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AVIFAUNAL ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS FOR PROPOSED SOLAR PHOTOVOLTAIC (PV) PROJECT ASSOCIATED WITH THE KOLOMELA MINE, NEAR POSTMASBURG, NORTHERN CAPE PROVINCE

Prepared for

EXM Advisory Services (Pty) Ltd.

August 2021

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Report Reference: STS 210053

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 medium low to low impacts on the receiving environment prior to the implementation of mitigation measures. With mitigation impacts scores can be reduced can be reduced to low and very low levels in most cases. Development within portions of *Tarconanthus - Senegalia* Thornveld will result in medium low both with and without mitigation as natural habitat with the potential to support several SCC will be transformed. Although a large contingent of SCC anticipated to occur within the study area no breeding is anticipated for these species. 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 Solar Photovoltaic (PV) Project associated with the Kolomela Mine, near Postmasburg, Northern Cape Province – henceforth referred to as the "**study area**". Although no layout was provided the project is anticipated to be associated with both linear developments (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 Tsantsabane Local Municipality which is an administrative area in the Siyanda District Municipality of the Northern Cape. The Kolomela Mine is located approximately 8,7 km south west of the town of Postmasburg while the R309 / R383 roadway is located approximately 1,6 km east of the Kolomela Mine. The location and extent of the study area is indicated in **Figures 1 & 2.**

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

- During the field assessment only a single species of Special Interest (*Ardeotis kori* (Kori Bustard, NT)) was observed within the study area on two occasions within the *Tarconanthus - Senegalia* Thornveld habitat;
- Habitat for several other avifaunal SCC, including: *Neotis ludwigii* (Ludwig's Bustard, EN), *Cursorius rufus* (Burchell's Courser, VU), *Polemeatus bellicosus* (Martial Eagle, EN), *Sagittarius serpentarius* (Secretarybird, VU), *Aquila rapax* (Tawny Eagle, EN), *Coracias garrulus* (European Roller) and *Falco biarmicus* (Lanner Falcon) was noted within the study area;
- Breeding habitat for *Ardeotis kori* (Kori Bustard, NT) and *Neotis ludwigii* (Ludwig's Bustard, EN) was observed within the *Tarconanthus - Senegalia* Thornveld and in habitat adjacent the proposed development;
- The largely homogeneous nature of the Transformed habitat and the high degree of edge effects exposed to the remaining *Tarconanthus - Senegalia* Thornveld provides intermediate and moderately low habitat suitability for avifauna. The homogeneity of the habitat structure limits niche habitats and thus species diversity;

- The proposed activities will lead to the transformation of natural *Tarconanthus - Senegalia* Thornveld 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 SCC due to the loss of habitat 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. Furthermore, the proposed activities occur adjacent to areas of high human disturbance further reducing the potential for breeding. Habitat for such species does exist in the surrounding areas and would likely be preferred as fewer disturbances occur. 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 medium low to low significance levels, with higher impact significance activities occurring as a result of the establishment of the transformation of the *Tarconanthus - Senegalia* Thornveld. This activity will likely result in a decrease in avian richness and abundance of SCC within the study area. If effective mitigation takes place, most impact may be reduced to lower significance levels.

Sensitivity

From an avifaunal ecological perspective, the study area has portions of intermediate sensitivity habitat within the *Tarconanthus - Senegalia* Thornveld and the Watercourse Habitats which is utilised by common and rarer and more reclusive avifaunal SCC. The remainder of the study area is considered to be of low sensitivity, mainly as a result historic clearing within the central portions of the study area and the largely homogenous nature of the vegetation within these locations. The natural *Tarconanthus - Senegalia* Thornveld and Watercourse habitat providing suitable foraging habitat for common avifauna and several avifaunal SCC. The surrounding landscape is largely natural and thus expected to retain an moderate abundance and diversity of birds. The proposed activities, notably the establishment of PV 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.

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GLOSSARY OF TERMS

Most definitions are based on terms and concepts elaborated by Richardson et al. (2011), Hui and Richardson (2017) and Wilson et al. (2017), with consideration to their applicability in the South African context, especially South African legislation [notably the National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004(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
DFFE	Department of Forestry Fisheries and Environment
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
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 Solar Photovoltaic (PV) Project associated with the Kolomela Mine, near Postmasburg, Northern Cape Province – henceforth referred to as the "**study area**".

The project is associated with a High-Voltage powerline, as well as surface infrastructure that includes the Solar PV panels, buildings, the main substation and battery storage. As no development layout was provided it is assumed that the entire study area will be developed.

The study area is located within the Tsantsabane Local Municipality which is an administrative area in the Siyanda District Municipality of the Northern Cape. The Kolomela Mine is located approximately 8,7 km south-west of the town of Postmasburg while the R309 / R383 roadway is located approximately 1,6 km east of the Kolomela Mine. The location and extent of the study area is indicated in Figures 1 & 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 Sishen Iron Ore Company (Pty) Ltd, part of Kumba Iron Ore Limited (hereafter referred to as Kumba), owns and operates Kolomela Mine, located approximately 8 km south-west of Postmasburg in the Tsantsabane Local Municipality, Northern Cape Province. The Minister of Mineral Resources granted a mining right for the mining of iron ore at Kolomela Mine on the 5th of May 2008, {Ref: (NC) 069 MR} and is valid until the 17th of September 2038, unless cancelled or suspended.

Kolomela Mine operates as a conventional open cast mine where ore is extracted by means of drilling, blasting, loading and hauling. Ore extracted from the pits is transported to a direct shipping ore (DSO) plant which involves the crushing and screening of recovered ore material into stockpiles of 'lump' and 'fines'. The processed iron ore is loaded onto an internal railway line which is connected to a direct rail link to Transnet's Sishen-Saldanha railway line from where the iron ore is transported to the Port of Saldanha for export. Kolomela Mine also utilises

a Modular Dense Media Separation (DMS) Processing Plant for the processing of low grade ore not suitable for processing at the DSO plant. Kolomela Mine produced 10.8 million tonnes during its first full year of production in 2013 and currently produces 13-14 million tonnes per annum (Mtpa) facilitated by enhanced stripping techniques and processing of 1-3 Mtpa of lower grade of ore at the Tierbult DMS Modular Plant.

The Kolomela Mine proposes to expand and amend some of the existing activities and also develop new infrastructure to support continued and future production at the mine. This report focuses on the proposed new PV Solar Facility.

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 Northern Cape Critical Biodiversity Areas (2016); The National Environmental Management: Biodiversity Act, 2004 (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 (Species of Conservation Concern) only and to develop mitigation and management measures in terms of avifaunal SCC for all phases of the development.

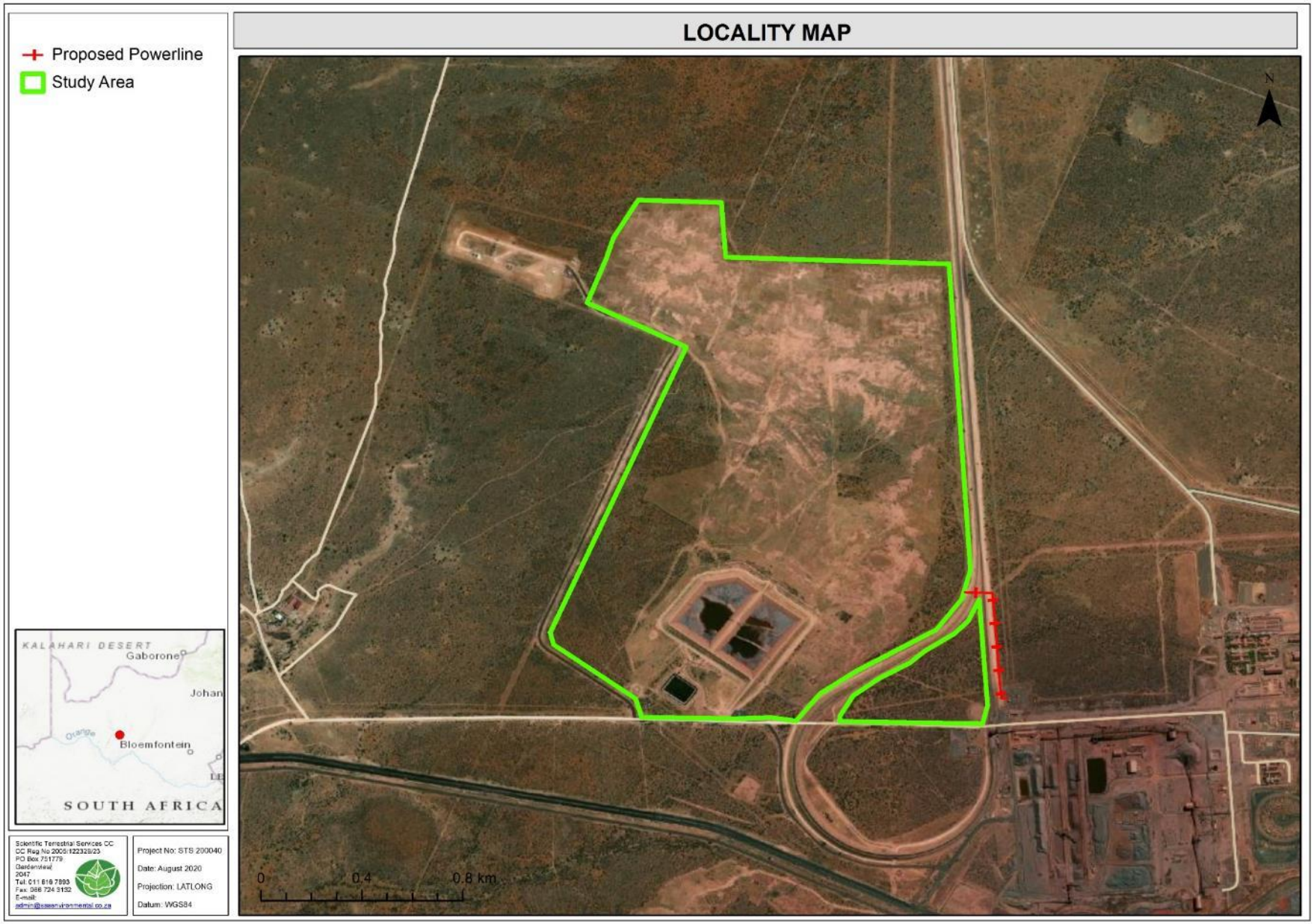

Figure 1: Digital satellite image depicting the study area in relation to surrounding area.

