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SITE SENSITIVITY VERIFICATION AND AGRICULTURAL COMPLIANCE STATEMENT FOR THE PROPOSED BOSHOEK SOLAR 1 SOLAR ENERGY FACILITY AND GRID CONNECTION INFRASTRUCTURE NEAR RUSTENBURG, NORTH WEST PROVINCE

Report by
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EXECUTIVE SUMMARY

South Africa urgently needs electricity generation, and renewable energy offers good potential for that, but requires land. Agriculturally zoned land will inevitably need to be used for the renewable energy generation that the country requires. However, to ensure food security, energy facilities should be located where they will not exclude viable, future crop production from land.

The overall conclusion of this assessment is that the proposed development is acceptable because it can provide benefits to agriculture but leads to no loss of potential cropland and therefore minimal loss of future agricultural production potential.

The farm is in an area where only grazing (game and boerbokke) and limited irrigation are practised. Satellite imagery shows no rain-fed cropping in the area, only lands where bush is cleared to improve grazing. The climate is classified as arid and therefore limiting to rain-fed cropping. The mean annual rainfall versus evaporation and the seasonal distribution of rainfall in the area means that there is an insufficient moisture reservoir to carry a crop through the season. Some irrigation is practised in the area on sites closer to the river, but the amount of irrigation water is very limited. There has never been irrigation on the particular farm. The agricultural potential of the site is therefore limited, predominantly by climate, to being suitable only as grazing land.

An agricultural impact is a change to the future agricultural production potential of land. This is primarily caused by the exclusion of agriculture from the footprint of a development. In this case, the entire proposed PV area is considered to be below the threshold for needing to be conserved as agricultural production land because of the limitations on its cropping potential. The production potential of the land is limited to only being suitable as grazing land, and there is no particular scarcity of such land in the country, in contrast to arable land, which is very scarce. The use of this land for solar power generation will cause minimal loss of agricultural production potential in terms of national food security.

Furthermore, the land occupied by PV panels can be used for the dual purposes of solar power generation and agricultural food production by way of sheep grazing. This has potential benefits for both activities and means that the land remains agriculturally productive. The benefit for sheep farming is that the security infrastructure of the solar facility will protect the sheep within it against stock theft. The benefit for the solar facility is that the sheep will control the height of the vegetation below the solar panels thus reducing the need to mechanically control the height of vegetation.

At the farm level, the development will provide a positive economic impact. This is likely to increase cash flow and financial security and may improve farming operations and productivity on other parts of the farm or properties owned by the same farmer, through increased investment into farming.

Due to the facts that the energy facility will not occupy scarce, viable cropland, that the land can potentially still be used to graze sheep, and that its negative impact is offset by economic benefits to farming, the overall negative agricultural impact of the development (loss of future agricultural production potential) is assessed here as being of low significance and as acceptable.

With regards to the agricultural impacts of the proposed overhead power line, it will result in negligible loss of future agricultural production potential and its agricultural impact is therefore assessed as being of very low significance.

The development's acceptability is further substantiated by the following points:

- The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy.
- In addition, the proposed development will contribute to the country's urgent need for energy generation, particularly renewable energy that has much lower environmental and agricultural impact than existing, coal powered energy generation.
- All renewable energy development in South Africa decreases the need for coal power and thereby contributes to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land throughout the coal mining areas of the country.

From an agricultural impact point of view, it is recommended that the proposed development be approved.

1 INTRODUCTION

Environmental and change of land use authorisation is being sought for the proposed Boshoek Solar 1 solar energy facility and grid connection infrastructure near Rustenburg, North West Province (see location in figure 1). In terms of the National Environmental Management Act (Act No 107 of 1998 - NEMA), an application for environmental authorisation requires an agricultural assessment. In this case, based on the verified medium agricultural sensitivity of the proposed development area (see Section 7), the level of agricultural assessment required is an Agricultural Compliance Statement.

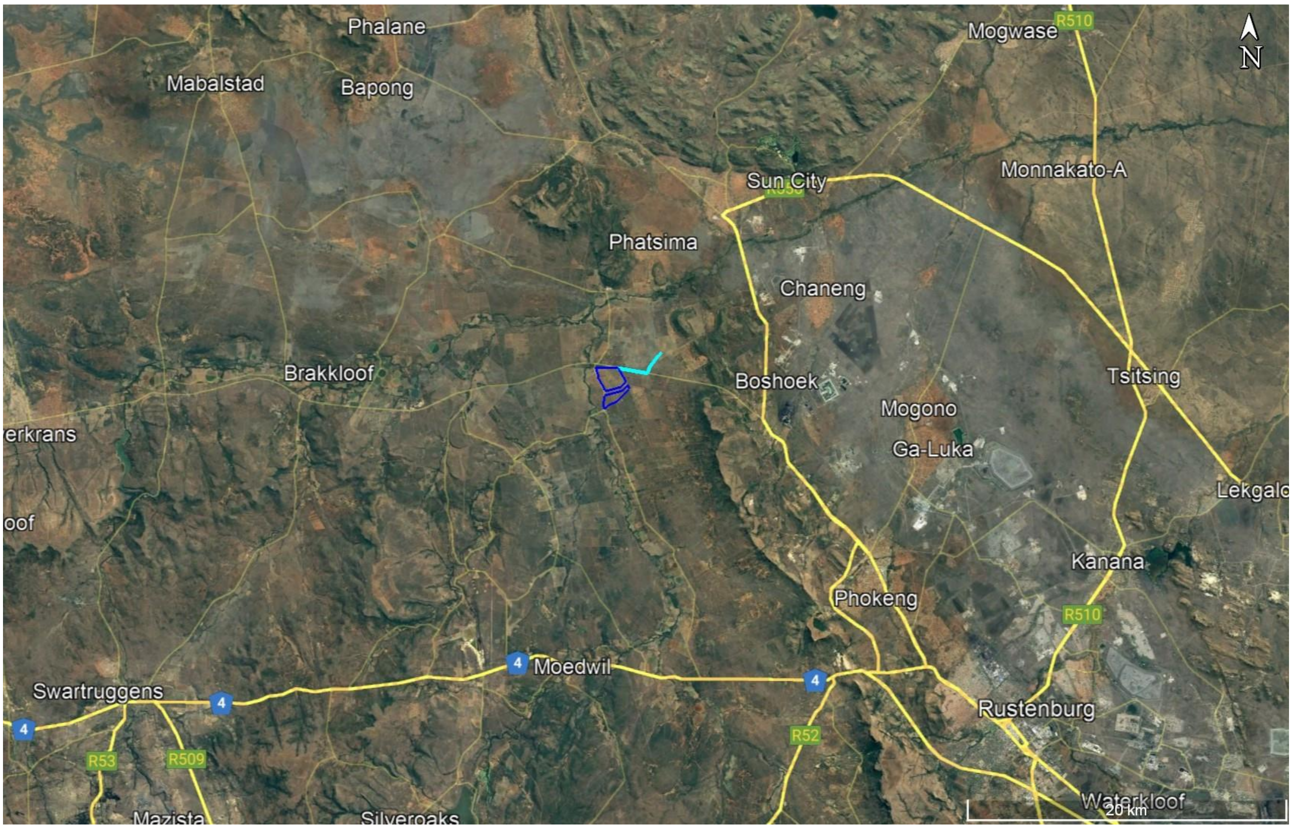

Figure 1. *Locality map of the development north-west of the town of Rustenburg.*

The purpose of an agricultural assessment is to answer the question:

> Will the proposed development cause a significant reduction in agricultural production potential, and most importantly, will it result in a loss of arable land?

Section 9 of this report unpacks this question, particularly with respect to what constitutes a significant reduction. To answer the above question it is necessary to determine the existing agricultural production potential of the land that will be impacted, and specifically whether it is viable arable land or not. This is done in Section 8 of this report. Section 8, 9, and the conclusion of this report directly address the above question and therefore contain the essence of the agricultural impact assessment.

As is shown in Section 9, this assessed development will not result in any loss of viable arable land and therefore poses minimal threat to agricultural production potential.

2 PROJECT DESCRIPTION

The exact nature and layout of the different infrastructure within the boundary fence of a solar energy facility has absolutely no bearing on the significance of agricultural impacts. All that is of relevance is simply the total footprint of the facility that excludes agricultural land use or impacts agricultural land, referred to as the agricultural footprint. This is the area within the facility fence. Whether that footprint comprises, for example, a solar array, a road or a BESS is irrelevant to agricultural impact. The total proposed development area, as shown in Figures 2 and 3, is 269 hectares. Due to the negligible agricultural impact of a power line, the power line corridor is not considered to be part of the agricultural footprint, in keeping with NEMA's agricultural protocol.

Although the specifics of the project design are irrelevant to agricultural impact, the project description is included below for completeness.

Boshoek Solar 1 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province.

The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW. The development area is situated approximately 33 km north west of Rustenburg within the Rustenburg Local Municipality and the Bojanala District Municipality, in the North West Province.

The development area for the PV facility and associated infrastructure will be located on the following properties:

Farm Name	Farm No.	Portion No.
Boshoek Solar 1 PV Facility		
Farm Rhenosterdoorns	531	0
Farm Zwaarverdiend	234	1
Boshoek Solar 1 PV Grid Connection		
Zwaarverdiend 234 JP	234	18
Paul Bodenstein Landgoed 571 JG	571	RE
Elandsfontein 102 JG	102	1
Onderstepoort 98 JG	98	RE

The project is planned as part of a larger cluster, which includes two additional PV facilities (Boshoek Solar 2 and Boshoek Solar 3) up to 150 MW and 50 MW respectively.

An assessment area of approximately 290 ha is being assessed as part of this EIA process and the infrastructure associated with the 150 MW facility includes:

- PV modules (mono- or bifacial) and mounting structures;
- Inverters and transformers;
- Battery Energy Storage System (BESS);
- Site access road;
- Internal access roads;
- Auxiliary buildings (switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Temporary and permanent laydown area; and
- Grid connection infrastructure, including:
- Underground medium-voltage cabling between the project components and the facility substation;
- Up to 132kV facility substation;
- Switching station;
- A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.

3 TERMS OF REFERENCE

The terms of reference for this study is to fulfill the requirements of the *Protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources by onshore wind and/or solar photovoltaic energy generation facilities where the electricity output is 20 megawatts or more*, gazetted on 20 March 2020 in GN 320 (in terms of Sections 24(5)(A) and (H) and 44 of NEMA, 1998).

The terms of reference for an Agricultural Compliance Statement, as stipulated in the agricultural protocol, are listed below, and the section number of this report which fulfils each stipulation is given after it in brackets.

