high within the study area. The broad grassland habitat offers good habitat for grassland specialist species with both taller, more rank grassland occurring in the central and more eastern areas of the Secondary and Wetland Habitat and more open short, occasionally rocky, grassland within the Eastern Highveld Grassland. The Degraded and Transformed Habitat will be of little value yet may provide an increase in rodent abundances which are an important component of accipiter diets. The lack of dense sheltered areas and trees within the landscape reduces the habitat available and shelter for many avifaunal species who require these features for nesting and foraging. The habitat remains of similar grassland structure throughout, the only noticeable change is the higher density of Alien Invasive Plants (AIP) shrubs where historic agriculture occurred in the Secondary Grassland Habitat. The study area offers habitat of similar structure, which is a primary determinant of bird species assemblages, throughout and as such it is not anticipated that a highly diverse assemblage of birds will occur here.
Business Case and Conclusion:	The avifaunal habitat sensitivity for the study area is considered to range from moderately high to low. Although a large contingent of SCC are considered likely to utilise the study area, it is not anticipated that they will permanently occur here yet will utilise favourable conditions when present within the study area. Two species are deemed likely to utilise the site for breeding, *Tyto capensis* (African Grass Owl) and *Eupodotis caerulescens* (Blue Korhaan). African Grass Owl has marginal habitat within the Wetland habitat. The gradient is rather steep in much of this habitat, yet, as a species which is known to breed alongside Marsh Owl, and Marsh Owl were seen it is likely that breeding opportunities exist here. The Blue korhaan has been noted within the area QDS and habitat characteristics offered within the Eastern Highveld Grassland will be suitable for the breeding of this species in the study area. Most SCC which may inhabit the study area have wide ranges and often respond to favourable environmental conditions (grazing, fire, rainfall, or invertebrate outbreaks) and as such may find suitable habitat within the study area intermittently. Although, PV structures have been excluded from the Wetland Habitat adjacent foraging grounds and avifaunal flight paths will be compromised by the proposed infrastructure. The proposed activities will increase the risk of birds colliding with or being electrocuted by PV infrastructure, powerlines or when perching or nesting on support towers, which can also be a fire risk. Potential impacts arising from the proposed activities are likely to impact on SCC diversity or abundance as a reduction in suitable habitat within the Eastern Highveld Grassland will occur within the study area. Provided that mitigation measures stipulated in this report are adhered to the risk of bird collisions with powerlines can be minimised.

4.2 Avifaunal SCC Assessment

During field assessments, it is not always feasible to identify or observe all species within an area, largely due to the secretive nature of many avifaunal species, possible low population numbers or varying habits of species or seasonality. As such, and to specifically assess an area for avifaunal SCC, a Probability of Occurrence (POC) matrix is used, utilising a number of factors to determine the probability of avifaunal SCC occurrence within the study area. Species listed in Appendix F or other regional listings, whose known distribution ranges and habitat preferences include the study area were taken into consideration. Only species who are anticipated to have a medium or high probability of occurring within the study area are listed.

Several SCC listed in Appendix F, which include: *Circus maurus* (Black Harrier), *Falco vespertinus* (Red-footed Falcon), *Falco amurensis* (Amur Falcon), *Circus ranivorus* (African Marsh-Harrier), *Tyto capensis* (African Grass Owl), *Glareola nordmanni* (Black-winged Pratincole), *Circus macrourus* (Pallid Harrier), *Ciconia abdimii* (Abdim's Stork), *Eupodotis caerulescens* (Blue Korhaan), *Geronticus calvus* (Southern Bald Ibis), *Heteromirafra ruddi* (Rudd's Lark), *Mycteria ibis* (Yellow-billed Stork), *Sagittarius serpentarius* (Secretarybird), *Falco biarmicus* (Lanner Falcon) have distribution ranges which encompass the study area and habitat preferences for the characters exhibited on site.

Due to the habitat unit associated with the study area the likelihood for avifaunal SCCs occurring within the study area is deemed to be medium to high. Should the nests of any avifaunal SCC as listed above and in Appendix C of this report, be encountered during the course of the proposed development activities, all operations must be stopped immediately, and an avifaunal specialist must be consulted in order to advise on the best way forward. For mitigation on how to appropriately manage and treat potential SCC present in the study area refer to Section 6.4.

Table 3: Avifaunal SCC that may occur within the subject property due to suitable habitat.

SCIENTIFIC AND COMMON NAME	HABITAT DESCRIPTION	REGIONAL STATUS	POC (%)
Circus maurus (Black Harrier)	**Range**: Restricted to southern Africa, Namibia and South Africa only. **Major habitats**: Fynbos, renosterveld, Strandveld, karoo shrublands, dry grasslands and croplands. **Description**: Near endemic species with its core range in the fynbos biome. The harriers undergo seasonal migrations during summer travelling eastwards to Free State and Lesotho and marginally Mpumalanga before returning during winter. **Food:** Small mammals and birds, also reptiles, insects and frogs to a lesser extent. **Available habitat:** Entire Study Area.	EN	**M**
Falco vespertinus (Red-footed Falcon)	**Range**: Most of Europe and Central Asia with a migratory passage through much of Africa to its wintering grounds in Southern and eastern Africa. **Major habitats**: Forest, Savanna, shrubland, grassland, Wetlands and artificial terrestrial habitats. **Description**: Inhabits mostly open lowlands where a prominant perch location is located. **Food:** Mainly insects, especially crickets, locusts and termites. **Available habitat within the Subject Property:** Wetland, Degraded and Transformed and Eastern Highveld Grassland Habitat	**SI**	**M**
Circus ranivorus (African Marsh-Harrier)	**Range**: The species is sparsely distributed across wetlands throughout central and east Africa, and southwards towards southern Africa. **Major habitats**: Dependant on permanent wetlands for both breeding and feeding. Avoids large areas of the drier Northern Cape and inland areas of the Western Cape especially areas with <300mm rain. **Description**: Hunts over permanent wetlands, drier floodplains, grassland, croplands and fynbos where it mainly preys on rodents. **Food:** Mostly small rodents, birds, frogs and fish. **Available habitat within the Subject Property:** Entire Study area.	EN	**M**
Tyto capensis (African Grass Owl)	**Range**: Fragmented range within central and southern Africa. Within the region it predominantly occurs within high rainfall areas in the eastern half of the country. **Major habitats**: Wetlands, grassland and arable lands. **Description**: The species breeds in wetlands and forages over reeds and adjacent tall grassland. **Food:** Rodents (predominantly large Vlei rats), birds and insects. **Available habitat with the Subject Property:** Wetland Habitat and adjacent habitats.	VU	**H**
Glareola nordmanni (Black-winged Pratincole)	**Range**: Breeding primarily occurs within Russia, Ukraine and Kazakhstan after which most migrate to southern Africa (Botswana, Zimbabwe, Namibia and South Africa. **Major habitats**: Wetlands, grasslands and arable lands. **Description**: The species is gregarious and commonly occurs in flocks of 100 or more. The species responds quickly to insect outbreaks feeding in the early morning and in the evening. Can be attracted to agricultural activities which disturb insects. **Food:** Wide variety of flying and epigeic insects. **Available habitat with the Subject Property:** The species may utilize the entire study area, avoiding the Freshwater habitat.	NT	**M**
Circus macrourus (Pallid Harrier)	**Range**: Occurs within Central and southern Asia and eastern Europe with passage occurring through the Sahara to overwintering grounds south of the Sahara in eastern Africa and southern Africa. **Major habitats**: Forest, savanna, grasslands and inland wetlands. **Description**: This species inhabits semi-dessert, scrub, savanna and wetlands where they hunt relatively close to the ground. **Food:** Mainly insects, also small mammals, birds and reptiles. **Available habitat with the Subject Property:** Entire study area.	**NT**	**M**
Ciconia abdimii (Abdim's Stork)	**Range**: Non-breeding Intra-African migrant. Breeding occurs in the northern tropics, hereafter, individuals move south following higher rainfall to sub-saharan Africa.	**NT**	**M**