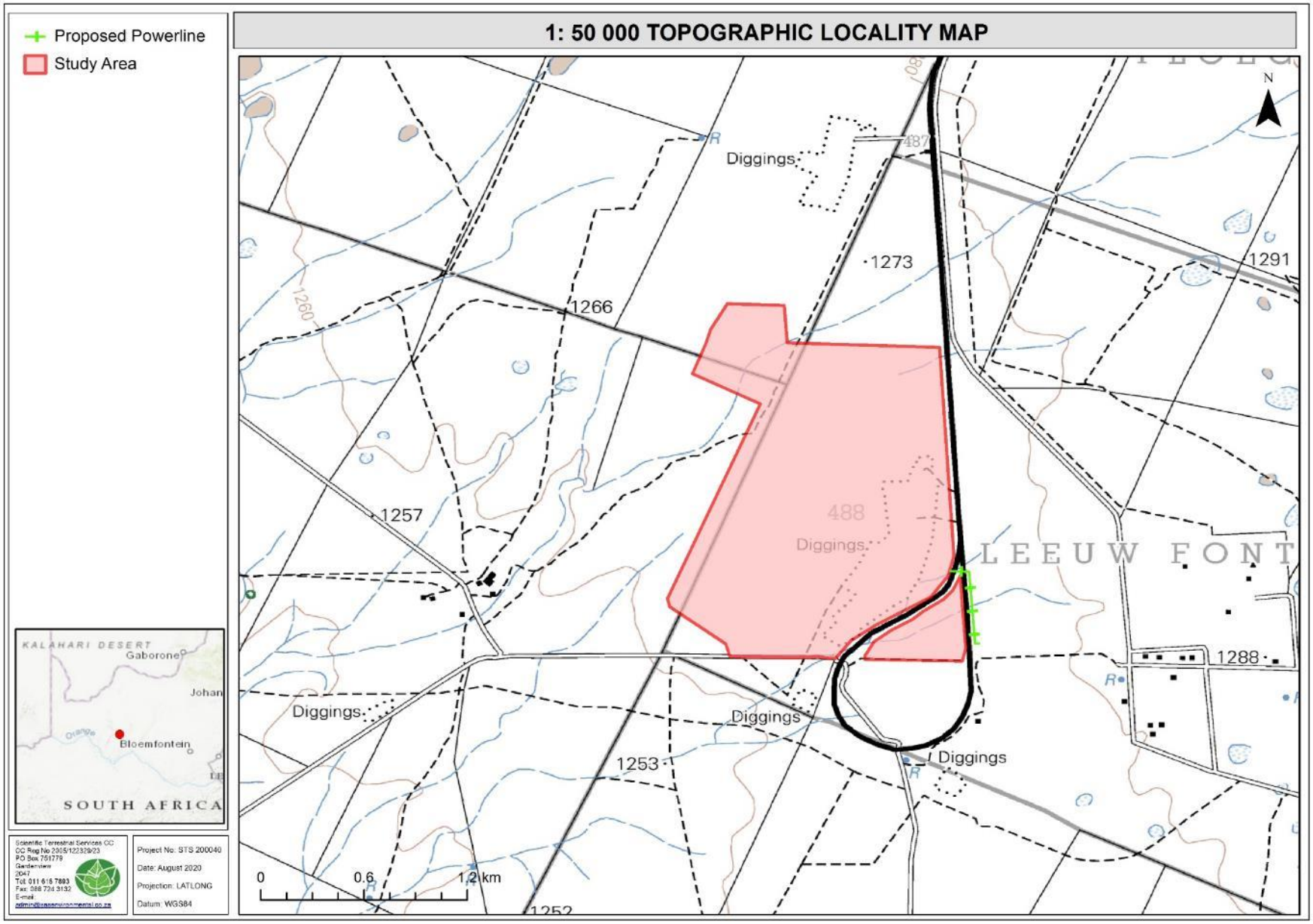

Figure 2: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The avifaunal assessment results are confined to the study area and do not include the neighbouring and adjacent properties. The entire study area and immediate surroundings were, however, included in the desktop analysis of which the results are presented in **Section 3**;
- The site investigation was restricted to the proposed study area. No buffers around the proposed study area were investigated on foot yet avian habitat adjacent the proposed infrastructure was considered due to avian movement habits;
- 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;
- For the purpose of this report it is assumed that development will not occur within Watercourse Habitat or the relevant zones of regulation as presented within the Freshwater Ecological Assessment (SAS 202147, 2021);
- 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 a single field assessments, undertaken during winter (28th June to the 2nd July). For a more representative assessment a summer survey may provide valuable observations. However, 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

The field assessments were undertaken during winter season (from the 28th June to the 2nd July 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) 2822BB].

DESCRIPTION OF THE VEGETATION TYPE(S) RELEVANT TO THE STUDY AREA ACCORDING TO MUCINA & RUTHERFORD (2012; 2018 (BETA-VERSION) (FIGURE 3)		
Biome		The study area is situated within the **Savanna Biome**.
Bioregion		The study area occurs within the **Eastern Kalahari Bushveld Bioregion.**
Vegetation type		**Postmasburg Thornveld (Svk 14) (95% of the assessment site)**
Altitude (m)		1 180 –1 440 m
Climate		Summer and autumn rainfall with very dry winters.
Climate	**MAP (mm)**	306
	MAT (°C)	17.0
	MFD (Days)	38
	MAPE (mm)	2752
	MASMS (%)	84
Distribution		Northern Cape Province
Geology & soils		Red aeolian sand of the Kalahari Group overlying the volcanics and sediments of the Griqualand West Supergroup that outcrop in places. Deep soils are of the Hutton form
Conservation		Least threatened. Target 16%. None of the unit is conserved in statutory conservation areas, but very little has been transformed
Vegetation & landscape features (dominant floral taxa in appendix D)		Flats surrounded by mountains supporting open, shrubby thornveld characterised by a dense shrub layer, often lacking a tree layer. The grass layer is very sparse. Shrubs generally low with a karroid affinity

CONSERVATION DETAILS PERTAINING TO THE AREA OF INTEREST (VARIOUS DATABASES)		NATIONAL WEB BASED ENVIRONMENTAL SCREENING TOOL (2020)	
NBA (2018): **1) Ecosystem Threat Status** **2) Ecosystem Protection Level**	Small western and south eastern portions of the study area is located within the **Postmasburg Thornveld** which is considered a **Least Concern** ecosystem and is currently **Poorly Protected (Figure 3)**. 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 National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEMPAA) 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,	The screening tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas	
		Avian species theme (Figure 5)	For the animal species theme, the study area is considered to have a **high** and **medium sensitivity.** The study area does however have sections where no sensitivity has been provided**.** The sensitivities were triggered by the potential occurrence of the following species: the avifauna *Neotis ludwigii* (Ludwig's bustard) and *Sagittarius serpentarius* (Secretarybird).
		Terrestrial biodiversity theme	For the Terrestrial Biodiversity Theme, the study area is considered to have a **very high sensitivity**. The triggered sensitivity features include a CBA 1, an Ecological Support Areas (ESA), and a Freshwater Ecosystem Priority Area.

	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.		
National Threatened Ecosystems[1] (2011)	The study area is located within an ecosystem that is currently considered to be **Least Concern**. Least Concern ecosystems have not experienced a significant loss of natural habitat or deterioration in condition.	**STRATEGIC WATER SOURCE AREAS FOR SURFACE WATER (2017)**	
IBA (2015)	The study area is not located within or near an IBA (within 10 km).	Surface Water Strategic Water Source Area (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.	
SAPAD (2021, Q1); SACAD (2021, Q1); NPAES (2009).	According to the South African Protected Areas Database (SAPAD, 2021)[2], the South African Conservation Areas Database (SACAD, 2021)[3] and the National Protected Areas Expansion Strategy (NPAES, 2009), no protected areas or conservation areas are indicated within 10 km of the study area.	**Name & Criteria**	The study area is not within 10 km of a Surface Water Strategic Water Source Area.

[1] For Environmental Impact Assessments (EIAs), the 2011 National list of Threatened Ecosystems remains the trigger for a Basic Assessment in terms of Listing Notice 3 of the EIA Regulations 2014, as amended published under the National Environmental Management Act, 1998 (Act No. 107 of 1998). However, the updated 2018 ecosystem threat status have been considered in the assessment of impact significance in EIAs.