1. The Agricultural Compliance Statement must be prepared by a soil scientist or agricultural specialist registered with the South African Council for Natural Scientific Professions (SACNASP) **(Appendix 3)**.
2. The compliance statement must:
    1. be applicable to the preferred site and proposed development footprint **(Figures 2 and**

    3);
  2. confirm that the site is of “low” or “medium” sensitivity for agriculture **(Section 7)**; and
  3. indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site **(Section 10)**.
3. The Agricultural Compliance Statement must contain, as a minimum, the following information:
  1. details and relevant experience as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the statement including a curriculum vitae **(Appendix 1)**;
  2. a signed statement of independence by the specialist **(Appendix 2)**;
  3. a map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool **(Figure 2)**;
  4. calculations of the physical development footprint area for each land parcel as well as the total physical development footprint area of the proposed development including supporting infrastructure **(Section 9.4)**;
  5. confirmation that the development footprint is in line with the allowable development limits contained in Table 1 of the protocol **(Section 9.4)**;
  6. confirmation from the specialist that all reasonable measures have been taken through micro-siting to avoid or minimize fragmentation and disturbance of agricultural activities **(Section 9.6)**;
  7. a substantiated statement from the soil scientist or agricultural specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not of the proposed development **(Section 10)**;
  8. any conditions to which this statement is subjected **(Section 10)**;
  9. in the case of a linear activity, confirmation from the agricultural specialist or soil scientist, that in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase **(Section 9.7)**;
  10. where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr **(Section 9.3)**; and
  11. a description of the assumptions made and any uncertainties or gaps in knowledge or data **(Section 5)**.

4 METHODOLOGY OF STUDY

The assessment was based on an on-site investigation of the soils and agricultural conditions and was also informed by existing climate, soil and agricultural potential data for the site (see references). The aim of the on-site assessment was to:

1. ground-truth cropland status and consequent agricultural sensitivity;
2. gain an understanding of overall agricultural production potential across the site.

The site investigation was conducted on 27 July 2023. An interview was also conducted with the farmer for information on farming practices on the site. Soils were assessed based on the investigation of existing soil exposures in combination with indications of the surface conditions and topography, and strategically positioned auger samples where necessary. Soils were classified according to the South African soil classification system (Soil Classification Working Group, 1991).

An assessment of soils and long-term agricultural potential is in no way affected by the season in which the assessment is made, and therefore the fact that the assessment was done in winter has no bearing on its results. The level of agricultural assessment is considered entirely adequate for an understanding of on-site agricultural production potential for the purposes of this assessment.

5 ASSUMPTIONS, UNCERTAINTIES OR GAPS IN KNOWLEDGE OR DATA

There are no specific assumptions, uncertainties or gaps in knowledge or data that affect the findings of this study.

6 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

This section identifies all applicable legislation and permit requirements over and above what is required in terms of NEMA.

The development requires approval from the National Department of Agriculture, Land Reform and Rural Development (DALRRD) because it is on agriculturally zoned land. This approval is separate to the Environmental Authorisation. There are two approvals that apply. The first is a No Objection Letter for the change in land use. This letter is one of the requirements for receiving municipal rezoning. This application requires a motivation backed by good evidence that the development is acceptable in terms of its impact on the agricultural production potential of the development site. This agricultural assessment report will serve that purpose.

The second approval is a consent for long-term lease required in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA). SALA approval is not required if the lease is over the entire farm portion. If DALRRD approval for the development has already been obtained in the form of the No Objection letter, then SALA approval is likely to be readily forthcoming. SALA approval can only be applied for once the Municipal Rezoning Certificate and Environmental Authorisation has been obtained.

Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural

Resources Act (Act 43 of 1983 - CARA). A consent in terms of CARA is required for the cultivation of virgin land. Cultivation is defined in CARA as "any act by means of which the topsoil is disturbed mechanically". The purpose of this consent for the cultivation of virgin land is to ensure that only land that is suitable as arable land is cultivated. Therefore, despite the above definition of cultivation, disturbance to the topsoil that results from construction of infrastructure does not constitute cultivation as it is understood in CARA. This has been corroborated by Anneliza Collett (Acting Scientific Manager: Natural Resources Inventories and Assessments in the Directorate: Land and Soil Management of the Department of Agriculture, Land Reform and Rural Development (DALRRD)). The construction and operation of the facility will therefore not require consent from the Department of Agriculture, Land Reform and Rural Development in terms of this provision of CARA.

Power lines require the registration of a servitude for each farm portion crossed. In terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA), the registration of a power line servitude requires written consent of the Minister unless either of the following two conditions apply:

- if the servitude width does not exceed 15 metres; and
- if Eskom is the applicant for the servitude.

If one or both conditions apply, then no agricultural consent is required. The second condition is likely to apply, even if another entity gets Environmental Authorisation for and constructs the power line, but then hands it over to Eskom for its operation. Eskom is currently exempt from agricultural consent for power line servitudes.

7 SITE SENSITIVITY VERIFICATION

A specialist agricultural assessment is required to verify the agricultural sensitivity of the development site as per the sensitivity categories used by the DFFE's web-based environmental screening tool. However, such an exercise is of very limited value once the agricultural assessment, which supersedes any screening tool result, has been done. What is of much more importance to this assessment than the site sensitivity verification, is its assessment of the cropping potential (see Section 8) and its assessment of the impact significance (see Section 9).

The screening tool classifies agricultural sensitivity according to two independent criteria, from two independent data sets, both of which may be indicators of the land's agricultural production potential but are limited in that the first is outdated and the second relies on fairly course data. The two criteria are:

1. whether the land is classified as cropland or not on the field crop boundary data set, and
2. its land capability rating on the land capability data set

All classified cropland is by definition either high or very high sensitivity. Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rain-fed agricultural production. It is rated by the Department of Agriculture's updated and refined, country-wide land capability mapping, released in 2016. The higher land capability values (≥8 to 15) are likely to indicate suitability as arable land for crop production, while lower values (<8) are only likely to be suitable as non-arable grazing land. The direct relationship between land capability rating and the screening tool's agricultural sensitivity is shown in Table 1.

Table 1: Relationship between land capability and agricultural sensitivity as given by the screening tool.

Land capability value	Agricultural sensitivity
1 - 5	low
6 - 8	medium
9 - 10	high
11 - 15	very high

The agricultural sensitivity of the site, as given by the screening tool, is shown in Figure 2.

The screening tool classifies the proposed PV development area as ranging from medium to high agricultural sensitivity. None of the land is classified as cropland and the rating of agricultural sensitivity is therefore purely a function of classified land capability as per Table 1 above. The high sensitivity classification is due to that land being classified with a land capability of 9 and 10.

The classified land capability of the site ranges from 7 to 10. This assessment disputes the classified land capability, based on the assessment in this report that the site is unsuitable for viable rain-fed crop production (see following section). The appropriate land capability of land that is unsuitable for viable rain-fed crop production is ≤7 because the relationship between land capability and agricultural production potential is such that a land capability of >7 should denote land that is suitable for viable rain-fed crop production. This assessment therefore disputes the high sensitivity rating by the screening tool that is based on a classified land capability of 9 and 10 and rates the entire proposed PV development area as being of medium agricultural sensitivity with a maximum land capability of 7.

Note that the screening tool sensitivity of a power line corridor has very little relevance to the assessment of its agricultural impact because the impact is likely to be negligible (see Section 9), regardless of the agricultural sensitivity of the land which it crosses.

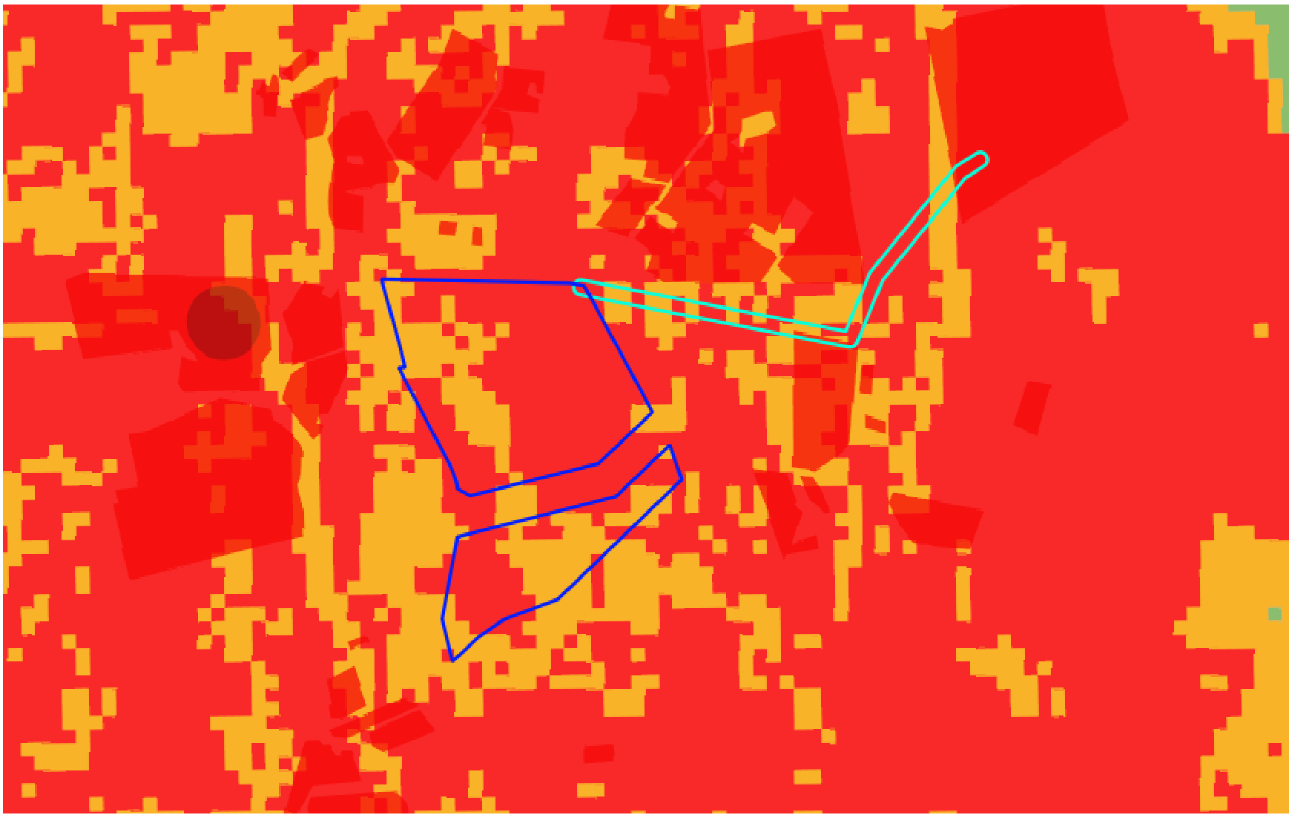

Figure 2. *The proposed PV development area (dark blue outline) and the power line corridor (light blue outline) overlaid on agricultural sensitivity, as given by the screening tool (green = low; yellow = medium; red = high; dark red = very high). The screening tool's high sensitivity is disputed by this assessment, which rates the entire proposed PV development area as being of medium agricultural sensitivity. Note that the agricultural sensitivity of the power line corridor is largely irrelevant to agricultural impact.*

8 BASELINE DESCRIPTION OF THE AGRO-ECOSYSTEM

The purpose of this section of an agricultural assessment report is to present the baseline information that controls the agricultural production potential of the site so that an assessment of that potential can be made. Agricultural production potential, and particularly cropping potential is one of three factors that determines the significance of the agricultural impact, together with size of footprint and duration of impact (see Section 9).