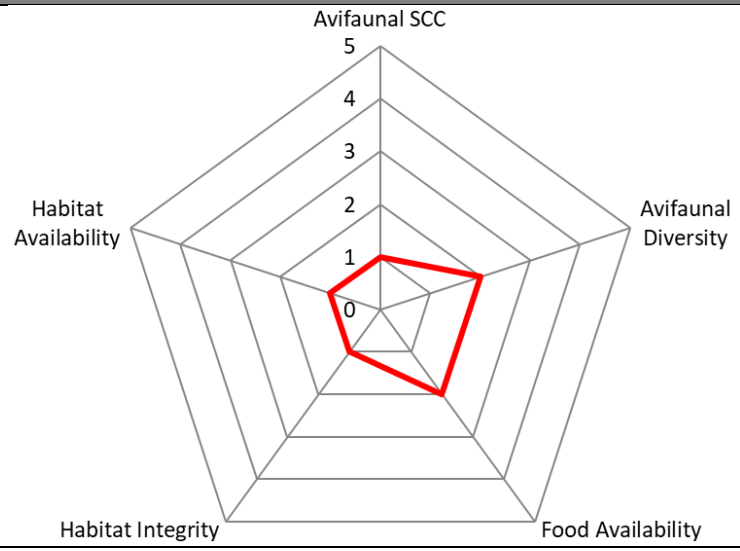
SCIENTIFIC AND COMMON NAME	HABITAT DESCRIPTION	REGIONAL STATUS	POC (%)
	Major habitats: Savanna, grassland, inland wetlands, rocky area, inland cliffs and artificial terrestrial habitat. **Description**: Intra-African migrant with seasonal movements that coincide with rainfall. The species is gregarious and rarely seen in groups of less than 10. **Food:** Wide variety of insects and small vertebrates. **Available habitat with the Subject Property:** Entire Study area.		
Eupodotis caerulescens (Blue Korhaan)	**Range**: Breeding primarily occurs within the Sahel were colonies of less than 20 occur on cliffs. Following breeding the birds occupy areas within sub-Saharan Africa. **Major habitats**: Wetlands, grasslands and arable lands. **Description**: Usually found above 1500 m in grasslands well as karoo dwarf shrubland within 1km of water, with termite mounds and few trees. May benefit from small-scale agriculture, as it regularly forages in crop fields and planted pastures. **Food:** Feeds on insects, small reptiles and vegetable matter. **Available habitat with the Subject Property:** Wetland, Eastern Highveld Grassland and Degraded and Transformed Habitat	**SI**	**H**
Heteromirafra ruddi (Rudd's Lark)	**Range**: Endemic to high altitude grassland (1700-2200 m) in South Africa along the eastern escarpment. **Major habitats**: Grassland. **Description**: Usually solitary or in pairs and easily overlooked. **Food:** Insects and seeds. **Available habitat with the Subject Property:** Eastern Highveld Grassland	**EN**	**L**
Mycteria ibis (Yellow-billed Stork)	**Range**: Breeding primarily occurs within Russia, Ukraine and Kazakhstan after which most migrate to southern Africa (Botswana, Zimbabwe, Namibia and South Africa. South Africa does maintain a few small breeding colonies. **Major habitats**: Wetlands, grasslands and arable lands. **Description**: The species is gregarious and commonly occurs in flocks of 100 or more. The species responds quickly to insect outbreaks feeding in the early morning and in the evening. Can be attracted to agricultural activities which disturb insects. **Food:** Wide variety of flying and epigeic insects. **Available habitat with the Subject Property:** Wetland Habitat	**EN**	**M**
Geronticus calvus (Southern Bald Ibis)	**Range**: Endemic to the grassland habitat within the Region. **Major habitats**: Grassland. **Description**: The species is prefers high altitude grassland, but are found in grassland right down to the coast. For breeding the species requires cliffs. **Food:** Mainly insects, also earthworms, snails and frogs **Available habitat with the Subject Property:** Eastern Highveld Grassland.	**VU**	**M**
Sagittarius serpentarius (Secretarybird)	**Range**: Sub-Saharan Africa where it avoids densely wooded or forested areas. **Major habitats**: Savanna, Shrubland and grassland. **Description**: The species is prefers open grassland and scrub with a height lower than 50cm where it stalks its prey on foot. It requires sufficient scattered trees in which to nest. Birds are normally found singly or in pairs. **Food:** Has a cosmopolitan diet but appears to prey mostly on snakes. Other prey includes invertebrates, small mammals, birds and their eggs. **Available habitat with the Subject Property:** Entire study area.	**VU**	**M**
Falco biarmicus (Lanner Falcon)	**Range**: Southern Europe and the Arabian Peninsula with most of its range within Africa. **Major habitats**: Forest, Savanna, shrubland, Grassland, Rocky areas (inland cliffs and mountains) and desert. Favours open grassland or woodland near cliffs. **Description**: Inhabits a wide variety of habitats and may illustrate crepuscular behaviour. Mostly resident with some birds migrating to west Africa. **Food:** Birds, small mammals, insects and reptiles. **Available habitat with the study area:** Entire study area.	**VU**	**M**

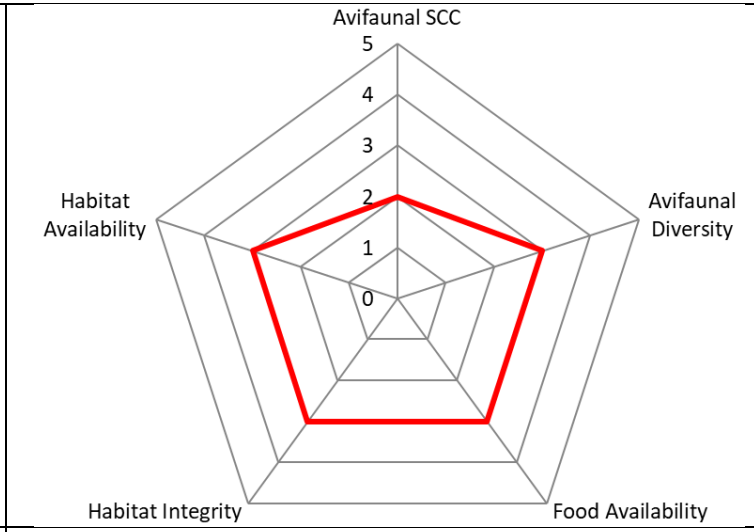
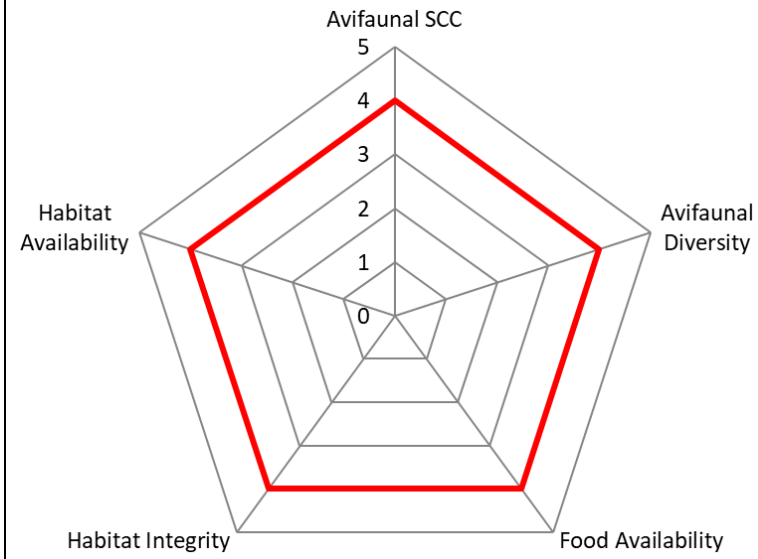
EN= Endangered; CR= Critically Endangered; VU= Vulnerable; NT=Near Threatened; LC=Least concern; SI=Special Interest.

5. SENSITIVITY MAPPING

The figure below conceptually illustrates the areas considered to be of increased ecological sensitivity. The areas are depicted according to their sensitivity in terms of the presence or potential for avifaunal SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. The table below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

Table 4: Summary of sensitivity of each habitat unit and implications for development.

Habitat Unit	Habitat Sensitivity Graph	Sensitivity	Development Implications
Degraded and Transformed Habitat		**Low Sensitivity** Conservation Objective for areas of Low Sensitivity**:** Optimise development potential.	These habitats are deemed to be of low sensitivity for avifauna due to their altered state and lack of heterogeneity. Development within these areas is unlikely to lead to high impacts to avifaunal habitat or species diversity provided mitigation measures are implemented, as discussed in Section 6.4.