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

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

NORTHERN CAPE CRITICAL BIODIVERSITY AREAS (2016) (FIGURE 10)		NORTHERN CAPE PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK (NCPSDF, 2019)
CRITICAL BIODIVERSITY AREA (CBA): CATEGORY 1	A small central western portion of the study area falls within an area identified as a **Category 1 CBA,** which seems to be a buffer associated with a watercourse. Critical Biodiversity Area (CBA) 1 areas are areas that are considered irreplaceable or near-irreplaceable (i.e. high selection frequency) for meeting biodiversity targets. There are no or very few other options for meeting biodiversity targets for the features associated with these areas.	The NCPSDF is to function as an innovative strategy that will apply sustainability principles to all forms of land use management throughout the Northern Cape as well as to facilitate practical results, as it relates to the eradication of poverty and inequality and the protection of the integrity of the environment. The study area is located within the **Griqualand West Centre (GWC)** of plant endemism. This semi-arid region is broadly described as savanna, forming part of the eastern Kalahari Bushveld Bioregion. Studies investigating the endemism of the centre report at least 23 plant species that have restricted distributions (Frisby *et al.* 2019). The study area also falls within the **Gamagara Corridor**. The Gamagara Corridor comprises the mining belt of the John Taolo Gaetsewe and Siyanda Districts and runs from lime acres and Danielskuil to Hotazel in the north. The corridor focuses on the mining of iron and manganese.
OTHER NATURAL AREAS (ONA)	A small western and south eastern portion of the study area falls within an area that is identified as **ONAs.** According to the Technical Guidelines for CBA Maps document, ONA consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs (SANBI, 2017).	
CBA REASONS	The Northern Cape Critical Biodiversity Areas (2016) database also includes the "reasons" layer, which is based on the planning units used in the spatial analysis and provides a list of biodiversity and ecological features found in each planning unit, which contribute to the biodiversity target (CBA Map Reason Metadata). According to this Northern Cape Critical Biodiversity Areas Reasons layer, the triggering biodiversity and ecological features for the CBA within the study area include the below: All natural wetlands; FEPA catchment; Conservation Areas; and Postmasburg Thornveld	

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.

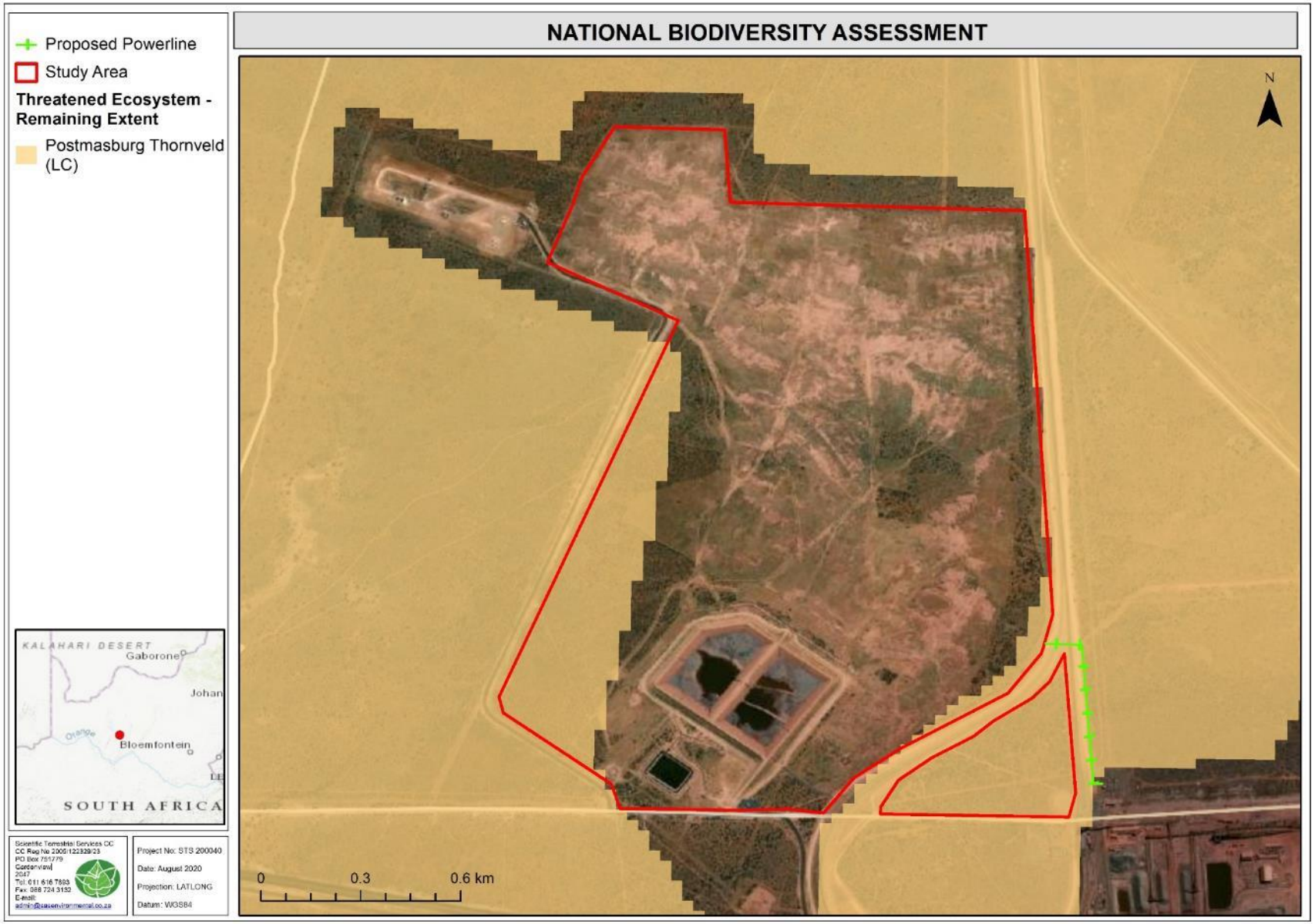


Figure 3: The proposed layout in relation to the remaining extent of the Postmasberg Thornveld (LC), according to the National Biodiversity Assessment (NBA, 2018).

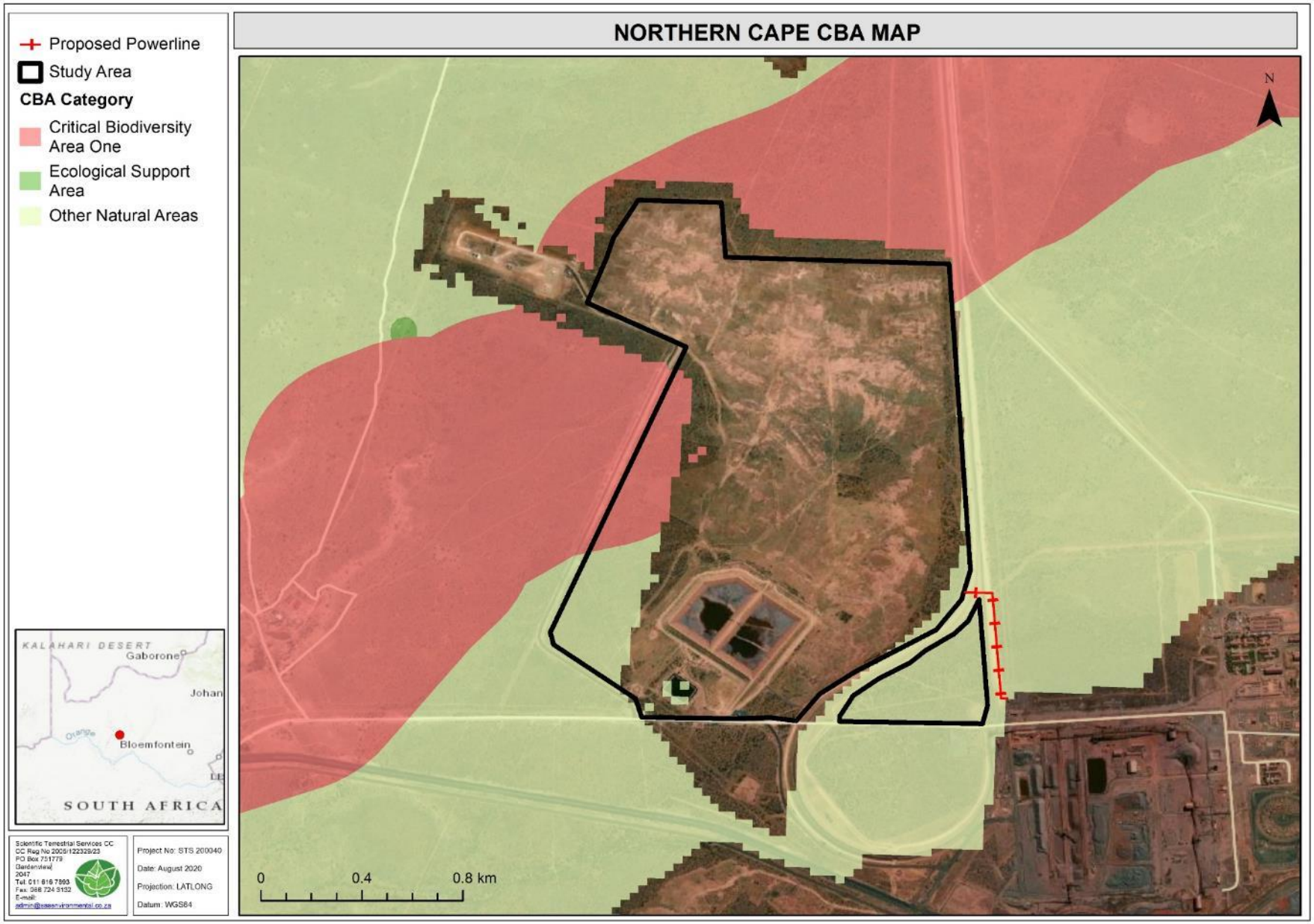


Figure 4: The study area in relation to the various CBA categories as indicated in the Northern Cape CBA Map (2016).