All important parameters that control the agricultural production potential of the site are given in Table 2. The land type soil data is given in Appendix 4. A satellite image map of the development site is given in Figure 3 and photographs of site conditions are shown in Figures 4 to 6.

The site falls within an area that is classified as a Protected Agricultural Area. A Protected Agricultural Area is a demarcated area in which the climate, terrain, and soil are generally conducive for agricultural production and which, historically, has made important contributions to the production of the various crops that are grown across South Africa. Within Protected Agricultural Areas, the protection, particularly of arable land, is considered a priority for the protection of food security in South Africa. However, there may be much variation within a Protected Agricultural Area and all land within it is not necessarily of sufficient agricultural potential to be suitable for crop production, due to site-specific terrain, soil, and other constraints. All land within a Protected Agricultural Area is therefore not necessarily worthy of prioritised protection as agricultural production land. The proposed facility avoids all viable cropland areas and only utilises areas that are not suitable for cropland.

8.1 Assessment of the agricultural production potential

This assessment of the agricultural production potential of the site is based on an integration of the different parameters in Table 2 above and the on-site investigation.

The farm is in an area where only grazing (game and boerbokke) and limited irrigation are practised. Satellite imagery shows no rain-fed cropping in the area, only lands where bush is cleared to improve grazing. The climate is classified as arid and therefore limiting to rain-fed cropping. The mean annual rainfall versus evaporation and the seasonal distribution of rainfall in the area means that there is an insufficient moisture reservoir to carry a crop through the season. Some irrigation is practised in the area on sites closer to the river, but the amount of irrigation water is very limited. There has never been irrigation on the particular farm. The agricultural potential of the site is therefore limited, predominantly by climate, to being suitable only as grazing land.

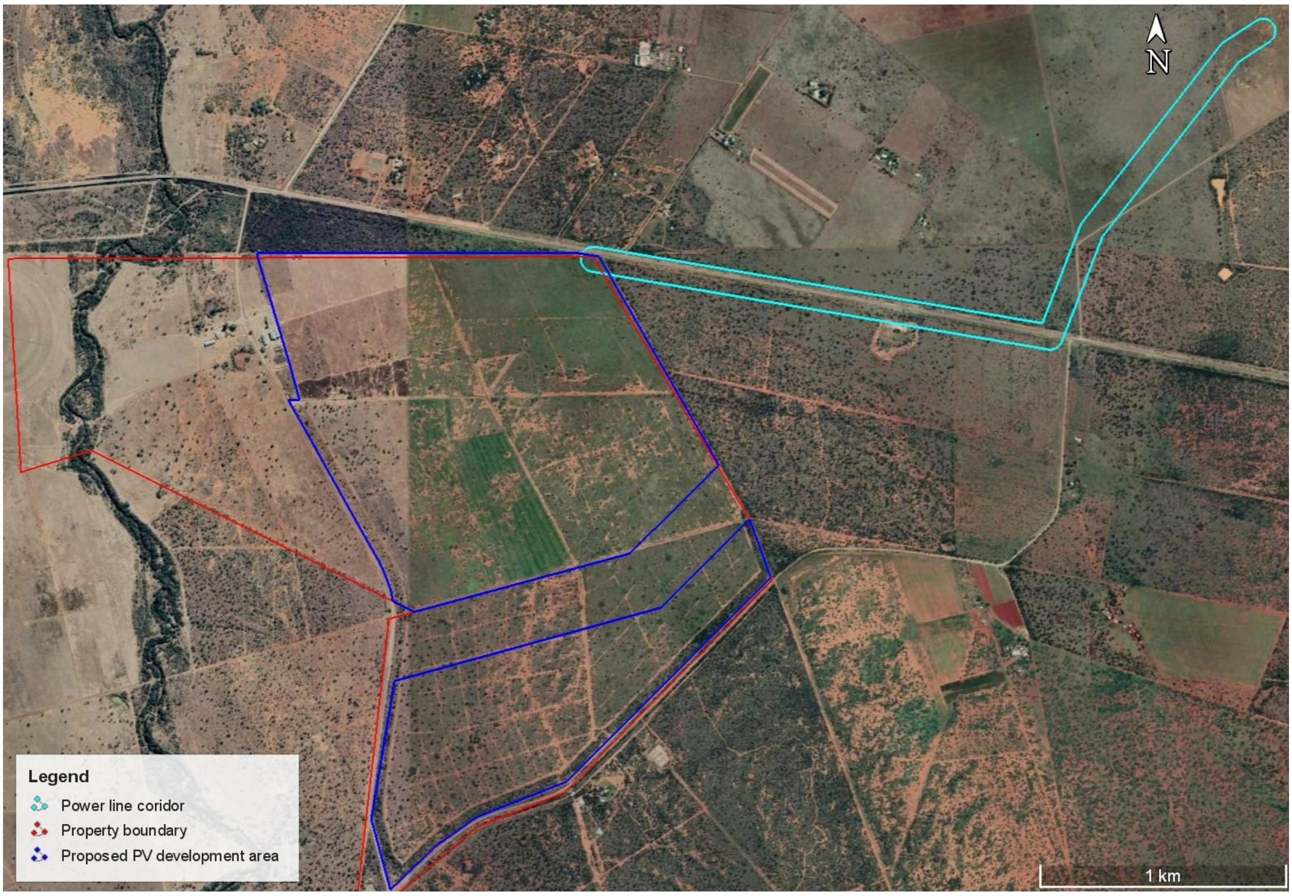

Figure 3. *Satellite image map of the proposed development.*


Figure 4. *Typical site conditions.*

Table 2: Parameters that control and/or describe the agricultural production potential of the site.

	Parameter	Value
Climate	Köppen-Geiger climate description (Beck *et al*, 2018)	Arid, steppe, hot
	Mean Annual Rainfall (mm) (Schulze, 2009)	535
	Reference Crop Evaporation Annual Total (mm) (Schulze, 2009)	1570
	Climate capability classification (out of 9) (DAFF, 2017)	5 (moderate)
Terrain	Terrain type	Flat plain between hills and river course
	Terrain morphological unit	Mid-slope to foot slope
	Slope gradients (%)	0 to 2
	Altitude (m)	1075
	Terrain capability classification (out of 9) (DAFF, 2017)	7 (high)
Soil	Geology (DAFF, 2002)	Predominantly slate and hornfels of the Silverton Formation; abundant diabase sills.
	Land type (DAFF, 2002)	Ea68
	Description of the soils	Shallow to deep, heavy textured, red, well-drained soils on underlying rock
	Dominant soil forms	Shortlands, Hutton
	Soil capability classification (out of 9) (DAFF, 2017)	5 (moderate) to 7 (high)
Land use	Agricultural land use in the surrounding area	Mostly grazing, with very limited centre pivot irrigation
	Agricultural land use on the PV footprint	Grazing only
General	Long-term grazing capacity (ha/LSU) (DAFF, 2018)	10 (very high)
	Land capability classification (out of 15) (DAFF, 2017)	7 (low-moderate) to 10 (moderate-high)
	Within Protected Agricultural Area (DALRRD, 2020)	Yes

Figure 5. *Typical site conditions.*

9 ASSESSMENT OF THE AGRICULTURAL IMPACT

9.1 Impact identification and assessment

It should be noted that an Agricultural Compliance Statement is not required to formally rate agricultural impacts by way of impact assessment tables.

An agricultural impact is a change to the future agricultural production potential of land. In most developments, including the one being assessed here, this is primarily caused by the exclusion of agriculture from the footprint of the development. Soil erosion and degradation may also contribute to loss of agricultural production potential. The significance of an agricultural impact is a direct function of the following three factors:

1. the size of the footprint of land from which agriculture will be excluded (or the footprint that will have its potential decreased)
2. the baseline production potential (particularly cropping potential) of that land
3. the length of time for which agriculture will be excluded (or for which potential will be decreased).

The most significant agricultural impact possible, ignoring the length of time component, is therefore a loss of a large area of high yielding cropland and the least significant impact is a loss of a small area of low carrying capacity grazing land.

Cropping potential is highlighted in factor 2, above, because the threshold, above which it is a priority to conserve land for agricultural production, is determined by the scarcity of arable crop production land in South Africa and the relative abundance of land that is only good enough to be used for grazing. If land can support viable and sustainable crop production, then it is considered to be above the threshold and is a priority for being conserved as agricultural production land. If land is unable to support viable and sustainable crop production, then it is considered to be below the threshold and of much lower priority for being conserved.

In this case, the entire proposed PV area is considered to be below the threshold for needing to be conserved as agricultural production land because of the limitations on its cropping potential, discussed in Section 8. The production potential of the land is limited to only being suitable as grazing land, and there is no particular scarcity of such land in the country, in contrast to arable land, which is very scarce. The use of this land for solar power generation will cause minimal loss of agricultural production potential in terms of national food security.

Furthermore, the land occupied by PV panels can be used for the dual purposes of solar power generation and agricultural food production by way of sheep grazing. This has potential benefits for both activities and means that the land remains agriculturally productive. The benefit for sheep farming is that the security infrastructure of the solar facility will protect the sheep within it against stock theft. The benefit for the solar facility is that the sheep will control the height of the vegetation below the solar panels thus reducing the need to mechanically control the height of vegetation.

At the farm level, the development will provide a positive economic impact. The income generated by the farming enterprises through the lease of the land to the energy facility is highly likely to exceed the potential agricultural income from the site. It will diversify the farm's income sources and provide reliable and predictable income that is independent of variable agricultural economic factors such as weather, agricultural markets and agricultural input costs. This is likely to increase cash flow and financial security and may improve farming operations and productivity on other parts of the farm or properties owned by the same farmer, through increased investment into farming.

Due to the facts that the energy facility will not occupy scarce, viable cropland, that the land can potentially still be used to graze sheep, and that its negative impact is offset by economic benefits to farming, the overall negative agricultural impact of the development (loss of future agricultural production potential) is assessed here as being of low significance and as acceptable.

With regards to the agricultural impacts of the proposed overhead power line, all possible agricultural activities can continue entirely unhindered underneath the power line. The direct, permanent, physical footprint that has any potential to interfere with agriculture (pylon bases and servitude track, where it is needed, is insignificantly small. The only potential source of impact of the power line is minimal disturbance to the land (erosion and topsoil loss) during construction (and decommissioning). This impact can be completely prevented with standard, generic mitigation measures that are all inherent in the project engineering and/or are standard, best-practice for construction sites, and are included in the EMPr. The power line development will result in negligible loss of future agricultural production potential and its agricultural impact is therefore assessed as being of very low significance.