Secondary Grassland Habitat		**Intermediate Sensitivity** Conservation Objective: Preserve and enhance the biodiversity of the habitat unit and the surrounds while optimising development potential	Areas of intermediate sensitivity include those that have been impacted on by previous agricultural activities. From an avifaunal perspective it is likely that mostly common species who have broad habitat requirement are likely to utilize this unit for breeding though most avifauna within the vicinity will forage here. The relatively homogenous structure and composition of the vegetation reduces its appeal to SCC who will readily favour neighboring intact habitats where no historic disturbances have occurred. Development within these areas are less likely to have significant impacts on avifaunal communities within the study area. It remains important that edge effect impacts on areas outside of the direct footprint be strictly managed to minimise further impacts to the ecological functionality of the surrounding habitats. Mitigation measures included within this report should be adhered to limit ecological impacts.
Eastern Highveld Grassland **And** **Wetland Habitat**		**Moderately High Sensitivity** Conservation Objective: Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance	These areas are of moderately high sensitivity from an avifaunal perspective. The sensitivity generally reflects the absence of any large-scale human disturbances ensuring that these systems have moderately high integrity and remain ecologically functional. These habitats offer enough forage and breeding locations for their respective avian communities and only show minor disturbances by alien species invasion and edge effects. SCC species are largely restricted to these units. Due to these habitat units providing suitable habitat for SCC, they are of increased species importance due to their increased ecological functionality and sensitivity from an avifaunal perspective and development within this habitat unit should, as far as possible, be avoided. Planned activities in this area should follow the mitigation hierarchy. Since it has been determined that avoidance is not possible, measures to minimise the impact should be sought with mention of rehabilitation and support of biodiversity in the operational phase of the development. Where areas of moderately high sensitivity occur in CBAs or Protected Areas, there is a conflict between the intended land use and the conservation requirements for the region. The requirements for authorization in this regard should be determined through consultation with the relevant provincial conservation authorities.

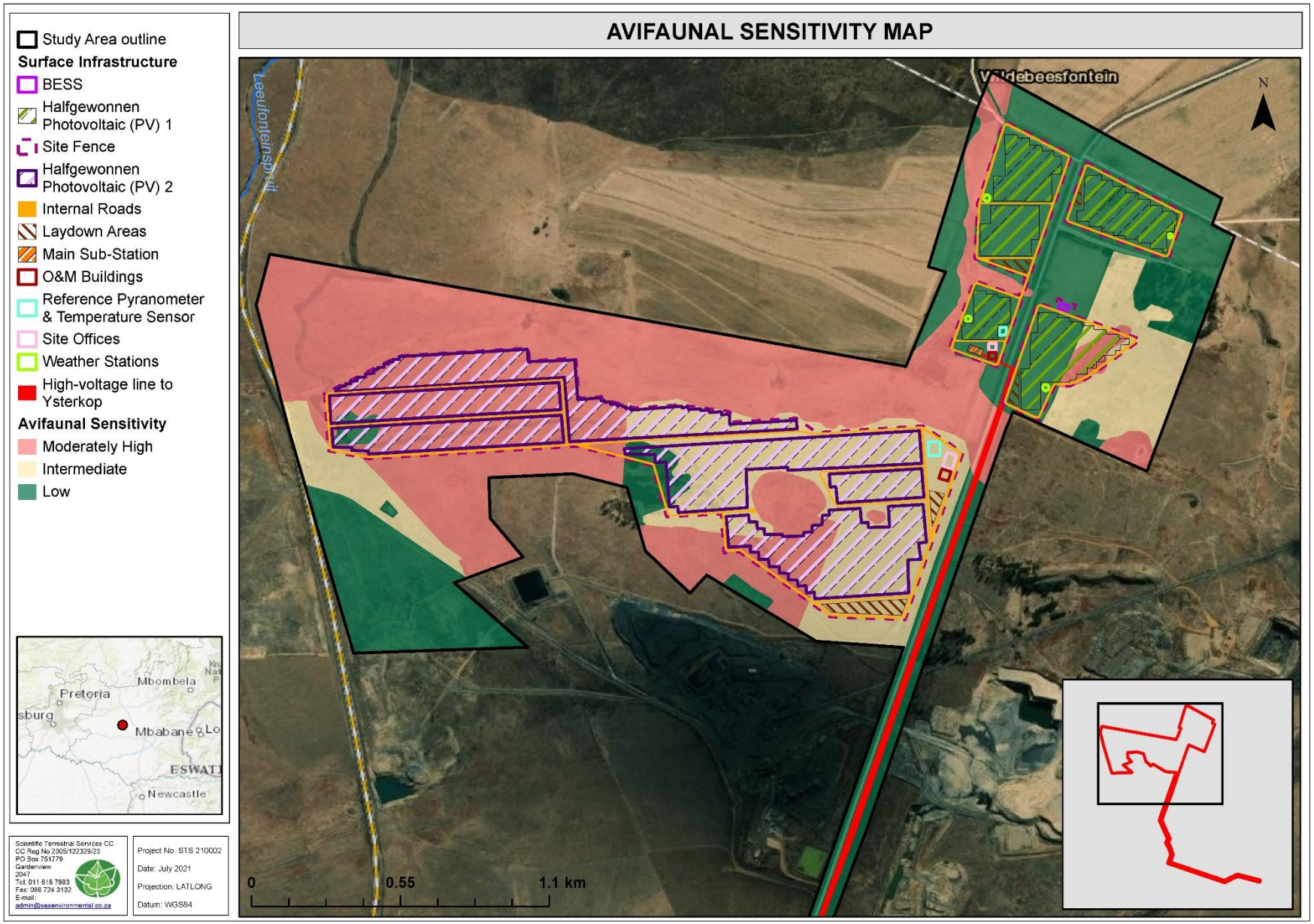


Figure 11: Avifaunal sensitivity map of the northern portion of the study area.

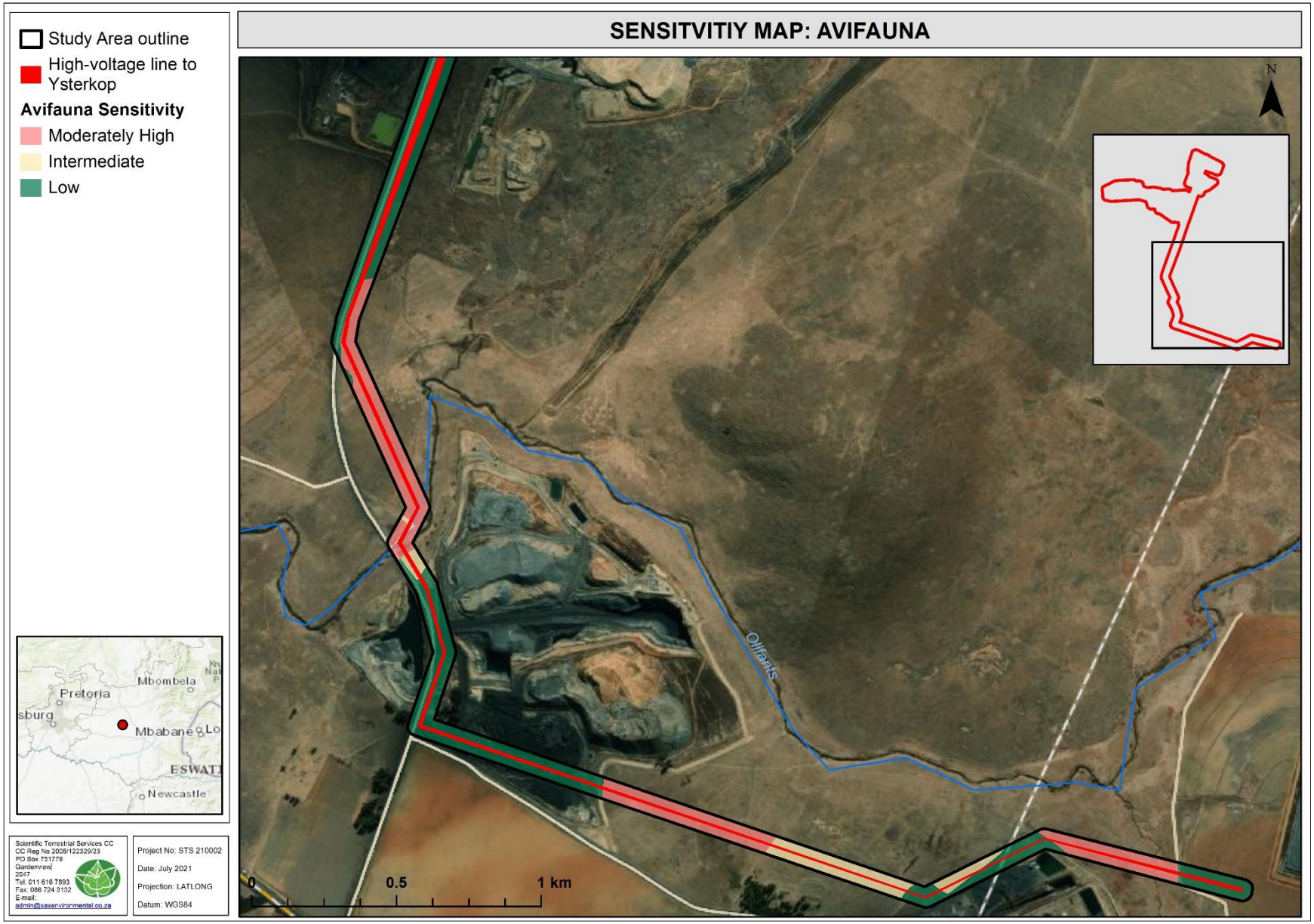


Figure 12: Avifaunal sensitivity map of the southern portion of the study area.