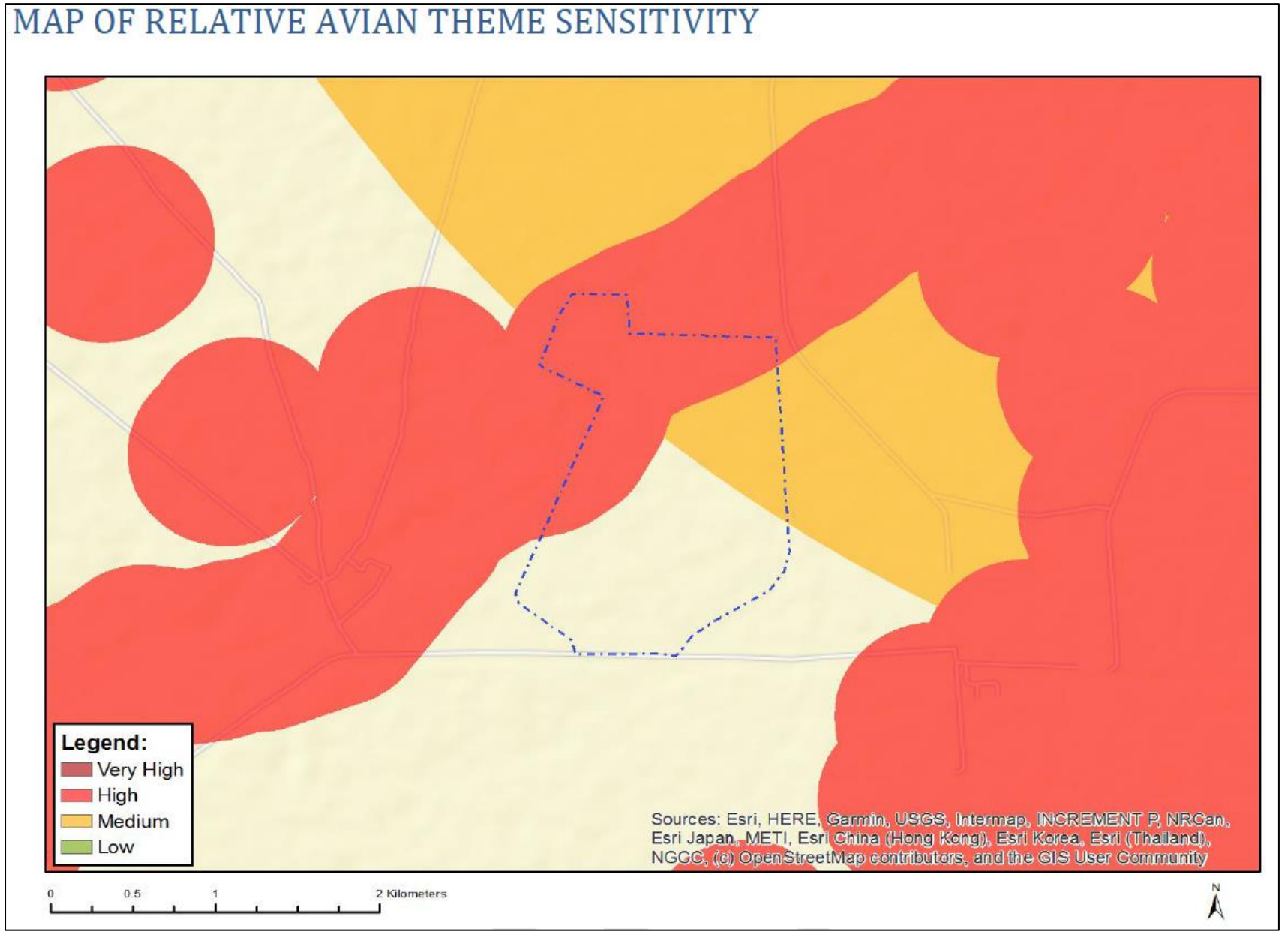


Figure 5. Avian Species Theme sensitivity map generated by the National Web based Screening Tool.

3.2 Important Bird and Biodiversity Areas (IBA)

According to Birdlife South Africa (BLSA), the study area does not fall within any Important Bird and Biodiversity Areas (IBA). The closest IBA to the study area is the Spitskop Dam IBA (located 160 km to the east).

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 pentads 2820_2250, 2820_2255, 2825_2250 and 2825_2255, including 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 (2820_2255 pentad).

Common Name	Scientific Name	Regional Status (Taylor *et al*, 2015)	SABAP2 Reporting Rate (%)				POC
			2820_2250 (2 FP cards)	2820_2255 (2 FP cards)	2825_2250 (4 FP cards)	2825_2255 (3 FP cards)	
Ludwig's Bustard	*Neotis ludwigii*	EN	50	100	25	-	H
Martial Eagle	*Polemeatus bellicosus*	EN	-	-	-	-	M
Tawny Eagle	*Aquila rapax*	EN	-	-	-	-	M
Kori Bustard	*Ardeotis kori*	NT	50	-	50	-	Confirmed
Burchell's courser	*Cursorius rufus*	VU	-	-	-	-	M
White-backed Vulture	*Gyps africanus*	CR	-	-	25	-	L
Lappet-faced Vulture	*Torgos tracheliotos*	EN	50	-	25	-	L
Lanner Falcon	*Falco biarmicus*	VU	-	-	-	-	M
Secretarybird	*Sagittarius serpentarius*	VU	-	-	-	-	M
European Roller	*Coracias garrulus*	NT	-	-	-	-	M

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

4. AVIFAUNAL ASSESSMENT RESULTS

Three habitat units were identified during the site assessment of the study area, they are briefly discussed below. The habitat units are depicted in Figure 6 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). Habitat onsite is largely comprised of Transformed habitat which had previously been cleared in 2013/2014. The remaining habitat comprises medium to high density shrub and thornveld (*Tarconanthus-Senegalia* Thornveld) and Watercourse Habitat with taller trees and a more open graminoid layer (see below for more details). As limited diversity in vegetation structure exist it is not anticipated that the site will preserve a broad assemblage of birds but will mostly host arid adapted species and generalist granivorous and insectivorous species.

Based on the results of the field investigations, three habitat units were distinguished for the study area:

- Transformed Habitat Unit (habitat that has experienced impacts from clearing activities without rehabilitation to the reference state). It had grassland characteristics and its graminoid layer is homogenous and swards of grass are dense and relatively tall (1 m). Granivorous avifauna will prefer this unit, however, resource provisioning is anticipated to be ephemeral in nature as a result of the low floral diversity;
- *Tarconanthus-Senegalia* Thornveld Habitat Unit (this unit is comprised of dense stands of shrubs and thorn trees with a reduced herbaceous cover). Greater floral diversity provides more opportunities in terms of both forage and shelter. The bare ground patches may be utilized by ground dwelling avifaunal SCC; and
- The Watercourse Habitat comprises of a small portion of the study area and has the characters of an episodic drainage line which will temporarily flow during high rainfall events. This habitat mimics the adjacent *Tarconanthus-Senegalia* Thornveld Habitat but contains taller and larger trees with a more open grass layer.

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 210053; Part B).

Section 4.1 summarises the field observations that were made during the site visit with regards to overall avifaunal diversity, food availability, habitat integrity, habitat availability, general comments and business case and conclusion.