9.2 Cumulative impact assessment

The cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present or reasonably foreseeable future activities that will affect the same environment.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of future agricultural production potential. The defining question for assessing the cumulative agricultural impact is this:

> What loss of future agricultural production potential is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present or reasonably foreseeable future impacts, cause that level in the area to be exceeded?

Department of Forestry, Fisheries and the Environment (DFFE) requires compliance with a specified methodology for the assessment of cumulative impacts. This is positive in that it ensures engagement with the important issue of cumulative impacts. However, the required compliance has some limitations and can, in the opinion of the author, result in an over-focus on methodological compliance, while missing the more important task of effectively answering the above defining question.

This cumulative impact assessment determines the quantitative loss of agricultural land if all renewable energy project applications within a 50 km radius become operational. These projects are listed in Appendix 4 of this report. In quantifying the cumulative impact, the area of land taken out of agricultural use as a result of all the projects listed in Appendix 4 (total generation capacity of

515 MW) will amount to a total of approximately 1288 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 50 km radius (approximately 785,300 ha), this amounts to only 0.16% of the surface area. This is well within an acceptable limit in terms of loss of low potential agricultural land which is only suitable for grazing, and of which there is no scarcity in the country.

All of the projects contributing to cumulative impact for this assessment have the same agricultural impacts in a very similar agricultural environment, and therefore the same mitigation measures apply to all.

It should also be noted that renewable energy development can only be located in fairly close proximity to a substation that has available capacity. This creates cumulative impact in such places. However, this is acceptable because it also effectively protects most agricultural land in the country from renewable energy development because only a small proportion of the country's total land surface is located in close enough proximity to an available substation to be viable for renewable energy development.

Furthermore, it should be noted that there are few land uses, other than renewable energy, that are competing for agricultural land use in this area. The cumulative impact from developments, other than renewable energy, is therefore likely to be low.

The loss of agricultural potential by soil degradation can effectively be prevented for renewable energy developments by generic mitigation measures that are all inherent in the project engineering and/or are standard, best-practice for construction sites. Soil degradation does not therefore therefore pose a cumulative impact risk.

Due to all of the considerations discussed above, the cumulative impact of loss of future agricultural production potential is assessed as low. It will not have an unacceptable negative impact on the agricultural production capability of the area and it is therefore recommended, from a cumulative agricultural impact perspective, that the development be approved.

9.3 Mitigation measures

Generic mitigation measures that are effective in preventing soil degradation are all inherent in the project engineering and/or are standard, best-practice for construction sites.

- A system of storm water management, which will prevent erosion on and downstream of the site, will be an inherent part of the engineering design on site.

- Any excavations done during the construction phase, in areas that will be re-vegetated at the end of the construction phase, must separate the upper 30 cm of topsoil from the rest of the excavation spoils and store it in a separate stockpile. When the excavation is back-filled, the topsoil must be back-filled last, so that it remains at the surface. Topsoil should only be stripped in areas that are excavated. Across the majority of the site, including construction lay down areas, it will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire cut surface. It will be advantageous to have topsoil and vegetation cover below the panels during the operational phase to control dust and erosion.

For the power line, there are no additional mitigation measures required, over and above what has already been included in the Generic Environmental Management Programmes (EMPr's) For The Development And Expansion For Overhead Electricity Transmission And Distribution Infrastructure as per Government Notice 435, which was published in Government Gazette 42323 on 22 March 2019.

9.4 Compliance with the allowable development limits

The agricultural protocol stipulates allowable development limits for renewable energy developments of > 20 MW. Allowable development limits refer to the area of a particular agricultural sensitivity category that can be directly impacted (i.e. taken up by the physical footprint) by a renewable energy development. The agricultural footprint is defined in the protocol as the area that is directly occupied by all infrastructures, including roads, hard standing areas, buildings, substations etc., that are associated with the renewable energy facility during its operational phase, and that result in the exclusion of that land from potential cultivation or grazing. It excludes all areas that were already occupied by roads and other infrastructure prior to the establishment of the energy facility but includes the surface area required for expanding existing infrastructure (e.g. widening existing roads). It excludes the corridor underneath overhead power lines but includes the pylon footprints. It therefore represents the total land that is actually excluded from agricultural use as a result of the renewable energy facility (the agricultural footprint).

For a solar energy facility, the footprint is considered to be the total area inside the security fence of the facility.

The allowable development limit on land of medium agricultural sensitivity with a land capability of < 8, as this site has been verified to be, is 2.5 ha per MW. This would allow the proposed facility with a total generating capacity of 150 MW to occupy an agricultural footprint of 150 X 2.5 = 375 hectares.

The total proposed development area, as shown in Figures 2 and 3, is 269 hectares. It is therefore confirmed that the facility is in line with the allowable development limits contained in the agricultural protocol.

9.5 Assessment of alternatives

Specialist assessments for environmental authorisation are required to assess the impacts of alternatives including the no-go alternative. As already noted, the exact nature and layout of the different infrastructure within the boundary fence of a solar energy facility has absolutely no bearing on the significance of agricultural impacts. Any alternative layouts within the boundary fence will have equal impact and are assessed as equally acceptable. All technology alternatives will also have no bearing on the significance of agricultural impacts. All will have equal impact and are assessed as equally acceptable.

The no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. There are no agricultural impacts of the no-go alternative. Even though the impacted land is not cropland, and the impact of the development is low, its negative agricultural impact is marginally more significant than that of the no-go alternative, and so from an agricultural impact perspective, the no-go alternative is the preferred alternative. However, the no-go option would prevent the proposed development from contributing to the environmental, social and economic benefits associated with the development of renewable energy in South Africa.

9.6 Micro-siting

The agricultural protocol requires confirmation that all reasonable measures have been taken through micro-siting to minimize fragmentation and disturbance of agricultural activities. As already discussed in the section above, micro-siting within the footprint will make no material difference to agricultural impacts and disturbance. For the overhead power lines, the micro-siting of pylons is not necessary because there is no cropland present in the power line corridor.

9.7 Confirmation of linear activity impact

The protocol requires confirmation, in the case of a linear activity, that the land can be returned to the current state within two years of completion of the construction phase. It is hereby confirmed that the land under the overhead power line can be returned to the current state of agricultural production potential within two years of construction, with the obvious disclaimer that the pylons will continue to be present for the duration of the operational life time of the power line. The micro-siting of pylons for the overhead power line within croplands is addressed under mitigation in Section 9.3, above.

10 CONCLUSION: AGRICULTURAL COMPLIANCE STATEMENT

The overall conclusion of this assessment is that the proposed development is acceptable because it can provide benefits to agriculture but leads to no loss of potential cropland and therefore minimal loss of future agricultural production potential.

The farm is in an area where only grazing (game and boerbokke) and limited irrigation are practised. Satellite imagery shows no rain-fed cropping in the area, only lands where bush is cleared to improve grazing. The climate is classified as arid and therefore limiting to rain-fed cropping. The mean annual rainfall versus evaporation and the seasonal distribution of rainfall in the area means that there is an insufficient moisture reservoir to carry a crop through the season. Some irrigation is practised in the area on sites closer to the river, but the amount of irrigation water is very limited. There has never been irrigation on the particular farm. The agricultural potential of the site is therefore limited, predominantly by climate, to being suitable only as grazing land.

An agricultural impact is a change to the future agricultural production potential of land. This is primarily caused by the exclusion of agriculture from the footprint of a development. In this case, the entire proposed PV area is considered to be below the threshold for needing to be conserved as agricultural production land because of the limitations on its cropping potential. The production potential of the land is limited to only being suitable as grazing land, and there is no particular scarcity of such land in the country, in contrast to arable land, which is very scarce. The use of this land for solar power generation will cause minimal loss of agricultural production potential in terms of national food security.

Furthermore, the land occupied by PV panels can be used for the dual purposes of solar power generation and agricultural food production by way of sheep grazing. This has potential benefits for both activities and means that the land remains agriculturally productive. The benefit for sheep farming is that the security infrastructure of the solar facility will protect the sheep within it against stock theft. The benefit for the solar facility is that the sheep will control the height of the vegetation below the solar panels thus reducing the need to mechanically control the height of vegetation.

At the farm level, the development will provide a positive economic impact. This is likely to increase cash flow and financial security and may improve farming operations and productivity on other parts of the farm or properties owned by the same farmer, through increased investment into farming.

Due to the facts that the energy facility will not occupy scarce, viable cropland, that the land can potentially still be used to graze sheep, and that its negative impact is offset by economic benefits to farming, the overall negative agricultural impact of the development (loss of future agricultural production potential) is assessed here as being of low significance and as acceptable.

With regards to the agricultural impacts of the proposed overhead power line, it will result in negligible loss of future agricultural production potential and its agricultural impact is therefore assessed as being of very low significance.

The development's acceptability is further substantiated by the following points:

- The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy.
- In addition, the proposed development will contribute to the country's urgent need for energy generation, particularly renewable energy that has much lower environmental and agricultural impact than existing, coal powered energy generation.
- All renewable energy development in South Africa decreases the need for coal power and thereby contributes to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land throughout the coal mining areas of the country.

From an agricultural impact point of view, it is recommended that the proposed development be approved. The conclusion of this assessment on the acceptability of the proposed development and the recommendation for its approval is not subject to any other conditions other than recommended mitigation.

11 REFERENCES

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APPENDIX 1: SPECIALIST CURRICULUM VITAE

Johann Lanz
Curriculum Vitae

Education

M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - 1997
B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I have been registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science since 2012 (registration number 400268/12) and am a member of the Soil Science Society of South Africa.

Soil & Agricultural Consulting **Self employed** **2002 - present**

Within the past 5 years of running my soil and agricultural consulting business, I have completed more than 170 agricultural assessments (EIAs, SEAs, EMPRs) in all 9 provinces for renewable energy, mining, electrical grid infrastructure, urban, and agricultural developments. I was the appointed agricultural specialist for the nation-wide SEAs for wind and solar PV developments, electrical grid infrastructure, and gas pipelines. My regular clients include: Zutari; CSIR; SiVEST; SLR; WSP; Arcus; SRK; Environamics; Royal Haskoning DHV; ABO; Enertrag; WKN-Windcurrent; JG Afrika; Mainstream; Redcap; G7; Mulilo; and Tiptrans. Recent agricultural clients for soil resource evaluations and mapping include Cederberg Wines; Western Cape Department of Agriculture; Vogelfontein Citrus; De Grendel Estate; Zewenwacht Wine Estate; and Goedgedacht Olives.
In 2018 I completed a ground-breaking case study that measured the agricultural impact of existing wind farms in the Eastern Cape.