6. IMPACT ASSESSMENT

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

An impact discussion and assessment of all potential pre-construction, construction, operational and maintenance phase impacts are provided in Section 6.2 and 6.3. All mitigatory measures required to minimise the perceived impacts are presented in Section 6.4.

Proposed Activity Description**:**

Surface developments will include the PV 1 (approximately 34 Ha) and PV 2 Panels (approximately 88 Ha), the Main Substation (± 0.3 Ha), additional Buildings (± 0.3 Ha), and the Battery Storage area (± 3.3 Ha). 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.

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.

6.1 Activities and Aspect Register

The table below indicates the perceived risks to avifaunal species associated with the activities pertaining to the proposed infrastructure developments listed in Section 1.2.

Table 5: Aspects and activities register considering avifaunal resources during all phases of development.

ACTIVITIES AND ASPECTS REGISTER
Planning Phase
- Potential failure to implement the required mitigation measures before and at the commencement of construction activities: • Potential failure to have a Rehabilitation Plan and anti-collision measures developed before the commencement of the development of the powerline. - **Impact**: Long-term or permanent degradation and modification of the receiving environment, loss of SCC and avifauna habitat.
- Potential failure to implement the required mitigation measures before and at the commencement of construction activities: • Potential failure to obtain the necessary permits for the removal of protected avifaunal species should they be needed resulting in delays to the construction activities. - **Impact**: Long-term or permanent degradation and modification of the receiving environment and displacement or loss of avifaunal SCC.
- Potential inadequate design of PV infrastructure, electricity pylons and powerlines increasing the possibility of birds being electrocuted or colliding with infrastructure. - **Impact:** Long-term collision and electrocution risks to SCC species leading to a reduction in SCC diversity.
Construction Phase
- Potential inadequate layout optimisation, resulting in extensive site clearing and the removal of indigenous vegetation. - **Impact:** Loss of important avifaunal habitat and the potential loss of avifaunal SCC.
- Potential uncontrolled and unplanned site clearing and the removal of vegetation and destruction of avifaunal habitat and forage. - **Impact:** Loss of sensitive avifaunal habitat and avifaunal species reliant on this specific habitat for survival.
- Proliferation of AIP species that colonise areas of increased disturbances and may outcompete indigenous plant species, including further transformation of adjacent, undeveloped habitat. - **Impact:** Degradation of favourable avifaunal habitat outside of the direct construction footprint, leading to a decrease in avifaunal diversity at a local scale and loss of land to meet biodiversity targets.
- Potential dumping of excavated and construction material outside of designated areas, promoting the establishment of AIPs. - **Impact:** Loss of avifaunal habitat, diversity and SCC.
- Potential failure to implement a rehabilitation and an alien floral control plan after the construction phase. - **Impact:** Potentially leading to permanent transformation of avifaunal habitat and long-term degradation of important avifaunal habitat within the region.
- Increased risk of avian collisions with construction vehicles. - **Impact:** Local loss of avifaunal SCC abundance and diversity.

- Additional pressure on avifaunal habitat as a result of an increased human presence associated with the proposed development, contributing to:
  • Potential hunting/trapping/removal/collection of avifaunal species or potential SCC; and
  • Increased human activity will lead to the displacement and/or loss of potential avifaunal SCC.
- **Impact:** Loss of sensitive avifaunal habitat and the potential loss of avifaunal SCC.

ACTIVITIES AND ASPECTS REGISTER
- Increased risk of collisions with the project infrastructure and/or electrocution while perching on the pylons or powerlines. - **Impact:** Local loss of avifaunal SCC abundance and diversity.
- Potential failure to concurrently rehabilitate bare or disturbed sites as soon as the construction activities have occurred will potentially result in loss of viable soils, increasing erosion risk and/or permitting the proliferation of AIPs. - **Impact:** Long-term loss of favourable habitat for historically recorded avifaunal species. Loss of avifaunal diversity and potential SCC which will disperse into the surrounding area in search of favourable habitat.
Operational and Maintenance Phase
- Ineffective rehabilitation of exposed and impacted areas potentially leading to vegetation succession and a possible reduction of avifaunal diversity and occurrence of potential avifaunal SCC over the long-term. - **Impact:** Permanent loss of avifaunal habitat, diversity and SCC, and a higher likelihood of edge effect impacts on adjacent and nearby natural avifaunal habitat of increased sensitivity. Further reduction of available habitat in the long-term, compounding the limiting factors to avifaunal assemblages.
- Potential poor management and failure to monitor rehabilitation efforts, leading to: • Landscapes being left fragmented, resulting in reduced migration capabilities of avifaunal species, isolation of avifaunal populations and a decrease in avifaunal diversity; • Compacted soils limiting the re-establishment of natural vegetation; and • Increased risk of erosion in areas left disturbed. - **Impact:** Long-term (or permanent) loss of avifaunal habitat, diversity and SCC.
- Poorly implemented and monitored AIP Management programme leading to the reintroduction and proliferation of AIP species. - **Impact:** Permanent loss of surrounding avifaunal niche habitat, diversity and SCC.
- Increased risk of collisions with the project infrastructure and/or electrocution while perching on the pylons or powerlines. - **Impact:** Local loss of avifaunal SCC abundance and diversity.
- Potential overexploitation through the removal and/or collection of important or sensitive avifaunal SCC on the property. - **Impact:** Local loss of avifaunal SCC abundance and diversity.
- Potentially poorly managed edge effects: - Ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to a continual proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas altering the avifaunal habitat; and - Potential erosion stemming from soil left bare leading to sedimentation of downslope avifaunal habitat. - **Impact:** Loss of avifaunal habitat, diversity and SCC within the direct expansion development footprint of the mine. Loss of surrounding avifaunal diversity and avifaunal SCC through the displacement of indigenous flora by AIP species - especially in response to disturbance in natural areas.

6.2 Avifaunal Impact Assessment Results

The below table indicates the perceived risks to the avian ecology associated with the planning, construction and operational and maintenance phases of the proposed development[3], no decommissioning is anticipated. The table also provides the findings of the impact assessment undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and

[3] Should decommissioning be undertaken the impacts stemming from these activities are anticipated to mimic the impacts scores from the construction phase."

implemented. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

The impact assessment focusses on the following activities:

- PV 1 Panels (anticipated 34 Ha) with associated Main Pipeline;
- PV 2 Panels (anticipated 88 Ha) with associated Main Pipeline;
- Additional Surface Infrastructure (the Main Substation, additional Buildings, and the Battery Storage area); and
- High Voltage Powerline.

Table 6: Summary of the Impact Assessment of the Planning, Construction, Operational and Maintenance Phases of the proposed project footprint on avifauna.