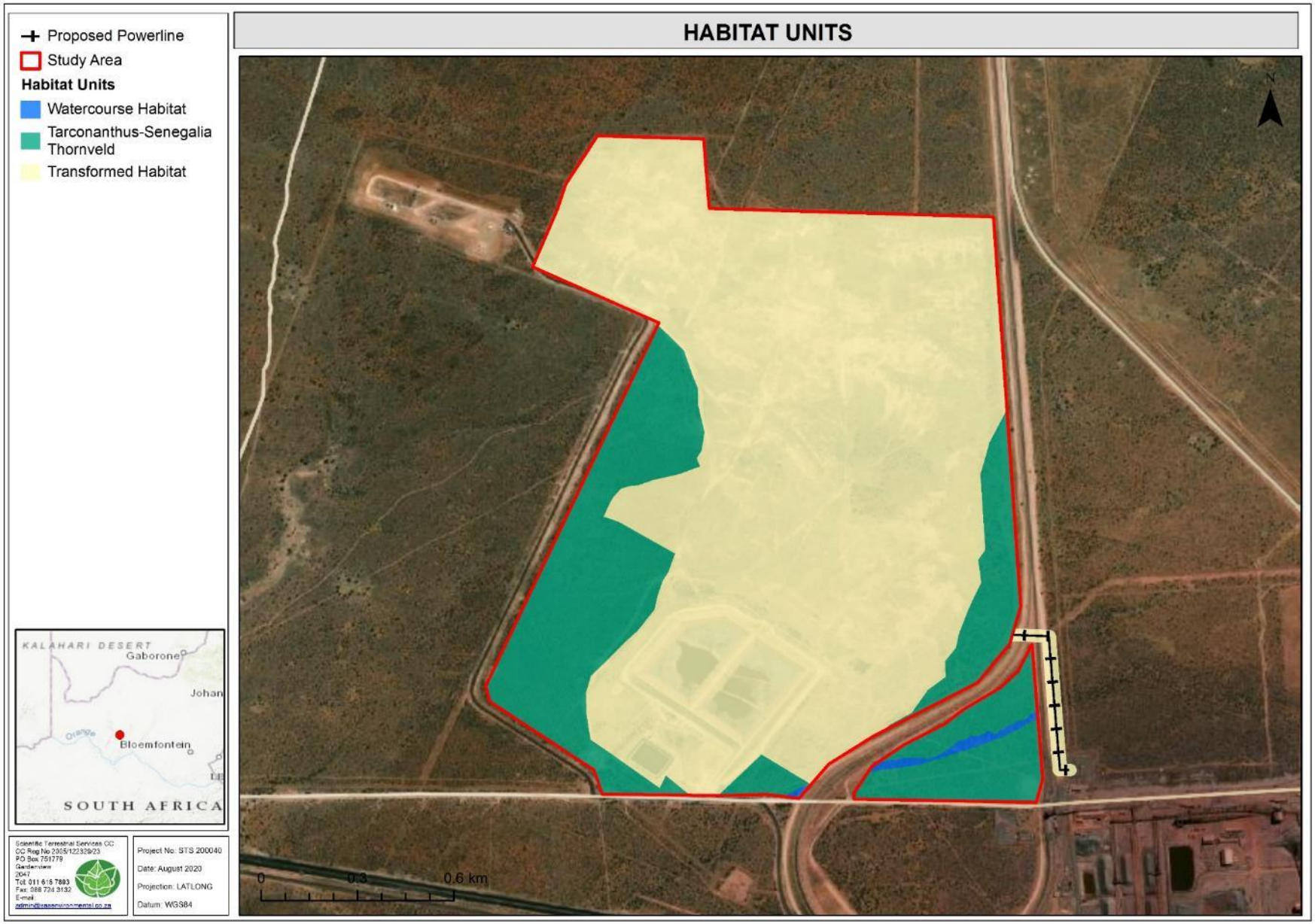


Figure 6: Habitat units encountered within the study area.

4.1 Summary of results for avifaunal species

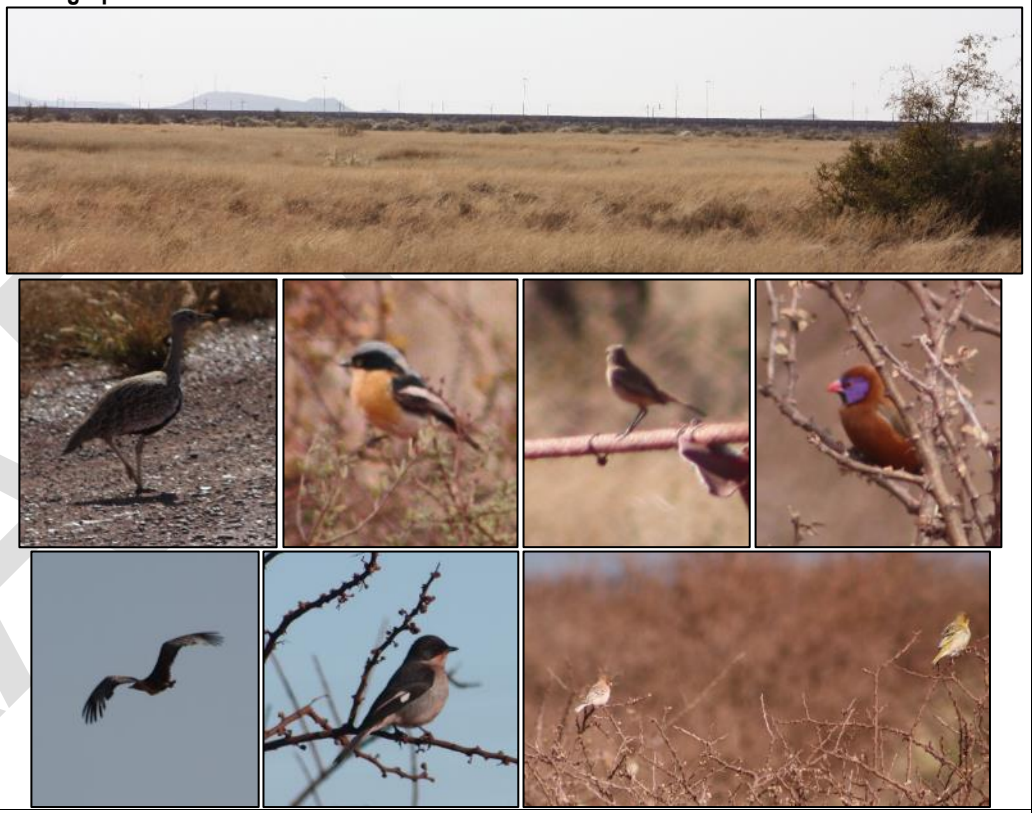
Faunal Class: Avifaunal	Habitat Sensitivity:	Intermediate

Notes on photographs:
Top: General habitat characteristics noted within the Transformed Habitat during the field investigation within the proposed PV facility locality. This portion was previously cleared in 2013/2014. Middle: Left to right - *Lophotis ruficrista* (Red-crested Korhaan, *Batis pririt* (Pririt Batis), *Cercomela familiaris* (Familiar Chat) and *Uraeginthus granatinus* (Violet-eared Waxbill). Bottom: Left to right – *Ardeotis kori* (Kori Bustard), *Sigelus silens* (Fiscal Flycatcher), *Crithagra flaviventris* (Yellow Canary) and a *Philetairus socius* (Sociable Weaver).

Faunal SCC/Endemics/TOPS/:

During the field assessment a pair of *Ardeotis kori* (Kori Bustard, NT) were encountered within the *Tarconanthus-Senegalia* Thornveld. *Gyps africanus* (White-backed Vulture, CR), *Neotis ludwigii* (Ludwig's Bustard, EN), *Ardeotis kori* (Kori Bustard, NT) and *Torgos tracheliotos* (Lappet-faced Vulture, EN) have been recorded within the pentads within which the study area is located. The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland indicates that several more SCC have distribution ranges which encompass the study area, these include: *Cursorius rufus* (Burchell's Courser, VU), *Polemeatus bellicosus* (Martial Eagle, EN), *Sagittarius serpentarius* (Secretarybird, VU), *Aquila rapax* (Tawny Eagle, EN), *Coracias garrulus* (European Roller) and *Falco biarmicus* (Lanner Falcon). These species would likely utilise the site for foraging should the oppurtunity present itself. Of these SCC, *Ardeotis kori* (Kori Bustard, NT) and *Neotis ludwigii* (Ludwig's Bustard, EN) may breed within the study area. The National Screening tool indicates that the study area has a high sensitivity for *Neotis ludwigii* (Ludwig's Bustard, EN) and a low sensitivity for *Sagittarius serpentarius* (Secretarybird, VU).

Photograph:



Avifaunal Diversity	The avifaunal diversity associated with the study area was moderately low, mainly consisting of common avifaunal species, with few 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: *Streptopelia capicola* (Cape turtledove), *Cercotrichas paena* (Kalahari Scrub Robin) *Pycnonotus nigricans* (Red-eyed bulbul), *Laniarius astrococcineus* (Crimson-breasted shrike), *Prinia masulosa* (Karoo prinia), *Sylvietta rufescens* (Long-billed crombec), and *Ardeotis kori* (Kori Bustard, NT), *Pterocles Namaqua* (Namaqua Sandgrouse), *Melierax canorus* (Pale-chanting Goshawk), *Calendulauda sabota* (Sabota Lark), *Rhinoptilus africanus* (Double-banded Courser), *Cisticola aridulus* (Desert Cisticola), *Saxicola torquatus* (African Stonechat), *Lanius collaris* (Common Fiscal), *Myrmecocichla formicivora* (Ant-eating Chat) and *Philetairus socius* (Sociable Weaver). Please refer to Appendix E for the full list of species identified on site.
Food Availability	The study area is considered to have a moderately low abundance of forage for avian species as a result of the historic clearing of a large extent within the study area. The graminoid layer was homogenous, largely comprised of *Heteropogon contortis* and *Aristida congesta* subsp. *congesta* greatly reducing the potential forage breadth for avifauna. The remaining portions of the natural Thornveld (*Tarconanthus - Senegalia* Thornveld) habitat unit provides valuable shelter and structure for avifauna and will be preferred to the historically disturbed areas as greater floral diversity ensures more forage opportunities. The largely transformed habitat offers poor resources for most avifauna with little niche habitat or sufficient food for the avian assemblages within the study area. Forage for granivores was noted within the Transformed habitat yet this is anticipated to be

	suitable for short periods during the year as a result of the homogenous vegetation. Birds that feed on invertebrates and vegetation would find suitable forage outside of the Transformed Habitat. Insect abundances were moderately low, limiting provisioning of a rich source of food for most passerines and fruiting vegetation appeared to occur in limited supply. Forage for large perch hunting raptors was noted in intermediate abundances, these species often have wide ranging habits and will cover large areas, and as such it is considered unlikely food will be a limiting factor for them. Larger raptor species were seldomly encountered during the site visit.
Habitat Integrity	The study area is largely transformed with sections of natural veld on the eastern and western boundaries of the study area. The large degree of historic transformation reduces the integrity of the study area as most of the habitat no longer represents the reference vegetation. The study area is bordered by the main access road (including rail lines) to Kolomela Mine on its eastern border and haul roads to the south. Much of the area to the west and north remains in a natural state which improved the integrity score. The absence of fire due to the surrounding mine activities does subtract important ecological functions which are valuable to many bird species as they create disturbances (natural), promote floral heterogeneity, and cause structural changes to herbaceous vegetation.
Habitat Availability	Habitat availability is considered moderately low within the Transformed portions of the study area and intermediate for the *Tarconanthus - Senegalia* Thornveld. The broad grassland like habitat within the Transformed habitat offers limited opportunities for most species within the study area and is not preferred to the *Tarconanthus - Senegalia* Thornveld. A low diversity of avifauna was noted within the Transformed area where habitat characteristics were homogenous and offered very little shelter, forage, or nesting opportunities for avifauna. The lack of dense sheltered areas and trees within the Transformed habitat reduces the habitat available and shelter for many avifaunal species who require these features for nesting and foraging.
Business Case and Conclusion:	The avifaunal habitat sensitivity for the study area is considered to range from intermediate to moderately low. Although a large contingent of SCC are considered likely to utilise the study area only *Neotis ludwigii* (Ludwig's Bustard, EN) and *Ardeotis kori* (Kori Bustard, NT) may potentially breed within the remaining portions of *Tarconanthus - Senegalia* Thornveld. It is not anticipated that the remaining SCC will permanently occur within the study area but will rather utilise the study area when favourable conditions present themselves. 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. The National Screening tool indicates that the northern portions of the study area are considered of High and Medium sensitivity from an avian perspective. The High sensitivity locations follow an ephemeral tributary which is possibly a migratory route for avifauna but has been disturbed from historic clearing and as such has lost conservation potential. The proposed activities will increase the risk of birds colliding with or being electrocuted by PV infrastructure and 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 Open *Tarconanthus - Senegalia* Thornveld 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 below.