Soil Science Consultant **Agricultural Consultors International (Tinie du Preez)** **1998 - 2001**

Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

Contracting Soil Scientist **De Beers Namaqualand Mines** **July 1997 - Jan 1998**

Completed a contract to advise soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

APPENDIX 2: SPECIALIST DECLARATION FORM AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE
Boshoek Solar 1 solar energy facility and grid connection infrastructure near Rustenburg, North West Province

Kindly note the following:

- This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
- This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
- An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
- The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Agricultural Assessment
Specialist Company Name	SoilZA (sole proprietor)
Specialist Name	Johann Lanz
Specialist Identity Number	6607045174089
Specialist Qualifications:	M.Sc. (Environmental Geochemistry)
Professional affiliation/registration:	Registered Professional Natural Scientist (Pr.Sci.Nat.) Reg. no. 400268/12 Member of the Soil Science Society of South Africa
Physical address:	1a Wolfe Street, Wynberg, Cape Town, 7800
Postal address:	1a Wolfe Street, Wynberg, Cape Town, 7800
Telephone	Not applicable
Cell phone	+27 82 927 9018
E-mail	johann@soilza.co.za

2. DECLARATION BY THE SPECIALIST

I, **Johann Lanz** declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. “the Protocols”) and in Government Notice No. 1150 of 30 October 2020.
- 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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 –
  12. any decision to be taken with respect to the application by the competent authority; and;
  13. 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; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

Johann Lanz – Soil Scientist (sole proprietor)

Name of Company:

16 April 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Johann Lanz**, swear under oath that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

SoilZA – sole proprietor

Name of Company

16 April 2024

Date

70869103 SF

Signature of the Commissioner of Oaths

2024/04/16

Date

SUID-AFRIKAANSE POLISIEDIENS
HOUT BAY
16 APR 2024
COMMUNITY SERVICE
SOUTH AFRICAN POLICE SERVICE

APPENDIX 3: SACNASP REGISTRATION CERTIFICATE

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Johan Lanz

Registration Number: 400268/12

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule 1 of the Act)

Soil Science (Professional Natural Scientist)

Effective **15 August 2012** Expires **31 March 2025**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

APPENDIX 4: PROJECTS INCLUDED IN CUMULATIVE IMPACT ASSESSMENT

Table 3: Table of all projects that were included in the cumulative impact assessment.

DFFE Reference	Project name	Technology	Capacity (MW)
14/12/16/3/3/1/498	MatauPV	PV	15
14/12/16/3/3/2/414	PV on Portion 44 Of Farm Kortfontein No.461	PV	50
TBC	Boshoek Solar 1	PV	150
TBC	Boshoek Solar 2	PV	150
TBC	Boshoek Solar 3	PV	150
Total solar			**515**

APPENDIX 5: SOIL DATA

Table 4**:** Table of land type soil data

Land type	Soil series (forms)	Depth (mm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ea68	Sd	500 > 1200	25 - 55	35 - 70	so,R	31.2
Ea68	Hu	500 - 1000	20 - 40	25 - 50	so,R	27.7
Ea68	Sd	100 - 400	25 - 55	35 - 70	so,R	12.2
Ea68	Hu	100 - 400	20 - 40	25 - 50	so,R	10.0
Ea68	Ar Rg	600 - 1100	45 - 60		so,G	7.9
Ea68	Va	200 - 450	20 - 30	35 - 55	B2	4.3
Ea68	R					4.0
Ea68	Ms Gs	50 - 250	15 - 35		R,so	2.9

forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002 Tel: +27 12 399 9000, Fax: +27 86 625 1042

SPECIALIST DECLARATION FORM AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE: AGRICULTURAL COMPLIANCE STATEMENT FOR THE PROPOSED BOSHOEK SOLAR 1 SOLAR ENERGY FACILITY AND GRID CONNECTION INFRASTRUCTURE NEAR RUSTENBURG, NORTH WEST PROVINCE

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with 't*he Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Agricultural Assessment
Specialist Company Name	SoilZA (sole proprietor)
Specialist Name	Johann Lanz
Specialist Identity Number	6607045174089
Specialist Qualifications:	M.Sc. (Environmental Geochemistry)
Professional affiliation/registration:	Registered Professional Natural Scientist (Pr.Sci.Nat.) Reg. no. 400268/12 Member of the Soil Science Society of South Africa
Physical address:	1a Wolfe Street, Wynberg, Cape Town, 7800
Postal address:	1a Wolfe Street, Wynberg, Cape Town, 7800
Telephone	Not applicable
Cell phone	+27 82 927 9018
E-mail	johann@soilza.co.za

2. DECLARATION BY THE SPECIALIST

I, **Johann Lanz** declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

SoilZA (sole proprietor)

Name of Company:

6 August 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Johann Lanz**, swear under oath that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

SoilZA – sole proprietor

Name of Company

6 Aug 2024

Date

Signature of the Commissioner of Oaths

2024/08/06

Date

SOUTH AFRICAN POLICE SERVICE
VISPOL COMMANDER
2024-08-06
LENASIA
SUID-AFRIKAANSE POLISIEDIENS

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Johan Lanz

Registration Number: 400268/12

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule 1 of the Act)

Soil Science (Professional Natural Scientist)

Effective **15 August 2012** Expires **31 March 2025**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

Nkurenkuru
ECOLOGY & BIODIVERSITY

PROPOSED BOSHOEK SOLAR PV 1 FACILITY NEAR BOSHOEK, NORTH WEST PROVINCE

FRESHWATER RESOURCE STUDY AND ASSESSMENT

Version: 1.0

Date: 28 June 2024

Author: Gerhard Botha

Report Title: The Proposed Boshoek Solar 1 Energy Facility and Associated Infrastructure near Boshoek, North West Province: Biodiversity (Fauna and Flora) and Ecological Scoping/Screening Phase Assessment.

Authors: Mr. Gerhard Botha

Project Name: The Proposed Boshoek Solar 1 Energy Facility and Associated Infrastructure near Boshoek, North West Province.

Status of report: Version 1.0

Date: 28 June 2024

Prepared for: Boshoek Solar 1 (Pty) Ltd.

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Suggested report citation

Nkurenkuru Ecology and Biodiversity, 2024. The Proposed Boshoek Solar 1 Energy Facility and Associated Infrastructure near Boshoek, North West Province. *Freshwater Resource Study and Assessment Report*. Unpublished report prepared by Nkurenkuru Ecology and Biodiversity for for Boshoek Solar 1 (Pty) Ltd. Version 1.0, 8th April 2024.

I. DECLARATION OF CONSULTANT INDEPENDENCE

The consultants hereby declare that they:

» act/ed as the independent specialists in this application;
» regard the information contained in this report as it relates to specialist input/study to be true and correct at the time of publication;
» do not, and will not, have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA Environmental Impact Assessment Regulations, 2014, and any specific environmental management Act;
» do not, and will not, have any vested interest(s) in the proceedings of the proposed activities;
» have disclosed, to the applicant, EAP, and competent authority(-ies), any information that have, or may have, the potential to influence the decision of the competent authority(-ies) or the objectivity of any report, plan, or document required in terms of the NEMA Environmental Impact Assessment Regulations 2014, and any specific environmental management Act;
» are fully aware of, and meet, the responsibilities in terms of the NEMA Environmental Impact Assessment Regulations 2014 (specifically in terms of regulation 13 of GN No. R. 326), and any specific environmental management Act, and that failure to comply with these requirements may result in disqualification;
» have provided the competent authority(-ies) with access to all necessary information at their disposal at the time of publication regarding the application, whether such information is favourable to the applicant or not; and
» are aware that a false declaration is an offense in terms of regulation 48 of GN No. R. 326.

REPORT AUTHORS:

Gerhard Botha Pr.Sci.Nat 400502/14 (Botanical and Ecological Science)

Fields of Expertise: Fauna & Flora; Terrestrial Biodiversity; Wetland Ecology; Aquatic and Wetland; Aquatic Biomonitoring; and Wetland Habitat Evaluations.

BSc (Hons) Zoology and Botany; MSc Botany (Phytosociology) from 2011 to present.

June 2024

II. STATEMENT OF WORK

- This study has been executed in accordance with and meet the responsibilities in terms of:
  - NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 326);
  - Procedures to be followed for the assessment and minimum criteria for reporting of identified environmental themes in terms of section 24(5)(a) and (h) of the National Environmental Management Act, 1998, when applying for Environmental Authorisation:
    - 3(c): Protocol for the assessment and reporting of environmental impacts on terrestrial animal species.
    - 3(d): Protocol for the assessment and reporting of environmental impacts on terrestrial plant species.

REPORT AUTHORS:

Gerhard Botha Pr.Sci.Nat 400502/14 (Botanical and Ecological Science)

June 2024

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1. INTRODUCTION

1.1. Applicant

Boshoek Solar 1 (Pty) Ltd.

1.2. Project

The project will be known as Boshoek Solar 1, and the entire study area with its collection of sites will generally be referred to either as the "study area" or the "study site".

1.3. Proposed Activity

Boshoek Solar 1 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province (Figure 1 and Figure 2).

The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW. The development area is situated approximately 33 km north west of Rustenburg within the Kgetlengrivier and Rustenburg Local Municipalities and the Bojanala District Municipality, in the North West Province.

The development area for the PV facility and associated infrastructure will be located on the following properties:

Farm Name	Farm No.	Portion No.
Boshoek Solar 1 Facility		
Farm Rhenosterdoorns	531	0
Farm Zwaarverdiend	234	1
Boshoek Solar 1 Grid Connection		
Paul Bodenstein Landgoed 571 JG	571	RE
Elandsfontein 102 JG	102	1
Onderstepoort 98 JG	98	RE

The project is planned as part of a larger cluster, which includes two additional PV facilities (Boshoek Solar 2 and Boshoek Solar 3) up to 150 MW and 50 MW respectively.

An assessment area of approximately 290 ha is being assessed as part of this EIA process and the infrastructure associated with the 150 MW facility includes:

- PV modules (mono- or bifacial) and mounting structures;
- Inverters and transformers;
- Battery Energy Storage System (BESS);
- Site access road;
- Internal access roads;
- Auxiliary buildings (switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Temporary and permanent laydown area; and
- Grid connection infrastructure, including:
  - Underground medium-voltage cabling between the project components and the facility substation;
  - Up to 132kV facility substation;
  - Switching station;
  - A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.

The EA applications for the solar facility and grid connection infrastructure are being undertaken simultaneously as the proposed infrastructure is co-dependent, i.e., one will not be developed without the other.