Impacting Activities	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
PLANNING PHASE																
Habitat and Diversity																
Photovoltaic (PV) 1 Panels	3	1	2	2	3	4	7	28 Low	2	1	1	2	3	3	6	18 Very low
Photovoltaic (PV) 2 Panels	3	4	4	2	3	7	9	63 Medium low	2	4	3	2	3	6	8	48 Low
Additional surface infrastructure	3	3	2	2	3	6	7	42 Low	2	3	1	2	3	5	6	30 Low
High-Voltage Line	3	3	2	2	3	6	7	42 Low	2	3	1	2	3	5	6	30 Low
Species of Conservation Concern																
Photovoltaic (PV) 1 Panels	3	1	2	2	3	4	7	28 Low	2	1	1	2	3	3	6	18 Very low
Photovoltaic (PV) 2 Panels	3	4	4	2	3	7	9	63 Medium low	2	4	3	2	3	6	6	48 Low
Additional surface infrastructure	3	3	2	2	3	6	7	42 Low	2	3	1	2	3	5	6	30 Low
High-Voltage Line	3	3	2	2	3	6	7	42 Low	2	3	1	2	3	5	6	30 Low
CONSTRUCTION PHASE																
Habitat and Diversity																
Photovoltaic (PV) 1 Panels	4	1	3	2	3	5	8	40 Low	4	1	2	2	3	5	7	35 Low
Photovoltaic (PV) 2 Panels	5	4	4	4	3	9	11	99 Medium high	4	4	4	3	3	8	10	80 Medium high
Additional surface infrastructure	3	3	3	2	3	6	7	48 Low	2	3	2	1	3	5	6	30 Low
High-Voltage Line	3	3	3	2	3	6	7	48 Low	2	3	2	2	3	5	7	35 Low

Species of Conservation Concern																
Photovoltaic (PV) 1 Panels	3	1	3	2	3	4	8	40 Low	2	1	2	2	3	3	7	21 Very low
Photovoltaic (PV) 2 Panels	5	4	4	4	3	9	11	99 Medium high	4	4	4	3	3	8	10	80 Medium high
Additional surface infrastructure	2	3	2	2	3	5	7	35 Low	1	3	1	1	3	4	5	20 Very low
High-Voltage Line	3	3	3	2	3	6	7	48 Low	2	3	2	2	3	5	7	35 Low
OPERATIONAL AND MAINTENANCE PHASES																
Habitat and Diversity																
Photovoltaic (PV) 1 Panels	4	1	2	2	5	5	9	45 Low	3	1	1	2	4	4	7	49 Low
Photovoltaic (PV) 2 Panels	4	4	4	4	5	8	13	104 High	3	4	4	3	4	7	11	77 Medium high
Additional surface infrastructure	3	3	2	2	5	6	9	54 Medium low	2	3	2	1	4	5	7	35 Low
High-Voltage Line	3	3	2	2	5	6	9	54 Medium low	2	3	1	2	4	5	7	35 Low
Species of Conservation Concern																
Photovoltaic (PV) 1 Panels	3	1	2	2	5	4	9	36 Low	2	1	1	2	4	3	7	21 Very low
Photovoltaic (PV) 2 Panels	4	4	4	4	5	8	13	104 High	3	4	4	3	4	7	11	77 Medium high
Additional surface infrastructure	2	3	2	2	5	5	9	45 Low	1	3	2	1	4	4	7	28 Low
High-Voltage Line	3	3	2	2	5	6	9	54 Medium low	2	3	1	2	4	5	7	35 Low

6.3 Impact discussion

The perceived impact significance of the proposed development (prior to mitigation) on avifaunal habitat, diversity and SCC range from high to low. The potential for local or regional impacts are likely if recommended mitigation measures as stipulated in Section 6.4 below are not adhered to.

Construction and, maintenance and operational phase impacts to the habitats are expected to be the highest in their severity with some impacts that are anticipated to be high and medium high without mitigation (Eastern Highveld Grassland). Impact mitigation is however expected to reduce the severity of some of these impacts. Impacts to SCC will be High and Medium high if mitigation measures are ignored during the construction and operational phases. Mitigation, if implemented correctly, will reduce the impact significance to lower levels for SCC.

6.3.1 Impact on avifaunal Diversity and Habitat

The western portions of the study area have avoided any form of large-scale landscape transformation (e.g. extensive agriculture or mining activities or earth works) ensuring that a modest assemblage of avifauna, with a reduced abundance of large raptors, has been conserved. Avifaunal diversity within the study area ranges from moderately high to low. Very little clearing of vegetation is anticipated for the construction of the Powerline and thus little alteration in the local habitat or impacts on SCC habitat are anticipated. However, these proposed infrastructures increase the potential for avifauna (particularly larger birds) to collide with the transmission cables and earth wires or be electrocuted on them while perching which may reduce their abundances, furthermore avifauna may collide with PV panels which they confuse for a waterbody. The major impact will result from the proposed PV 2 facility which will result in the alteration of intact portions of the Eastern Highveld Grassland (VU). Edge effects may also result in impacts to surrounding habitats if not properly managed and should rehabilitation of the site not be completed. Edge effects may alter the local environment to an extent where it is no longer representative of the reference type, rendering it unsuitable for many SCC. An increase in vehicle movement in the area during maintenance phases will increase the likelihood of collisions with avifauna, yet the vehicles are unlikely to be moving fast enough to be a significant risk to avifauna should a strict speed limit be kept. The impact significance of the loss of avifaunal species diversity and habitat based on the proposed layout plans for the construction and operational and maintenance phases is expected to vary between high and low prior to the implementation of mitigation measures and medium high to very low should mitigation be implemented thoroughly.

6.3.2 Impact on avifaunal SCC

Ten avifaunal SCC are anticipated to occur in the study area, either permanently for breeding or temporarily whilst for foraging. These species include; *Falco amurensis* (Amur Falcon), *Circus maurus* (Black Harrier), *Eupodotis caerulescens* (Blue Korhaan), *Falco vespertinus* (Red-footed Falcon), *Circus ranivorus* (African Marsh-Harrier), *Glareola nordmanni* (Black-winged Pratincole), *Circus macrourus* (Pallid Harrier), *Ciconia abdimii* (Abdim's Stork), *Mycteria ibis* (Yellow-billed Stork), *Sagittarius serpentarius* (Secretarybird) and *Falco biarmicus* (Lanner Falcon). Development within the Eastern Highveld Grassland will lead to vegetation clearance and the loss of breeding and foraging ground for these species.

Based on the habitats observed during the field investigation, suitable breeding habitat for both *Tyto capensis* (African Grass Owl) and *Eupodotis caerulescens* (Blue Korhaan) was noted. Habitat as described in the 2015 Eskom Red Data Book of Birds of South Africa,

Lesotho and Swaziland (Taylor *et al,* 2015) for *Heteromirafra ruddi* (Rudd's Lark) was observed within the study area but no records for the species exist here and this species prefers higher altitude locations. *Tyto capensis* (African Grass Owl) has suitable breeding and foraging habitat within the Wetland habitat and the adjacent grassland, especially the shorter Eastern Highveld Grassland. Although no individuals were observed a good indicator species for their co-occurrence, the Marsh Owl was seen. Lastly, habitat for *Eupodotis caerulescens* (Blue Korhaan) is marginal, however, this species appears to favour more open habitat with shorter vegetation in less undulating habitat.

Amur Falcon (Falco amurensis), *Circus maurus* (Black Harrier), *Falco vespertinus* (Red-footed Falcon), *Circus macrourus* (Pallid Harrier), *Ciconia abdimii* (Abdim's Stork), *Mycteria ibis* (Yellow-billed Stork) do not breed within the study area or the broader locality and as such their productivity is not likely to be impacted upon by the proposed development.

Falco biarmicus (Lanner Falcon, VU) is also unlikely to breed within the broader locality as no cliffs are available and generally their core breeding range is within the eastern sour grassland (Eastern Cape and Kwa-Zulu Natal). *Sagittarius serpentarius* (Secretarybird) have a high reporting rate for the areas and will likely loose foraging habitat within much of the study area. The absence of short trees within the study area reduces breeding opportunities for this species, however, its wide-ranging habits will likely bring it into the study area.

Local migrations from the development footprint and its direct surroundings will likely occur during the construction, operational and maintenance phase which will lead to higher competition for resources in adjacent habitats and a reduced species richness within the study area. Even with the proposed mitigation measures it is unlikely that diversity levels will return to baseline levels.

The impact associated with the loss of habitat for the above-mentioned SCC is of high significance within the Eastern Highveld Grassland during the construction and operational phases, prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact significance to the species can be marginally reduced by managing the extent of impacts and edge effects. Mitigation measures however will not be able to overcome the loss of habitat and foraging grounds as a result of vegetation clearance within the footprint areas. As such, these impacts will remain at medium-high levels of significance.

6.3.3 Probable Residual Impacts

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

- sustained loss of avifaunal habitat;
- Reduction in avifaunal SCC presence and in the surrounding habitats through edge effects, collisions and electrocutions;
- Loss of and altered avifaunal species diversity;
- Reduction of avifaunal abundance; and
- Disturbed areas are highly unlikely to be rehabilitated to baseline levels of ecological functioning and loss of avifaunal habitat, species diversity and avifaunal SCC may be permanent if mitigations are not implemented.