Several SCC listed in Appendix F have distribution ranges which encompass the study area and habitat preferences for the characters exhibited on site. These species include: *Ardeotis kori* (Kori Bustard, NT), *Gyps africanus* (White-backed Vulture, CR), *Neotis ludwigii* (Ludwig's Bustard, EN), *Ardeotis kori* (Kori Bustard, NT), *Torgos tracheliotos* (Lappet-faced Vulture, EN), *Cursorius rufus* (Burchell's Courser, VU), *Polemeatus bellicosus* (Martial Eagle, EN), *Sagittarius serpentarius* (Secretarybird, VU), *Aquila rapax* (Tawny Eagle, EN), *Coracias garrulus* (European Roller) and *Falco biarmicus* (Lanner Falcon). Of these SCC, *Ardeotis kori* (Kori Bustard, NT) (observed within the study area during the site visit) and *Neotis ludwigii* (Ludwig's Bustard, EN) are anticipated to forage and may breed within the *Tarconanthus - Senegalia* Thornveld. Furthermore, no SCC are anticipated to utilize the Transformed Habitat on a permanent basis.

Due to the habitat units associated with the study area the likelihood for avifaunal SCCs occurring within the study area is deemed to be medium to high due to the presence of natural portions of *Tarconanthus - Senegalia* Thornveld. Should the nests of any avifaunal SCC as listed above and in Appendix F 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 have a medium to high probability of occurring within the study area due to suitable habitat.

SCIENTIFIC AND COMMON NAME	HABITAT DESCRIPTION	REGIONAL STATUS	POC (%)
Ardeotis kori (Kori Bustard)	**Range**: In the region in occurs in Angola, Zimbabwe and South Africa, mostly in flat open arid country in grassland, bushveld, thornveld, scrubveld and savanna. South African Endemic. Ranging between Mbombela in Limpopo to Cradock in Eastern Cape and southern portion of the Northern Cape. **Major habitats**: Savanna, Grassland and Desert. **Description**: Inhabits mostly flat, arid, mostly open country (grassland, bushveld, thornveld, scrubland and savanna). **Food:** Omnivorous. Feeds on insects, small reptiles, birds, mammals and a variety of plant matter. **Available habitat with the Subject Property:** Entire study area	NT	Confirmed
Neotis ludwigii (Ludwig's Bustard)	**Range**: Near endemic to the regions occurring in the more arid regions of South Africa, Namibia and the Southern edge of Angola. **Major habitats**: Savanna, shrubland, Grassland, rocky areas (inland cliffs and mountains) and desert. **Description**: Inhabits mostly flat, semi-arid, open country in the Succulent Karoo, Nama Karoo and Namib. **Food:** Insects, small vertebrates and vegetable matter. **Available habitat with the Subject Property:** Entire study area	EN	H
Cursorius rufus (Burchell's Courser).	**Range**: Near endemic to the regions occurring in South Africa, Namibia and the Southern edge of Angola. **Major habitats**: Shrubland, grassland inland wetlands and desert. **Description**: A nomadic species with little known about its movement. Often utilizes open short sward grassland, dry savannas overgrazed or burnt grasslands or pastures, bare or sparsely vegetated sandy or gravelly deserts. **Food:** Insects (mainly termites) and occasionally seeds. **Available habitat with the Subject Property:** Entire study area	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
Polemeatus bellicosus (Martial Eagle)	**Range**: This species has a wide distribution from the Sahel south. Only avoiding dense forest. **Major habitats**: Savanna, Shrubland, Grassland and inland wetlands with expansion into the karoo. **Description**: This large raptor primarily is restricted to protected areas but in the region often utilized electricity pylons to nest in. Occurs within a range of habitat within Africa besides true dessert. **Food:** Small mammals. **Available habitat with the Subject Property:** Entire study area.	EN	M
Coracias garrulus (European Roller)	**Range**: Non-breeding migrant ranging from Morocco to south western and central Europe with its non-breeding range within Africa. **Major habitats**: Forest, grassland, shrubland and savanna. May utilise agricultural fields. **Description**: Perch hunter preferring a prominent point from which it can see prey. **Food:** Feeds primarily on invertebrates.	NT	M

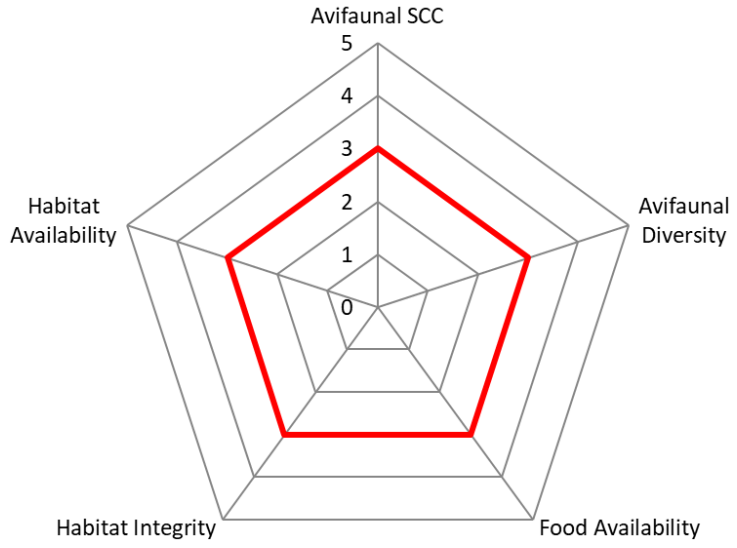
SCIENTIFIC AND COMMON NAME	HABITAT DESCRIPTION	REGIONAL STATUS	POC (%)
	Available habitat with the focus area: Entire study area.		
Aquila rapax (Tawny Eagle)	**Range**: These species prefers Savanna habitat and occurs in large portions of sub-Saharan Africa with small disjunct populations in Morocco and Algeria. A further population occurs India. **Major habitats**: Shrubland, savanna, open forest and grassland. May utilise agricultural fields. **Description**: Perch hunter preferring a prominent point from which it can see prey, or soars low over territory.. **Food:** Feeds on small mammals (up to the size of a small antelope), birds, reptiles, frogs, fish and insects, carcasses and kleptoparasites other eagles and storks **Available habitat with the focus area:** Entire study area.	**EN**	**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
Transformed Habitat		**Low Sensitivity** Conservation Objective for areas of Low Sensitivity: Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	This habitat has been previously transformed and is deemed to be of low sensitivity for avifauna due to the 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.
***Tarconanthus - Senegalia* Thornveld and Watercourse 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 remain in a natural state but are fragmented and exposed to edge effects. From an avifaunal perspective it is likely that mostly common species who have broad habitat requirement are likely to utilise this unit for breeding though most avifauna, including SCC, within the vicinity will forage here. The relatively homogenous structure and composition and the dense nature of the vegetation reduces its appeal to SCC who will readily favor neighboring more open habitats. *Ardeotis kori* (Kori Bustard) was noted within this habitat unit. 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.