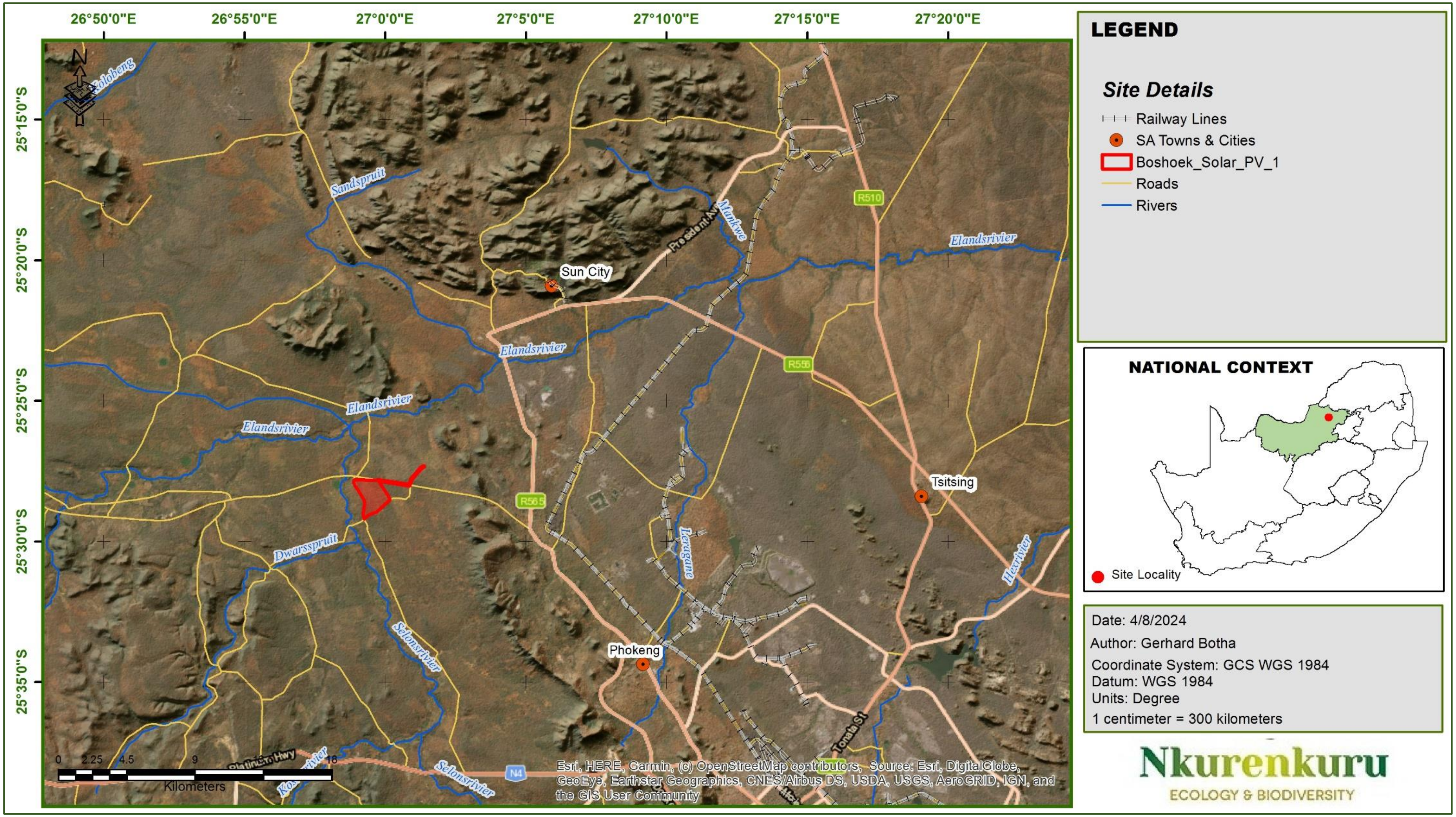

Figure 1: Locality of the project site earmarked for the development of the Boshoek PV 1 facility, west of Boshoek and north-west of Phokeng in the North West Province.

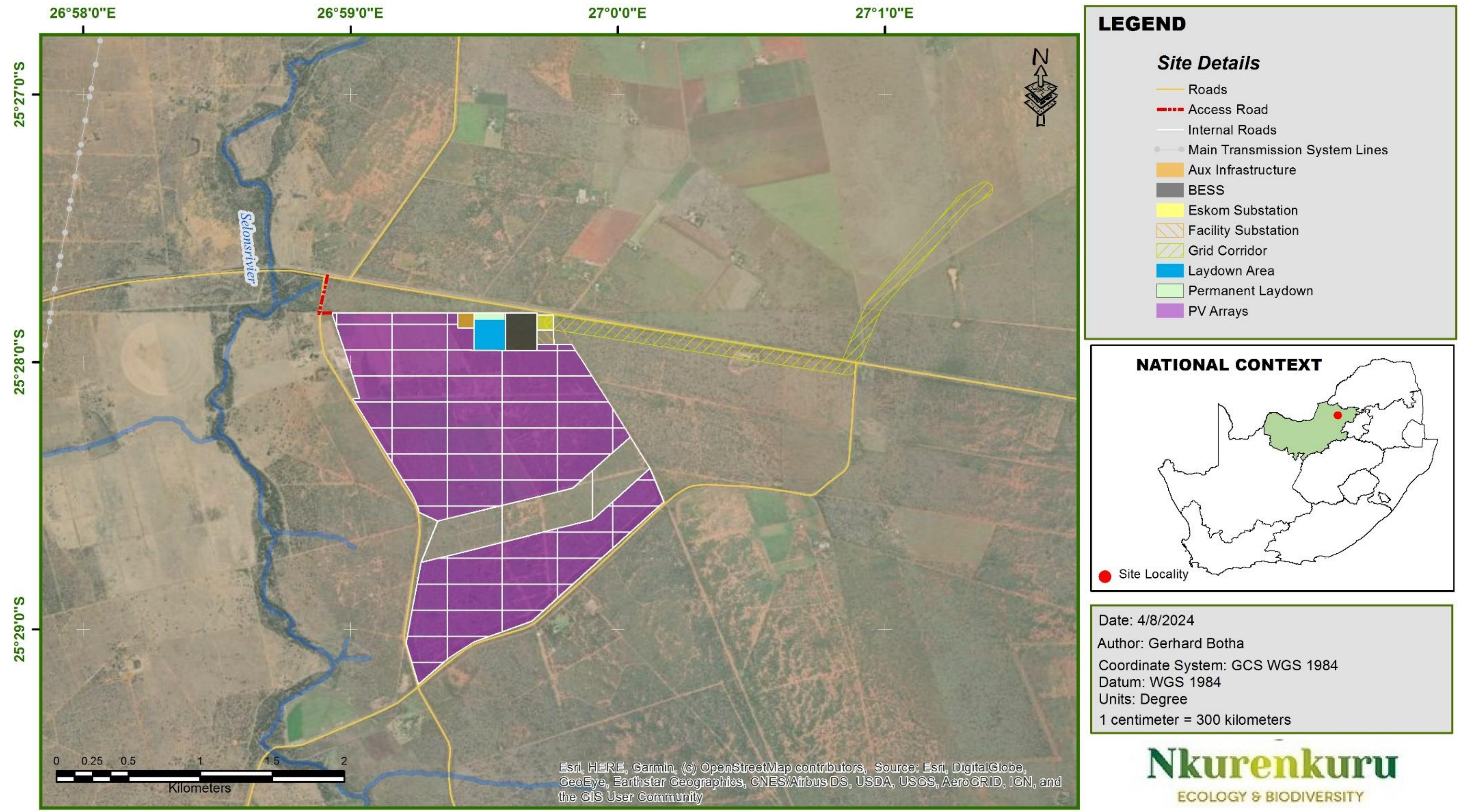

Figure 2: Locality of the project site earmarked for the development of the Boshoek PV 1 facility, west of Boshoek and north-west of Phokeng in the North West Province. This map is specifically zoomed in to give a higher resolution.

1.4. Scope and Purpose of this Specialist Report

The proposed project stands to potentially impact onsite freshwater resource features. The requirement for this freshwater resource study and assessment and the Scope of Work is prescribed in terms of NEMA. As such the study aims to comply with legislative requirements. In terms of NEMA wetlands, rivers and ephemeral drainage lines fall under the identified theme of Aquatic Biodiversity.

This freshwater resource study and assessment was undertaken and the relevant specialist report compiled in accordance with the requirements in the latest NEMA Minimum Requirements and Protocol for Specialist Aquatic Biodiversity Impact Assessment as contained in the "Procedures to be followed for the assessment and minimum criteria for reporting of identified environmental themes of Section 45 (a) and (h) of the National Environmental Management Act, 1998, when applying for Environmental Authorization", contained in Government Gazette No. 320 (20 March 2020).

1.5. Details of the Specialist

Gerhard Botha is the Managing Director of Nkurenkuru Ecology and Biodiversity (Pty) Ltd and has an Honours degree in Ecology. He is currently completing a MSc degree in Botany with his dissertation focusing on the phytosociology of the Nxamaseri floodplain in Botswana. He is registered with the South African Council of Natural Scientific Professionals (SACNASP) in the fields of Botany and Ecology (Reg No. 400502/14) and has over 12 years of experience and a broad interest in various ecological and biodiversity fields. He has worked on a variety of environmental management projects, with a strong focus on arid terrestrial and aquatic/freshwater ecology.

A curriculum vitae is included in Appendix A of this specialist assessment.

1.6. Terms of Reference (ToR)

The primary objective of the specialist freshwater resource assessment was to provide information to guide the proposed Wind Energy Facility development with respect to the potential impacts on the affected freshwater ecosystems within the project site. The focus of this study was solely on the specific Hydrogeomorphic Units (HGMs), within a radius of 500m of the proposed footprint and which will likely be impacted by the proposed development.

The focus of the work involved the undertaking of a specialist assessment of freshwater resource features, which included the following tasks:

- Desktop identification and delineation of potential freshwater resource areas affected by the proposed development, or occurring within a 500m radius of the proposed development using available imagery, contour information and spatial datasets in a Geographical Information System (GIS);
- Undertaking a rapid water resource screening and risk assessment to determine which desktop delineated/mapped watercourses/wetlands are likely to be measurably affected by the proposed activities. This was used to flag watercourses/wetlands for further infield assessments as well as identify those watercourses/wetlands to be unaffected and not require further assessment (i.e. wetlands/rivers within adjacent catchments, upstream or some distance downstream of the predicted impact zone);
- Site-based (detailed in-field) delineation of the outer wetland boundary of wetland/watercourse areas within the project focal area and which were flagged during the desktop screening/risk assessment;
- Classification of wetlands and riparian areas and assessment of conservation significance based on available data sets;
- Description of the biophysical characteristics of the delineated freshwater habitats based on onsite observations and sampling (i.e. hydrology, soils, vegetation, existing impacts etc.);
- Baseline functional assessment of wetland habitats based on field investigations, involving the:
  - PES (Present Ecological State/Condition) of the delineated wetland units;
  - EIS (Ecological Importance and Sensitivity) of the delineated wetland units;
  - Direct and indirect ecosystem services (functions) importance of the delineated wetland units only.
- Impact assessment and identification of mitigation measures to reduce the significance of potential aquatic impacts for both the construction and operation phases of the wind energy facility project. For this section the same methodology and layout approach within the existing report was followed in order to maintain uniformity and coherence between the two reports.
- Compilation of a specialist wetland assessment report detailing the methodology and findings of the assessment, together with relevant maps and GIS information.

1.7. Conditions of this Report

Findings, recommendations, and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation. No form of this report may be amended or extended without the prior written consent of the author. Any recommendations, statements, or conclusions drawn from or based on this report must clearly cite or refer to this report. Whenever such recommendations, statements or conclusions form part of the main report relating to the current investigation, this report must be included in its entirety.