6.3.4 Cumulative Impacts

Based on the number of avifaunal SCC whose distribution overlay the study area, it is likely that the location plays a role in supporting SCC populations and may also be used for breeding. As some areas within the study area and the surrounding landscape have escaped transformation, suitable areas for SCC habitation exist within the study area and the broader area.

Based on the general landscape and habitat within the study area the site has the potential to host a low to moderately high assemblage of avifauna and several potential SCC. Two SCC have possible breeding habitat within the study area and as such development within the sensitive habitats may result in the loss of breeding habitat for these species within the footprint areas. The proposed activities will lead to the loss of avifaunal habitat and to a reduction in the abundance of common avifauna and local reductions in SCC presence. The activities will lead to the displacement of avifaunal species currently inhabiting these areas, pushing them into the surrounding vegetated areas leading to increased competition for territories and breeding sites. Moreover, there is likely to be a knock-on dispersal affect, leading to increased resource competition and possible increased mortality rates due to insufficient food resources and collisions with newly constructed powerlines and other PV infrastructure, resulting in a decreased species abundance and possible further loss of species diversity. Lastly, if there is ineffective control and monitoring of edge effects will result in the spread of AIP species to areas outside of the study area, which will further alter avifaunal habitat and subsequently abundance within the habitats surrounding the study areas.

6.4 Integrated Impact Mitigation

The table below highlights the key integrated mitigation measures that are applicable to the proposed study area in order to suitably manage and mitigate the ecological impacts that are associated with the proposed development. Provided that all the management and mitigation measures as stipulated in this report are implemented the overall risk associated with the activities may be minimised, although impacts are still considered unavoidable.

Table 7: A summary of the mitigatory requirements for avifaunal resources.

Project phase	*Planning Phase*
Impact Summary	*Loss of avifaunal habitat, species and avifaunal SCC*
Management Measures	***Proposed mitigation and management measures:***
	Avifaunal Habitat and Diversity
	- During the site-pegging phase of surface infrastructure, any avifaunal SCC that will be affected by surface infrastructure must be noted and recorded. Should the species (likely its nest) need to be removed the relevant permits must be applied for from the Mpumalanga Tourism and Park Agency (MTPA) or from the Department of Environment, Forestry and Fisheries (DEFF) prior to construction; - Minimise loss of indigenous vegetation where possible by implementing construction methods to limit disturbance to the Eastern Highveld Grassland vegetation where the PV 2 panels are proposed; - If avian SCC nests are located, a qualified avifaunal specialist should be consulted to determine the best management options. If nests are known to have nestlings or eggs within, these should be allowed to fledge prior to the nest removal; - All construction equipment to be utilised must be a good working condition, and all possible precautions, as listed below in this report, taken to prevent potential avifaunal collisions or electrocutions, and mechanical spills and/or leaks; and - Prior to the commencement of proposed activities on site an alien vegetation management plan should be compiled for implementation throughout all development phases.
Project phase	*Construction Phase*
Impact Summary	*Loss of avifaunal habitat, species and avifaunal SCC*
Management Measures	***Proposed mitigation and management measures:***
	Development footprint
	- The development footprint should be demarcated, and it should be ensured that no development related activities take place outside of the demarcated footprint; - Any structures which may act as perching sites for birds should be installed with anti-perching spikes; - Should any lights be installed they should face downwards to reduce the abundance of insects attracted to the night lights. This prey source may attract birds to the study area and may increase avian collisions or electrocutions; - Avifaunal habitat beyond the demarcated area should not be cleared or altered; - Avifaunal monitoring within the proposed PV facilities and along the proposed power line should be undertaken by the ECO and reported every second month to monitor or record avifauna and collect any birds which have collided with or been electrocuted by the proposed infrastructure for the 1st year, these must be reported by the ECO to the department (MTPA) and further mitigation measures should be investigated as to how to minimise the mortalities; - Anti-collision devices should be installed along the entire length of the powerline. These must be Eskom approved anti-collision devices that are durable as the area is prone to strong winds. Anti-collision devices must be installed as soon as the wires are strung. The devices must be installed 5m apart and alternate between a light and dark colour in order to increase the visibility of the earth wires; - Construction equipment should be restricted to travelling only on designated roadways to limit the ecological footprint of the development activities; - No dumping of litter, rubble or cleared vegetation on site should be allowed. As such it is advised vegetation cuttings (especially AIP) to be carefully collected and disposed of at a separate waste facility;

	- If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral rehabilitation later down the line and avifaunal recolonization. In the event of a breakdown, maintenance of vehicles must take place with care, and the collection of spillages should be practised preventing the ingress of hydrocarbons into the topsoil; and - No hunting/trapping or collecting of avifaunal species is allowed. **Avifaunal SCC** - No collection of avifaunal SCC or their eggs may be allowed by construction personnel; - Edge effect control needs to be implemented to prevent further degradation and potential loss of avifaunal SCC habitat outside of the proposed development footprint; - Should any other avifaunal species protected under the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) or the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) be encountered, construction should be halted and authorisation to relocate such species must be obtained from MTPA or DEFF; and - Should any SCC be found nesting within the development footprint during construction activities, all activities are to stop and a suitably qualified specialist consulted as to the best way forward. In the instance of nesting species, activities will have to cease until the young have fledged. **Fire** - No illicit / uncontrolled fires must be allowed during the construction phase of the proposed development. **Rehabilitation** - A rehabilitation plan should be compiled by a suitable specialist. This rehabilitation plan should consider all development phases of the project indicating rehabilitation actions to be undertaken during, and once construction has been completed as well as ongoing rehabilitation during the operational phase of the project to ensure habitat for avifauna is restored; and - Any natural areas beyond the development footprint, that have been affected by the construction activities, must be rehabilitated using indigenous plant species.
Project phase	*Operational and Maintenance Phase*
Impact Summary	*Loss of avifaunal habitat, species and SCC*
Management Measures	**Development footprint** - All vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the development activities; - Bird nests on Powerlines or the PV infrastructure are potential fire hazards and should be removed from structures regularly; and - Monitoring (every 2 months) should be undertaken for the 1st year and a record of potential bird strikes or collisions should be kept by the ECO and reported to the MTPA. Mitigation measures should be updated thereafter depending on monitoring results. **Alien Vegetation** - Ongoing alien and invasive plant monitoring and clearing/control should take place throughout the operational phase, and the project perimeters should be regularly checked for AIP establishment to prevent spread into surrounding natural areas which may alter the suitability of the habitat to avifaunal species; and - Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility, which comply with legal standards. **Avifaunal SCC** - No collection of avifaunal SCC or their eggs may be allowed by operational phase personnel unless as part of mortality monitoring activities. **Rehabilitation** - Where bare soils are left exposed as a result of construction activities, they should be immediately rehabilitated. Rehabilitated efforts should continue to be monitored throughout the operational phase, until natural processes will allow the ecological functioning and biodiversity of the area to be re-instated.

7. CONCLUSION AND RECOMMENDATIONS

STS was appointed to conduct an Avifaunal Assessment as part of the EIA process for the proposed Halfgewonnen Solar PV Project, near Hendrina, Mpumalanga Province. The project is associated with both linear developments (Main Pipelines and a High-Voltage Line), as well as surface infrastructure including the Solar PV Panels, Buildings, the Main Substation and Battery Storage.

Based on the findings of the avifaunal assessment it is the opinion of the ecologists that from an avifaunal ecological perspective, the impacts anticipated from the proposed activities range from high to low, prior to the implementation of mitigation measures. With mitigation, impacts from the proposed development are anticipated to be reduced to medium high and very low significance levels. The major impact anticipated to occur is the alteration of Eastern Highveld Grassland (VU) which has the potential to host several SCC. Further impacts that may result from the proposed project are collisions and electrocutions resulting from the proposed PV facilities and power lines. It is anticipated that should the proposed mitigation measures be implemented the risk of collisions and electrocutions can be reduced. Although the proponent has made a concerted effort to avoid impacts to the local Wetland Habitat by moving initial designs to locations outside this unit, the impacts have been relocated to the equally important and sensitive Eastern highveld Grassland. Thus, it is essential that all mitigation measures and recommendations presented in this report be adhered to in order to mitigate the impact significance to as low a level as possible.