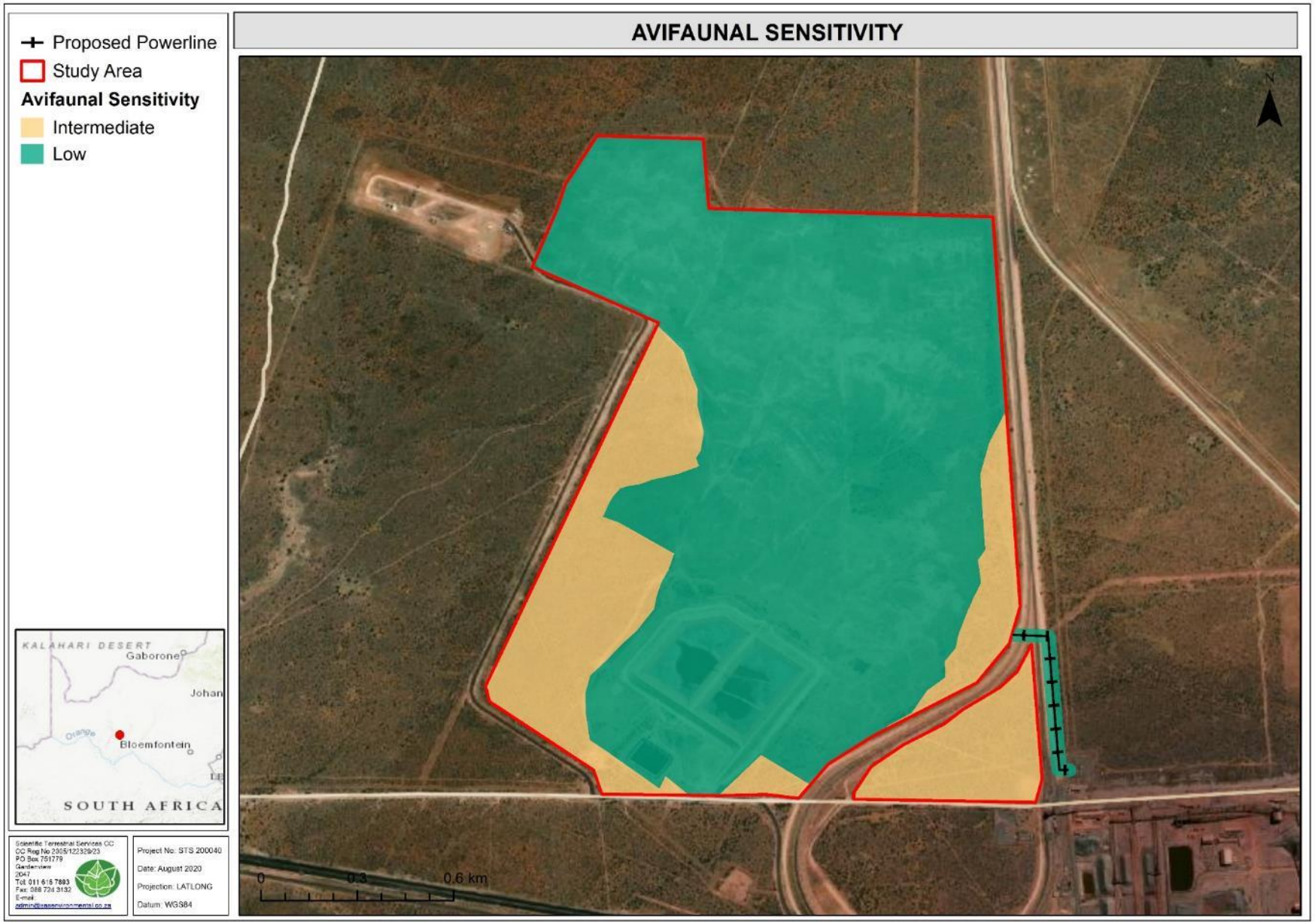


Figure 7: Avifaunal sensitivity map of the northern portion of the study area.

6. IMPACT ASSESSMENT

The sections below provide the significance of perceived impacts arising from the proposed PV facility development and associated powerline on the habitat units within 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. As no layout was provided no activity description can be provided. Anticipated infrastructure may include: PV panels, a main substation, additional buildings and the battery storage area, pipelines running between the Solar Panels, as well as a High-Voltage Line. The impact assessment scoring was undertaken assuming the entire study area would be developed. It is assumed by the ecologist that the Watercourse Habitat and its zone of regulation will not be developed within.

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 PV facility and 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
- Inadequate layout optimisation, resulting in extensive site clearing and the removal of indigenous vegetation beyond the development footprint. - **Impact:** Loss of important avifaunal habitat and the potential loss of avifaunal SCC.

ACTIVITIES AND ASPECTS REGISTER
- 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.
- 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.
- 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.
- Poorly implemented and monitored AIP Management programme leading to the reintroduction and proliferation of AIP species into the surrounding landscape. - **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[4], 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 implemented. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

As no specific layout was provided at the time of the assessment it is considered that the entire study area will be developed, however, it is assumed that no development will occur within the watercourse habitat or the conservation buffer area as proposed by the freshwater ecologist (SAS 202147, 2021). The impact assessment considers the impact on habitat as opposed to specific activities. The following activities are anticipated to occur from the proposed development:

- PV Panels;
- 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																
Transformed Habitat	3	1	2	3	3	4	8	32 Low	2	1	1	3	2	3	6	18 Very low
Tarconanthus - Senegalia Thornveld	4	3	3	2	3	7	8	56 Medium-low	3	3	2	2	2	6	6	36 Low
Watercourse Habitat	3	3	3	1	3	6	7	42 Low	3	3	2	1	2	6	5	30 Low
Species of Conservation Concern																
Transformed Habitat	3	1	2	3	3	4	8	32 Low	2	1	1	3	2	3	6	18 Very low
Tarconanthus - Senegalia Thornveld	4	3	3	2	3	7	8	56 Medium-low	3	3	2	2	2	6	6	36 Low
Watercourse Habitat	3	3	3	1	3	6	7	42 Low	3	3	2	1	2	6	5	30 Low

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

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
CONSTRUCTION PHASE																
Habitat and Diversity																
Transformed Habitat	3	1	2	3	3	4	8	32 Low	2	1	2	3	2	3	7	21 Very low
Tarconanthus - Senegalia Thornveld	4	3	4	2	3	7	9	63 Medium-low	3	3	3	2	2	6	7	42 Low
Watercourse Habitat	4	3	4	1	3	7	8	56 Medium-low	3	3	2	1	2	6	5	30 Low
Species of Conservation Concern																
Transformed Habitat	3	1	3	3	3	4	9	36 Low	2	1	2	3	2	3	7	21 Very low
Tarconanthus - Senegalia Thornveld	4	3	4	2	3	7	9	63 Medium-low	3	3	3	2	2	6	7	42 Low
Watercourse Habitat	3	3	4	1	3	6	8	48 Low	3	3	2	1	2	6	5	30 Low
OPERATIONAL AND MAINTENANCE PHASES																
Habitat and Diversity																
Transformed Habitat	3	1	3	3	5	4	11	44 Low	2	1	2	3	4	3	9	27 Low
Tarconanthus - Senegalia Thornveld	4	3	3	2	5	7	10	70 Medium low	3	3	3	2	4	6	9	54 Medium low
Watercourse Habitat	3	3	3	1	5	6	8	48 Low	3	3	2	1	4	6	7	42 Low
Species of Conservation Concern																
Transformed Habitat	3	1	3	3	5	4	11	44 Low	2	1	2	3	4	3	9	27 Low
Tarconanthus - Senegalia Thornveld	4	3	3	2	5	7	10	70 Medium low	3	3	3	2	4	6	9	54 Medium low
Watercourse Habitat	3	3	3	1	5	6	9	54 Medium-low	3	3	2	1	4	6	7	42 Low

6.3 Impact discussion

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

Construction and maintenance and operational phase impacts to the *Tarconanthus - Senegalia* Thornveld are expected to be the highest in their severity with unmitigated impacts

being of medium low impact significance. Impact mitigation is, however expected to reduce the severity of impacts to lower levels in most cases. Impacts to SCC largely reflect the impacts on habitat and diversity. Most of the proposed infrastructure will likely occur within the Transformed habitat (as this is the largest habitat unit associated with the study area) where recent earth moving activities have occurred, transforming the habitat to an extent where it no longer reflects the reference vegetation. This habitat offers poor resources for avifauna within the study area and comprises of a low diversity of avifauna. The watercourse and *Tarconanthus - Senegalia* Thornveld is exposed to a high degree of edge effects, located between linear infrastructure and the Transformed habitat reducing the habitat suitability for more shy and reclusive SCC sensitive to human disturbances.

6.3.1 Impact on avifaunal Diversity and Habitat

The *Tarconanthus - Senegalia* Thornveld and Watercourse Habitat portions of the study area have avoided any form of large-scale landscape transformation ensuring that a modest assemblage of avifauna, with a reduced abundance of large raptors, has been conserved. The large central portions of Transformed Habitat which were cleared in 2013/2014 offer a homogenous graminoid layer which was noted to have a poor diversity of avifauna. Avifaunal diversity within the study area ranges from intermediate to moderately 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 or species diversity 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 are confused for a waterbody. The major impact will result from the proposed PV facility which will result in the alteration of intact portions of the *Tarconanthus - Senegalia* Thornveld habitat. 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 (AIP proliferation, bush encroachment or human disturbances) may alter the local environment adjacent the proposed activities to an extent where it is no longer representative of the reference type, rendering it unsuitable for many SCC. Furthermore, an increase in vehicle movement in the area during maintenance phases will increase the likelihood of collisions with avifauna, although the vehicles are unlikely to be moving fast enough to be a significant risk to avifauna, 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

medium low and low prior to the implementation of mitigation measures and medium low to very low should mitigation be implemented thoroughly.

6.3.2 Impact on avifaunal SCC

Eight avifaunal SCC are anticipated to occur in the study area, either permanently for breeding or temporarily whilst for foraging. *Ardeotis kori* (Kori Bustard) was the only SCC observed during the field investigation. The remaining species include; *Neotis ludwigii* (Ludwig's Bustard), *Cursorius rufus* (Burchell's Courser), *Sagittarius serpentarius* (Secretarybird), *Falco biarmicus* (Lanner Falcon), *Polemeatus bellicosus* (Martial Eagle), *Coracias garrulus* (European Roller) and *Aquila rapax* (Tawny Eagle). Development within the *Tarconanthus - Senegalia* Thornveld, Watercourse habitat and Transformed habitat will lead to vegetation clearance and the loss of foraging habitat for these species.