1.8. Relevant Legislation

The link between ecological integrity of freshwater resources and their continued provision of valuable ecosystem goods and services to burgeoning populations is well-recognised, both globally and nationally (Rivers-Moore et al., 2007). In response to the importance of freshwater aquatic resources, protection of wetlands and rivers has been campaigned at national and international levels. A strong legislative framework which backs up South Africa's obligations to numerous international conservation agreements creates the necessary enabling legal framework for the protection of freshwater resources in the country. Relevant environmental legislation pertaining to the protection and use of aquatic ecosystems (i.e. wetlands and rivers) in South Africa has been summarized below.

1.8.1. South African Constitution 108 of 1996

Section 24 of Chapter 2 of the Bill of Rights No. 108 of 1996 states that everyone has the right to:

(a) to an environment that is not harmful to their health or well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that—
  (i) prevent pollution and ecological degradation;
  (ii) promote conservation; and
  (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

1.8.2. National Environmental Management Act 107 of 1998

Wetlands and other watercourses defined in the NWA are also protected in the National Environmental Management Act (Act 107 of 1998), (NEMA). The act lists several activities that require authorisation before they can be implemented. NEMA lists various activities that require authorisation when located within 32 m or less from the edge of a wetland or other watercourse type.

1.8.3. National Water Act (Act No. 36 of 1998)

According to the National Water Act (Act No. 36 of 1998), a water resource is defined as: "a watercourse, surface water, estuary, or aquifer. A watercourse in turn refers to

(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse. Reference to a watercourse includes, where relevant, its bed and banks."

A wetland is defined as: "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances support or would support vegetation typically adapted to life in saturated soil."

Chapter 4 of the Act deals with the regulation of the use of water and the requirements for controlled activities, general authorisations, and licenses. In general, a water use must be licensed unless: it is listed in Schedule 1 of the Act as an existing lawful water use, or is permissible under a general authorisation, or if a responsible authority waives the need for a license.

According to the Department of Water and Sanitation (DWS), any activity that falls within the temporary zone of a wetland or the 1:100 year floodline (whichever is greater) qualifies as a Section 21 water use activity (depending on the use) and will thus require either a general authorization or Water Use License (WUL). According to the NWA, an application for a WUL should be submitted to the DWS if any of the above activities are to be undertaken.

Section 21 of the National Water Act (NWA Act No. 36 of 1998) covers the following activities, which might be applicable to the proposed project. According to Section 21 of the NWA and in relation to the river ecosystem, the following activity is considered a use, and therefore requires a water use license:

» 21 (c) impeding or diverting the flow of water in a watercourse;
» 21 (i) altering the bed, banks, course or characteristics of a watercourse;

In terms of Section 22 (1), a person may only undertake the abovementioned water uses if it is appropriately authorised:

22(1) A person may only use water

(a) without a licence
 (i) if that water use is permissible under Schedule 1;
 (ii) if that water use is permissible as a continuation of an existing lawful use; or
 (iii) if that water use is permissible in terms of a general authorisation issued under section 39;
(b) if the water use is authorised by a licence under this Act; or
(c) if the responsible authority has dispensed with a licence requirement under subsection (3).

1.8.4. Other relevant applicable legislation

» The National Forests Act No. 84 of 1998;

» The Natural Heritage Resources Act No. 25 of 1999;
» The National Environmental Management: Protected Areas Act No. 57 of 2003;
» Minerals and Petroleum Resources Development Act No. 28 of 2002;

2. METHODOLOGY

2.1. Assessment Approach and Philosophy

2.1.1. Aquatic Biodiversity

The delineation and classification of freshwater resources were conducted using the standards and guidelines produced by the DWS (DWAF, 2005 & 2007) and the South African National Biodiversity Institute (SANBI, 2009).

In addition to these guidelines, the general approach to freshwater habitat assessment was furthermore based on the proposed framework for wetland assessment as proposed within the Water Research Commission's (WRC) report titled: "Development of a decision-support framework for wetland assessment in South Africa and a Decision-Support Protocol for the rapid assessment of wetland ecological condition" (Ollis et. al., 2014). A schematic illustration of the proposed decision-support framework for wetland assessment in South Africa is provided in Figure 3 below.

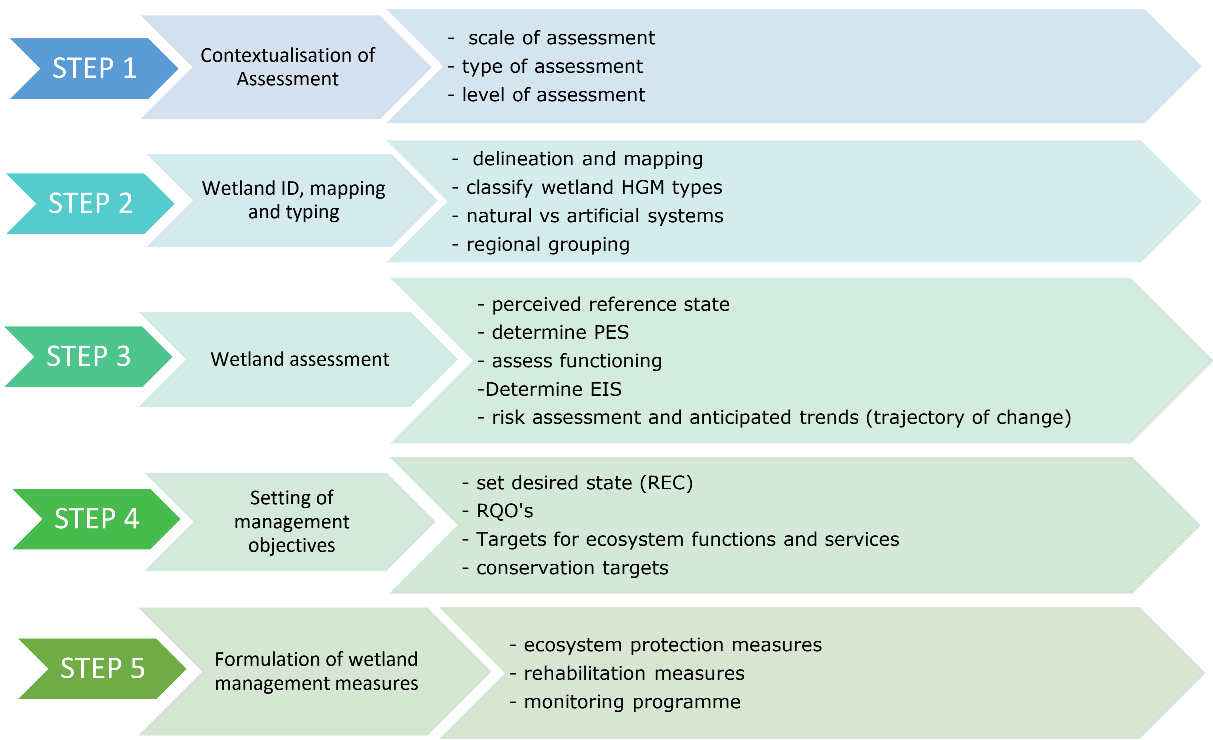

Figure 3: Proposed decision support framework for wetland assessment in South Africa (after Ollis et al., 2014) .

2.2. Data Exploration and Review

Data sources from the literature and GIS spatial information was consulted and used where necessary in the study and include the following (also refer to Table 1: Information and data coverages used to inform the ecological assessment.

	Data/Coverage Type	Relevance	Source
Biophysical Context	**Colour Aerial Photography**	Desktop mapping of habitat/ecological features	National Geo-Spatial Information (NGI)
	Latest Google EarthTM imagery	To supplement available aerial photography	Google EarthTM On-line
	1:50 000 Relief Line (20m Elevation Contours GIS Coverage)	Desktop mapping of terrain and habitat features as well as drainage network.	Surveyor General
	1:50 000 River Line (GIS Coverage)	Highlight potential on-site and local rivers and wetlands and map local drainage network.	CSIR (2011)
	South African Vegetation Map (GIS Coverage)	Classify vegetation types and determination of reference primary vegetation	Mucina & Rutherford (2012; 2018); Dayaram et al., 2018
	NFEPA: river and wetland inventories (GIS Coverage)	Highlight potential on-site and local rivers and wetlands	SANBI (2016)
Conservation and Distribution Context	**North West Biodiversity Sector Plan: Critical Biodiversity Areas** (GIS Coverage)	Determination of provincial freshwater conservation priorities and biodiversity buffers	SANBI (2019)
	NFEPA: River, wetland and estuarine FEPAs (GIS Coverage)	Shows location of national aquatic ecosystems conservation priorities	CSIR (2011)
	National Biodiversity Assessment – Threatened Ecosystems (GIS Coverage)	Determination of national threat status of local vegetation types	SANBI (2011)

The desktop delineation of all freshwater resources within 500 m of the proposed development / activities was undertaken by analysing available 20 m contour lines and colour aerial photography supplemented by Google Earth (TM) imagery where more recent imagery was needed. Digitization and mapping were undertaken using QGIS 3.32.2 and ArcMap 10.4.1 GIS software. All of the mapped freshwater resources were then broadly subdivided into distinct resource units (i.e. classified as ephemeral channels and drainage lines, washes and ephemeral rivers and wetlands). This was undertaken based on aerial photographic analysis and professional experience in working in the region. Please note that the desktop map was updated as part of the finalisation of the assessment to include the detailed delineation of the units occurring within the study area.

Following the desktop identification and mapping exercise, freshwater resource features where confirmed and their boundaries refined in-field for a summary):

Vegetation:

- » South African National Vegetation Map (SANBI, 2018); (Mucina & Rutherford, 2006) and National List of Threatened Ecosystems (NEM:BA, 2011): vegetation types and their respective conservation statuses. The latest version of the National Vegetation Map was also consulted to check for any updates of the respective regions (Dayaram, et al., 2019); (SANBI, 2018).
- » Botanical Database of Southern Africa (BODATSA), hosted by the South African National Biodiversity Institute (SANBI; https://posa.sanbi.org; also referred as POSA: Plants of Southern Africa): information on plant species recorded for the Quarter Degree Squares 2919BA, 2919BB, 2919BD and 2920AA. This is a larger area than required and is a conservative approach that ensures all species possibly occurring within the site have been represented. It also accounts for the fact that the site itself might not be well represented in national databases.
- » Threatened Species Programme, Red List of South African Plants (SANBI, 2021): The IUCN conservation statuses of all listed species were extracted from this database.

Ecosystem:

- » Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment (Nel, et al., 2011). This includes rivers, wetlands, and catchments defined in the study area.
- » Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (Government of South Africa, 2008).
- » Critical Biodiversity Areas for the site and surroundings (CBA Map for Eastern Cape; obtained from SANBI Biodiversity GIS (BGIS), specifically https://bgis.sanbi.org/SpatialDataset/Detail/4702.