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APPENDIX A: Legislative Requirements

National Environmental Management Act, 1998

The National Environmental Management Act (NEMA; Act 107 of 1998) and the associated Environmental Impact Assessment (EIA) Regulations (GN R982 of 2014) and well as listing notices 1, 2 and 3 (GN R983, R984 and R985 of 2014), 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. This could follow either the Basic Assessment process or the EIA process depending on the nature of the activity and scale of the impact.

National Environmental Management Biodiversity Act (NEMBA, Act No. 10 of 2004)

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.

Conservation of Agricultural Resources Act (CARA, Act 43 of 1983)

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 species should take place throughout the construction and operation, phases.

APPENDIX B: Avifaunal Method of Assessment

Avifaunal Assessment Methodology

A reconnaissance 'walk through' on foot was undertaken to determine the general habitat types found throughout the study area. Special emphasis was placed on areas that may potentially support avifaunal SCC. Sites representative of habitat units or unique niche habitats were then marked and point counts were undertaken in order to identify the occurrence of the avifaunal communities, species and habitat diversities. The presence of any avifaunal inhabitants of the study area was assessed through direct visual observation or identifying such species through calls, nests and potentially pellets.

It is important to note that avifaunal species have varied breeding patterns and are subject to seasonal fluctuations. As such, it is unlikely that all avifaunal species will have been recorded during the site assessment. However, even though some avifaunal species may not have been identified during the sight assessment, the habitat units and degree of transformation can be used to establish an accurate understanding of avifaunal species most likely associated with the study area.

Avifaunal Species of Conservational Concern Assessment

Throughout the fauna assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species. The **Probability of Occurrence (POC)** for each avifaunal SCC is described as:

- "**Confirmed'**: if observed during the survey.
- "**High**": if within the species' known distribution range and preferable habitat for foraging, roosting or breeding is available.
- "**Medium**": if either within the known distribution range of the species with marginal habitat that does not occur within the core of the species range or within an important foraging, roosting or breeding area; or
- "**Low**": if the habitat is not suitable and falls outside the distribution range of the species.

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

Avifaunal Habitat Sensitivity

The sensitivity of the study area for avifauna species was determined by calculating the mean of five different parameters which influence avifaunal species and provide an indication of the overall avifaunal ecological integrity, importance and sensitivity of the study area for each class. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Avifaunal SCC:** The confirmed presence or potential for avifaunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability:** The presence of suitable habitat for avifaunal species;
- **Food Availability:** The availability of food within the study area for avifaunal species;
- **Avifaunal Diversity:** The recorded avifaunal diversity compared to a suitable reference condition such as surrounding natural areas or available avifaunal databases; and
- **Habitat Integrity:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the suitability and sensitivity of the study area for avifaunal species. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the study area in relation to avifaunal species. The different classes and land-use objectives are presented in the table below:

Table B1: Avifaunal habitat sensitivity rankings and associated land-use objectives.

SCORE	RATING SIGNIFICANCE	CONSERVATION OBJECTIVE
1> and <2	Low	Optimise development potential.
2> and <3	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
3> and <4	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
4> and <5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
5	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX C: Impact Assessment Methodology

Ecological Impact Assessment Method

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'[4]. 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 the Table C1. 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 necessary[5].

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 takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

[4] The definition has been aligned with that used in the ISO 14001 Standard.

[5] Some risks/impacts that have low significance will however still require 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 (No. 108 of 1997) in instances of uncertainty or lack of 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 <	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear developments affected <	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.

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

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 impacts[6] 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.

[6] *Mitigation measures should address both positive and negative impacts*

APPENDIX D: Vegetation Type

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

APPENDIX E: Species Observation List

Table E1: Avifaunal species not already listed which were observed during site visits.

Scientific name	Common name	IUCN Red List Status	Summer	Winter
Streptopelia capicola	Cape turtledove	LC	X	X
Calandrella cinerea	Red-capped Lark	LC	X	
Microcarbo africanus	Reed Cormorant	LC	X	
Burhinus capensis	Spotted Thick-knee	LC	X	X
Euplectes progne	Long-tailed Widowbird	LC	X	
Cisticola tinniens	Levaillant's Cisticola	LC	X	X
Cisticola fulvicapilla	Neddicky	LC	X	X
Macronyx capensis	Cape Longclaw	LC	X	X
Telophorus zeylonus	Bokmakierie	LC	X	
Columba guinea	Speckled pigeon	LC	X	
Anhinga rufa	African Darter	LC	X	
Euplectes orix	Southern Red Bishop	LC	X	X
Vidua macroura	Pin-tailed Whydah	LC	X	X
Anas capensis	White-rumped Swift	LC	X	
Cisticola ayresii	Wing-snapping Cisticola	LC	X	
Pternistis swainsonii	Swainson's Spurfowl	LC	X	
Passer diffusus	Southern Grey-headed Sparrow	LC	X	
Cisticola aberrans	Lazy Cisticola	LC	X	X
Vanellus armatus	Blacksmith Lapwing	LC	X	X
Vanellus coronatus	Crowned Lapwing	LC	X	
Lanius collaris	Common Fiscal	LC	X	X
Numida meleagris	Helmeted Guineafowl	LC	X	X
Charadrius tricollaris	Three-banded Plover	LC	X	X
Bubulcus ibis	Cattle Egret	LC	X	
Falco amurensis	Amur Falcon	LC	X	
Riparia cincta	Banded Martin	LC	X	
Fulica cristata	Red-knobbed Coot	LC	X	
Anas undulata	Yellow-billed Duck	LC	X	
Threskiornis aethiopicus	Sacred Ibis	LC	X	
Ardea cinerea	Grey Heron	LC	X	X
Ardea melanocephala	Black-headed Heron	LC	X	X
Quelea	Red-billed Quelea	LC	X	
Cisticola textrix	Cloud Cisticola	LC	X	
Prinia flavicans	Black-chested Prinia	LC	X	
Hirundo rustica	Barn Swallow	LC	X	
Nectarinia famosa	Malachite Sunbird	LC	X	
Motacilla capensis	Cape Wagtail	LC	X	X
Plectropterus gambensis	Spur-winged Goose	LC	X	
Euplectes ardens	Red-collared Widowbird	LC	X	
Passer domesticus	House Sparrow	LC	X	X
Euplectes axillaris	Fan-tailed Widowbird	LC	X	
Ploceus velatus	Southern masked weaver	LC	X	X

Scientific name	Common name	IUCN Red List Status	Summer	Winter
Spilopelia senegalensis	Laughing Dove	LC	X	X
Passer melanurus	Cape Sparrow	LC	X	
Crithagra flaviventris	Yellow Canary	LC	X	
Saxicola torquata	African Stonechat	LC	X	X
Merops apiaster	European Bee-eater	LC	X	
Scopus umbretta	Hamerkop	LC		X

LC = Least concerned. NT = Near Threatened, NYBA = Not yet been assessed by the IUCN.

APPENDIX F: Avifaunal SCC

Avifaunal Species of Conservation Concern for the Mpumalanga Province

Table F1: List of bird species and IUCN Red List Category (Cohen & Camacho,2002b) as listed in the Mpumalanga State of the Environment Report (2003).

English Name	Species	MP 2003 Status	POC
Whitewinged Flufftail	*Sarothrura ayresi*	CR	Low
Rudd's Lark	*Heteromirafra ruddi*	CR	Low
Yellowbreasted Pipit	*Hemimacronyx chloris*	VU	Low
Southern Bald Ibis	*Geronticus calvus*	VU	Medium
Botha's Lark	*Spizocorys fringillaris*	EN	Low
Wattled Crane	*Bugeranus carunculatus*	CR	Low
Blue Crane	*Anthropoides paradiseus*	VU	Low
Grey Crowned Crane	*Balearica reguloru,*	VU	Low
Blue Swallow	*Hirundo atrocaerulea*	CR	Low
Pinkthroated Twinspot	*Hypargos margaritatus*	NT	Low
Chestnutbanded Plover	*Charadrius pallidus*	NT	Low
Striped Flufftail	*Sarothrura affinis*	VU	Low
Southern Ground Hornbill	*Bucorvus leadbeateri*	VU	Low
Blackrumped Buttonquail	*Turnix hottentotta nana*	EN	Low
Blue Korhaan	*Eupodotis caerulescens*	VU	High
Denham's Bustard	*Neotis denhami*	VU	Low
African Marsh Harrier	*Circus ranivorus*	VU	Medium
Grass Owl	*Tyto capensis*	VU	Medium
White-bellied Korhaan	*Eupodotis senegalensis*	VU	Low
Saddlebilled Stork	*Ephippiorhynchus senegalensis*	CR	Low
Lappetfaced Vulture	*Torgos tracheliotos*	EN	Low
Whiteheaded Vulture	*Trigonoceps occipitalis*	EN	Low
Bateleur	*Terathopius ecaudatus*	VU	Low
Cape Vulture	*Gyps coprotheres*	VU	Low
Martial Eagle	*Polemaetus bellicosus*	VU	Low
Peregrine Falcon	*Falco peregrinus minor*	VU	Low
Taita Falcon	*Falco fasciinucha*	NT	Low

EN= Endangered; CR= Critically Endangered; VU= Vulnerable; NT= Near Threatened

Table F2: MTPA protected fauna list that have been historically recorded in the study area[7] QDS 2629BA, 2629AB, 2629BC and 2629AD.