Based on the habitat and characteristics of the study area observed during the field investigation, it is considered that the *Tarconanthus - Senegalia* Thornveld provides suitable breeding habitat for two SCC. The majority of the habitat has been transformed and the remaining natural vegetation occurs between Transformed habitat and road, rail and existing overhead infrastructure which are expected to reduce the suitability for breeding of secretive and shy SCC (particularly *Ardeotis kori* (Kori Bustard) and *Neotis ludwigii* (Ludwig's Bustard)). These two species are more likely to breed within adjacent habitat where human disturbance is less, beyond the boundaries of the study area. Should favourable environmental conditions occur, e.g. locust outbreaks or hunting opportunities present themselves the abovementioned SCC may utilise the Transformed, Watercourse and *Tarconanthus - Senegalia* Thornveld habitat for foraging purposes on an adhoc basis.

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 medium low to low significance for the study area during the construction and operational phases, prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact significance to the ecology 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 due to the long term nature of the proposed development.

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;
- Potential 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 habitat characteristics and the current human activities associated with the Kolomela Mine, it is unlikely that the study area location plays an important role in supporting SCC populations. A large portion of the study area has been transformed reducing its suitability for SCC. However, as some areas within the study area have escaped transformation, suitable areas for SCC habitation do exist within the study 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. 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 Department of Environment, Forestry and Fisheries (DFFE) or the Northern Cape Department of Environmental Affairs and Nature Conservation (NCEA) prior to construction; - Minimise loss of indigenous vegetation where possible by implementing construction methods to limit disturbance to the natural *Tarconanthus - Senegalia* Thornveld habitat; - No infrastructure may be planned within the watercourse habitat. This habitat should be avoided; - 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; 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; - 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 5 m apart and alternate between a light and dark colour in order to increase the visibility of the earth wires; - 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; - 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 avifaunal species protected under the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) or the Northern Cape Nature Conservation Act, 1998 (Act No. 10 of 1998) or their nests be encountered, construction should be halted and authorisation to relocate such species must be obtained from NCEA or DFFE; 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; - 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 (DFFE) and further mitigation measures should be investigated as to how to minimise the mortalities; - 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 NCEA or DFFE. 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

STS was appointed to conduct an Avifaunal Assessment as part of the EIA process for the proposed Solar PV Project associated with the Kolomela Mine, near Postmasburg, Northern Cape Province. The project is associated with both linear developments (Main Pipelines and a High-Voltage Line), as well as surface infrastructure.

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 medium low to low, prior to the implementation of mitigation measures. With mitigation, impacts from the proposed development are anticipated to be reduced to medium low and very low significance levels. The major impact anticipated to occur is the alteration of *Tarconanthus-Senegalia* Thornveld which has the potential to host several SCC such as *Ardeotis kori* (Kori Bustard) that was observed during the site visit. Further impacts that may result from the proposed project are collisions and electrocutions resulting from the proposed PV facilities and their associated powerlines. It is anticipated that should the proposed mitigation measures be implemented the risk of collisions and electrocutions can be reduced. As the proposed activities occur within an area which is surrounded, beyond the current mining activities, by natural areas with high integrity 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

The Constitution of the Republic of South Africa, 1996

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

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)

The National Environmental Management Act (NEMA; Act 107 of 1998) and the associated Environmental Impact Assessment (EIA) Regulations (GN R326 as amended in 2017 and well as listing notices 1, 2 and 3 (GN R327, R325 and R324 of 2017)), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, an environmental authorisation process needs to be followed. 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, 2004 (Act No. 10 of 2004) (NEMBA)

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

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

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

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

Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)

Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of 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'[5]. 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[6].

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.

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

[6] 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[7] 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.

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

APPENDIX D: Vegetation Type

SVk 14 Postmasburg Thornveld

Dominant and typical floristic species of Postmasburg Thornveld (Mucina & Rutherford, 2012). The table contains the important taxa associated with the vegetation type.

Woody Layer	
Tall Tree	*Vachellia erioloba* (d).
Small Trees	*Vachellia karroo* (d), *Vachellia tortilis* subsp. *heteracantha* (d), *Searsia lancea* (d), *Ziziphus mucronata* (d).
Tall Shrubs	*Searsia tridactyla* (d), *Diospyros lycioides* subsp. *lycioides*, *Ehretia rigida* subsp. *rigida*, *Grewia flava*, *Tarchonanthus camphoratus*.
Low Shrubs	*Vachellia hebeclada* subsp. *hebeclada* (d), *Felicia muricata*, *Gomphocarpus fruticosus* subsp. *fruticosus*, *Lantana rugosa*, *Melolobium microphyllum*, *Chaenostoma halimifolia* (formerly *Sutera halimifolia*).
Succulent Shrubs	*Kalanchoe rotundifolia*, *Lycium cinereum*
Forb layer	
Herbs	*Dicoma anomala*, *Geigeria filifolia*, *Geigeria ornativa*, *Hibiscus pusillus*, *Jamesbrittenia aurantiaca*, *Selago densiflora*, *Osteospermum scariosum* (formerly *Tripteris aghillana*)
Geophytic Herb	*Boophone disticha*
Grass layer	
Graminoids	*Digitaria eriantha* subsp. *eriantha* (d), *Enneapogon scoparius* (d), *Eragrostis lehmanniana* (d), *Aristida adscensionis*, *Aristida congesta*, *Aristida diffusa*, *Eragrostis superba*, *Heteropogon contortus*, *Melinis repens*, *Schmidtia pappophoroides*, *Stipagrostis uniplumis*
Biogeographically Important Taxon (Griqualand West endemics)	
Succulent Shrub	*Euphorbia bergii*.
Graminoid	*Digitaria polyphylla*

(d) = dominant species
(The genus for all *Senegalia* and *Vachellia* spp. were formerly *Acacia,* and the genus for all *Searsia spp* was formerly *Rhus*)

Additional Remarks: In contrast to eastern parts of the unit, *Tarchonanthus camphoratus* is conspicuously absent in the western parts.

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	NCNCA (2009)
Streptopelia capicola	Cape turtledove	LC	Protected species
Pycnonotus nigricans	Red-eyed Bulbul	LC	NA
Sylvietta rufescens	Long-billed crombec	LC	
Ardeotis kori	Kori Bustard	NT	
Pterocles Namaqua	Namaqua Sandgrouse		
Columba guinea	Speckled pigeon	LC	Protected
Melierax canorus	Pale-chanting Goshawk		
Rhinoptilus africanus	Double-banded Courser		
Cisticola aridulus	Desert Cisticola		
Uraeginthus granatinus	Violet eared waxbill	LC	Protected
Urocolies indicus	Red-faced Mousebird	LC	NA
Colies	White-backed Mousebird	LC	N/A
Ploceus velatus	Southern masked weaver	LC	NA
Laniarius astrococcineus	Crimson-breasted shrike	LC	Protected
Lanius collaris	Common Fiscal		
Sylvietta rufescens	Long-billed crombec	LC	Protected
Upupa africana	African Hoopoe	LC	Protected
Myrmecocichla formicivora	Ant-eating Chat		
Spilopelia senegalensis	Laughing Dove	LC	Protected
Sylvia subcaerulea	Chestnut-vented tit-babbler	LC	Protected
Philetairus socius	Sociable Weaver		
Calendulauda sabota	Sabota Lark	LC	Protected
Prinia masulosa	Karoo Prinia	LC	Protected
Emberiza impetuani	Lark-like Bunting	LC	Protected
Plocepasser mahali	White-browed Sprrow-Weaver		
Tricholaema leucomelas	Acacia Pied Barbet	LC	Protected
Serinus flaviventris	Yellow Canary	LC	Protected
Quelea	Red-billed Quelea	LC	N/A
Plocepasser mahali	White-browed Sparrow-weaver	LC	Protected
Crithagra albogularis	White-throated Canary	LC	Protected
Crithagra atrogularis	Black-throated Canary	LC	Protected
Passer melanurus	Cape Sparrow	LC	NA
Sporopipes squamifrons	Scaly-feathered Weaver	LC	Protected
Onychognathus nabouroup	Pale Winged Starling	LC	Protected
Saxicola torquata	African Stonechat	LC	Protected
Anthus cinnamomeus	African Pipit	LC	Protected
Sigelus silens	Fiscal Flycatcher	LC	Protected
Erythropygia paena	Kalahari scrub Robin	LC	Protected

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 Northern Cape Province

Table F1: TOPS list of faunal species (2015) expected to occur within the Northern Cape.

Scientific Name	Common Name	Threat Status
Neophron percnopterus	Egyptian Vulture	CR
Aquila rapax	Tawny Eagle	EN
Torgos tracheliotos	Lappet-faced Vulture	EN
Gyps africanus	White-backed Vulture	CR
Gyps coprotheres	Cape Vulture	EN
Neotis ludwigii	Ludwig's Bustard	EN
Polemaetus bellicosus	Martial Eagle	EN
Terathopius ecaudatus	Bateleur	EN
Anthropoides paradiseus	Blue Crane	P
Ardeotis kori	Kori Bustard	P

VU = Vulnerable, NT = Near Threatened, LC = Least Concern NYBA = Not Yet Been Assessed = Threatened at a provincial level, Highlighted species may occur within the focus area.

South African Bird Atlas Project 2 list

Table F2: Avifaunal Species for the pentads 2820_2255 within the QDS 2822BB.

Pentads	Link to pentad summary on the South African Bird Atlas Project 2 web page
2820_2255	http://sabap2.birdmap.africa/coverage/pentad/2820_2255

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		

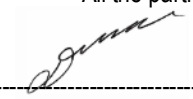
Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Daryl van Der Merwe		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Cell:	0780201 0069
Telephone:	011 616 7893	Fax:	086 724 3132
E-mail:	Daryl@sasenvgroup.co.za		
Qualifications	MSc (Conservation Biology)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

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