Scientific Name	Common Name	Conservation Status (RSA)	Conservation Status (MTPA)	Endemic
On the same property				
None recorded in the MTPA database				
Within 2 km				
None recorded in the MTPA database				
Within 5 km				
None recorded in the MTPA database				
Within 10 km				
Alopochen aegyptiaca	Egyptian Goose	No details provided	No details provided	-
Ardea melanocephala	Black-headed Heron	No details provided	No details provided	-
Fulica cristata	Red-knobbed Coot	No details provided	No details provided	-
Gallinago nigripennis	African Snipe	No details provided	No details provided	-
Himantopus	Black-winged Stilt	No details provided	No details provided	-
Phalacrocorax africanus	Reed Cormorant	No details provided	No details provided	-
Tringa nebularia	Common Greenshank	No details provided	No details provided	-
Tyto capensis	African Grass-Owl	VU	VU	-
Vanellus armatus	Blacksmith Lapwing	No details provided	No details provided	-
Within 15 km				
Alopochen aegyptiaca	Egyptian Goose	No details provided	No details provided	-
Ardea cinerea	Grey Heron	No details provided	No details provided	-
Ciconia	White Stork	No details provided	No details provided	-
Eupodotis caerulescens	Blue Korhaan	LC	NT	RSA
Fulica cristata	Red-knobbed Coot	No details provided	No details provided	-
Phoenicopterus minor	Lesser Flamingo	NT	NT	-
Phoenicopterus ruber	Greater Flamingo	NT	NT	-
Sagittarius serpentarius	Secretarybird	VU	VU	-
Tyto capensis	African Grass-Owl	VU	VU	-
Within 20 km				
Alopochen aegyptiaca	Egyptian Goose	No details provided	No details provided	-
Anas erythrorhyncha	Red-billed Teal	No details provided	No details provided	-
Eupodotis caerulescens	Blue Korhaan	LC	NT	RSA
Fulica cristata	Red-knobbed Coot	No details provided	No details provided	-
Geronticus calvus	Southern Bald Ibis	VU	VU	RSA
Glareola nordmanni	Black-winged Pratincole	NT	NT	-
Phoenicopterus minor	Lesser Flamingo	NT	NT	-
Phoenicopterus ruber	Greater Flamingo	NT	NT	-
Sagittarius serpentarius	Secretarybird	VU	VU	-
Threskiornis aethiopicus	African Sacred Ibis	No details provided	No details provided	-
Tyto capensis	African Grass-Owl	VU	VU	-
Within 30 km				
Afrotis afraoides	Northern Black Korhaan	No details provided	No details provided	-

[7] Information provided by the Mpumalanga Tourism and Parks Agency in January 2021.

Scientific Name	Common Name	Conservation Status (RSA)	Conservation Status (MTPA)	Endemic
Alopochen aegyptiaca	Egyptian Goose	No details provided	No details provided	-
Anas smithii	Cape Shoveler	No details provided	No details provided	-
Anas undulata	Yellow-billed Duck	No details provided	No details provided	-
Ardea cinerea	Grey Heron	No details provided	No details provided	-
Asio capensis	Marsh Owl	No details provided	No details provided	-
Bubo africanus	Spotted Eagle-Owl	No details provided	No details provided	-
Bubulcus ibis	Cattle Egret	No details provided	No details provided	-
Ciconia	White Stork	No details provided	No details provided	-
Circus macrourus	Pallid Harrier	NT	NT	-
Circus pygargus	Montagu's Harrier	No details provided	No details provided	-
Egretta alba	Great Egret	No details provided	No details provided	-
Elanus caeruleus	Black-shouldered Kite	No details provided	No details provided	-
Eupodotis caerulescens	Blue Korhaan	LC	NT	RSA
Falco amurensis	Amur Falcon	No details provided	No details provided	-
Falco biarmicus	Lanner Falcon	VU	VU	-
Falco vespertinus	Red-footed Falcon	NT	NT	-
Fulica cristata	Red-knobbed Coot	No details provided	No details provided	-
Geronticus calvus	Southern Bald Ibis	VU	VU	RSA
Himantopus	Black-winged Stilt	No details provided	No details provided	-
Oxyura maccoa	Maccoa Duck	NT	NT	-
Phoenicopterus minor	Lesser Flamingo	NT	NT	-
Phoenicopterus ruber	Greater Flamingo	NT	NT	-
Plectropterus gambensis	Spur-winged Goose	No details provided	No details provided	-
Plegadis falcinellus	Glossy Ibis	No details provided	No details provided	-
Ploceus rubiginosus	Chestnut Weaver	No details provided	No details provided	-
Sagittarius serpentarius	Secretarybird	VU	VU	-
Scleroptila levaillantii	Red-winged Francolin	No details provided	No details provided	-
Smithornis capensis	African Broadbill	No details provided	No details provided	-
Tyto alba	Barn Owl	No details provided	No details provided	-
Tyto capensis	African Grass-Owl	VU	VU	-
Beyond 30 km				
Falco amurensis	Amur Falcon	No details provided	No details provided	-

EN= Endangered; CR= Critically Endangered; VU= Vulnerable; P = Protected; NYBA = Not Yet Been Assessed

South African Bird Atlas Project 2 list

Table F3: Avifaunal Species for the pentads 2610_2930 within the QDS 2629BA.

Pentads	Link to pentad summary on the South African Bird Atlas Project 2 web page
2610_2930	http://sabap2.birdmap.africa/coverage/pentad/2610_2930

Species listed as protected under the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA)

Table F4: Schedule 2 - PROTECTED GAME (SECTION 4 (1) (b))

Common name	Scientific name
BIRDS	
Any bird which is a wild animal, excluding a bird referred to in Schedule 3, and the -	
White Breasted Cormorant	*Phalacrocorax lucidus*
Reed Cormorant	*Phalacrocorax africanus*
Red-Eyed Turtle Dove	*Streptopelia semitorquata*
Cape Turtle Dove	*Streptopelia capicola*
Laughing Dove	*Streptopelia senegalensis*
all species of mousebirds	all species of the Family Colidae
Pied Crow	*Corvus albus*
Black Crow	*Corvus capensis*
Red-Eyed Bulbul	*Pycnonotus nigricans*
Black-Eyed Bulbul	*Pycnonotus barbatus*
Red-Winged Starling	*Onychognathus morio*
Cape Sparrow	*Passer melanurus*
Spotted-Backed Weaver	*Ploceus cucullatus*
Cape Weaver	*Ploceus capensis*
Masked Weaver	*Ploceus velatus*
Red-Billed Quelea	*Quelea*
Red Bishop	*Euplectes orix*

APPENDIX G: Declaration and Specialists CV's

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

Daryl van der Merwe	MSc Conservation Biology (University of Cape Town)
Christopher Hooton	BTech Nature Conservation (Tshwane University of Technology)
Stephen van Staden	MSc Environmental Management (University of Johannesburg)

1. (A). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Chris Hooton		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Cell:	083 342 0639
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	Chris@sasenvgroup.co.za		
Qualifications	BTech Nature Conservation (Tshwane University of Technology National Diploma Nature Conservation (Tshwane University of Technology) Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA) Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs		

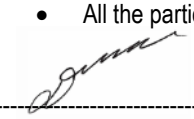
Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Daryl van Der Merwe		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Cell:	0780201 0069
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	Daryl@sasenvgroup.co.za		
Qualifications	MSc (Conservation Biology) (University of Cape Town) BSc (Hons) (Plant Science) (University of Pretoria) BSc (Environmental Science) (University of Pretoria)		

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	2007	Cell:	082 442 7637
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	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		

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

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, 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 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

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, Zambia

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 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