Table 1: Information and data coverages used to inform the ecological assessment.

	Data/Coverage Type	Relevance	Source
Biophysical Context	**Colour Aerial Photography**	Desktop mapping of habitat/ecological features	National Geo-Spatial Information (NGI)
	Latest Google Earth™ imagery	To supplement available aerial photography	Google Earth™ On-line
	1:50 000 Relief Line (20m Elevation Contours GIS Coverage)	Desktop mapping of terrain and habitat features as well as drainage network.	Surveyor General
	1:50 000 River Line (GIS Coverage)	Highlight potential on-site and local rivers and wetlands and map local drainage network.	CSIR (2011)
	South African Vegetation Map (GIS Coverage)	Classify vegetation types and determination of reference primary vegetation	Mucina & Rutherford (2012; 2018); Dayaram et al., 2018
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The desktop delineation of all freshwater resources within 500 m of the proposed development / activities was undertaken by analysing available 20 m contour lines and colour aerial photography supplemented by Google Earth (TM) imagery where more recent imagery was needed. Digitization and mapping were undertaken using QGIS 3.32.2 and ArcMap 10.4.1 GIS software. All of the mapped freshwater resources were then broadly subdivided into distinct resource units (i.e. classified as ephemeral channels and drainage lines, washes and ephemeral rivers and wetlands). This was undertaken based on aerial photographic analysis and professional experience in working in the region. Please note that the desktop map was updated as part of the finalisation of the assessment to include the detailed delineation of the units occurring within the study area.

Following the desktop identification and mapping exercise, freshwater resource features where confirmed and their boundaries refined in-field

2.3. Baseline Freshwater Resource Assessment

The methods of data collection, analysis and assessment employed as part of the baseline freshwater habitat assessment are briefly discussed in this section.

The on-site / in-field assessment of the freshwater resource indicators was conducted on the 20th to 23rd June 2022. The area was, prior to the time of the survey, experiencing an extensive drought period, however during the inspection, the conditions were slightly more favourable, as the area received some autumn precipitation, resulting in slightly more favourable survey conditions. Most of the dam features and natural freshwater features were slightly inundated (>10% capacity) during the inspection. However, the presence of inundation is not a prerequisite for the accurate delineation of freshwater resource features as other indicators were used as described below.

The assessments undertaken as part of this study are listed in Table 2 below along with the relevant published guidelines and assessment tools / methods / protocols utilised. A more comprehensive description of the methods listed below is included in Appendix C.

Table 2: Summary of methods used in the assessment of delineated freshwater resources.

Method/Technique	Reference for Methods / Tools Used
Freshwater Resource Delineation	A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas' (DWAF, 2005).
Freshwater Resource Classification	National Wetland Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis et al, 2013)
Freshwater Resource Condition/PES	Wetland Index of Habitat Integrity (DWAF, 2007).
Freshwater Ecological Importance and Sensitivity (EIS)	EIS (Ecological Importance and Sensitivity) assessment tool (DWAF 1999c; Rountree & Malan, 2013)
Buffers for rivers and watercourses	Recommended buffers are in line with the watercourse and wetland buffers that have been recommended in the Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (CSIR, 2015) and are deemed appropriate to the aquatic features and the proposed activities within the study area. Recommendations are made based on the wetlands functioning and site characteristics

2.4. Assumptions and Limitations

2.4.1. General Assumptions and Limitations

» This report deals exclusively within a defined area as well as downstream freshwater/aquatic resources that may potentially be impacted and which fall within the Regulated Areas (500 m) as defined by DWS.
» All relevant project information provided by the applicant and engineering design team to the specialist was correct and valid at the time that it was provided.
» Additional information used to inform the assessment was limited to data and GIS coverage's available for the Northern Cape Province at the time of the assessment.

2.4.2. Sampling Limitations and Assumptions

» While disturbance and transformation of habitats can lead to shifts in the type and extent of ecosystems, it is important to note that the current extent and classification are reported on here.

» The delineation of the outer boundary of riparian areas is based on several indicators, including topography (macro-channel features), the presence of alluvial deposition and vegetation indicators. The boundaries mapped in this specialist report, therefore, represent the approximate boundary of riparian habitat as evaluated by an assessor familiar and well-practiced in the delineation technique.
» The accuracy of the delineation is based solely on the recording of the relevant onsite indicators using a GPS. GPS accuracy will, therefore, influence the accuracy of the mapped sampling points and therefore resource boundaries and an error of 3 – 5m can be expected. All soil/vegetation/terrain sampling points were recorded using a Garmin etrex Touch 35 Positioning System (GPS) and captured using Geographical Information Systems (GIS) for further processing.
» Any freshwater resources that fall outside of the affected catchment (but still within the 500m DWS regulated area) and are not at risk of being impacted by the specific activity were not delineated or assessed. Such features were flagged during a baseline desktop assessment before the site visit.
» Sampling by its nature means that generally not all aspects of ecosystems can be assessed and identified.
» While every care is taken to ensure that the data presented are qualitatively adequate, inevitably conditions are never such that that is possible. The nature of the vegetation, seasonality, human intervention etc. limit the veracity of the material presented.
» No water sampling and analysis was undertaken.
» The vegetation information provided is based on onsite/ infield observations and not formal vegetation plots. As such, the species list provided only gives an indication of the dominant and/or indicator wetland/riparian species and thus only provides a general indication of the composition of the vegetation communities.
» No faunal sampling and/or faunal searches were conducted and the assessment was purely wetland and riverine habitat based.
» Probably the most significant potential limitation associated with such a sampling approach is the narrow temporal window of sampling.
  - Ideally, a site should be visited several times, during different seasons to ensure that the full complement of plant and animal species present is captured.
  - However, this is rarely possible due to time constraints and therefore, the representation of the species sampled at the time of the site visit should be critically evaluated.
  - The footprint was covered in detail and results are considered highly reliable and it is unlikely that there are any significant species or features present that were not recorded.

2.4.3. Baseline Assessment – Limitations and Assumptions

» All assessment tools utilised within this study were applied only to the resources and habitats located within the development footprint as well as the 500m DWS "regulated area" around the footprint area, and which are at risk of being impacted by the proposed development. Any resource located outside of the DWS "regulated area" and which is not a risk of being impacted was not assessed.

» It should be noted that the most appropriate assessment tools were selected for the analysis of the specific features and resources that may potentially be impacted by the proposed development. The selection was based on the specialist's knowledge and experience of these tools and their attributes and shortcomings.
» Furthermore, it should be noted that these assessment techniques and tools are currently the most appropriate available tools and techniques to undertake assessments of freshwater resources, there are however rapid assessment tools that rely on qualitative information and expert judgment. While these tools have been subjected to peer review processes, the methodology for these tools is ever-evolving and will likely be further refined in the near future. For the purposes of this assessment, the assessments were undertaken at rapid levels with somewhat limited field verification. It, therefore, provides an indication of the PES of the portions of the affected systems rather than providing a definitive measure.
» The PES, EIS and functional assessments undertaken are largely qualitative assessment tools and thus the results are open to professional opinion and interpretation. We have made an effort to substantiate all claims where applicable and necessary.
» The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological concerns arising from the field survey and based on the assessor's working knowledge and experience with similar development projects.
» The impact descriptions and assessment are based on the author's understanding of the proposed development based on the site visit and information provided.
» Evaluation of the significance of impacts with mitigation takes into account mitigation measures provided in this report and standard mitigation measures to be included in the Environmental Management Programme (EMPr).

3. CONSERVATION AND FUNCTIONAL IMPORTANCE OF AQUATIC ECOSYSTEMS

Water affects every activity and aspiration of human society and sustains all ecosystems. "Freshwater ecosystems" refer to all inland water bodies whether fresh or saline, including rivers, lakes, wetlands, sub-surface waters, and estuaries (Driver et al., 2011). South Africa's freshwater ecosystems are diverse, ranging from sub-tropical in the north-eastern part of the country, to semi-arid and arid in the interior, to the cool and temperate rivers of the fynbos. Wetlands and rivers form a fascinating and essential part of our natural heritage and are often referred to as the "kidneys" and "arteries" of our living landscapes and this is particularly true in semi-arid countries such as South Africa (Nel et al., 2013). Rivers and their associated riparian zones are vital for supplying freshwater (South Africa's most scarce natural resource) and are important in providing additional biophysical, social, cultural, economic, and aesthetic services (Nel et al., 2013). The health of our rivers and wetlands is measured by the diversity and health of the species we share these resources with. Healthy river ecosystems can increase resilience to the impacts of climate change, by allowing ecosystems and species to adapt as naturally as possible to the changes and by buffering human settlements and activities from the impacts of extreme weather events (Nel et al., 2013). Freshwater ecosystems are likely to be particularly hard hit by rising temperatures and shifting rainfall patterns, and yet healthy, intact freshwater ecosystems are vital for maintaining resilience to climate change and mitigating its impact on human wellbeing by helping to maintain a consistent supply of water and for reducing flood risk and mitigating the impact of flash floods. We, therefore, need to be mindful of the fact that without the integrity of our natural river systems, there will be no sustained long-term economic growth or life (DEA et al., 2013).

Freshwater ecosystems, including rivers and wetlands, are also particularly vulnerable to anthropogenic or human activities, which can often lead to irreversible damage or longer-term, gradual/cumulative changes to freshwater resources and associated aquatic ecosystems. Since channelled systems such as rivers, streams, and drainage lines are generally located at the lowest point in the landscape; they are often the "receivers" of wastes, sediment, and pollutants transported via surface water runoff as well as subsurface water movement (Driver et al., 2011). This combined with the strong connectivity of freshwater ecosystems means that they are highly susceptible to upstream, downstream, and upland impacts, including changes to water quality and quantity as well as changes to aquatic habitat & biota (Driver et al., 2011). South Africa's freshwater ecosystems have been mapped and classified into National Freshwater Ecosystem Priority Areas (NFEPAs). This work shows that 60% of our river ecosystems are threatened and 23% are critically endangered. The situation for wetlands is even worse: 65% of our wetland types are threatened, and 48% are critically endangered (Driver et al., 2011). Recent studies reveal that less than one-third of South Africa's main rivers are considered to be in an ecologically 'natural' state, with the principal threat to freshwater systems being human activities, including river regulation, followed by catchment transformation (Rivers-Moore & Goodman, 2009). South Africa's freshwater fauna also display high levels of threat: at least one-third of freshwater fish indigenous to South Africa are reported as threatened, and a recent southern African study on the conservation status of major freshwater-dependent taxonomic groups (fishes, molluscs, dragonflies, crabs, and vascular plants) reported far higher levels of threat in South Africa than in the rest of the region (Darwall et al., 2009). Clearly, urgent attention is required to ensure that representative natural examples of the different ecosystems that make up the natural heritage of this country for current and future generations to come. The degradation of South African rivers and wetlands is a concern now recognized by Government as requiring urgent action and the protection of freshwater resources, including rivers and wetlands, is considered fundamental to the sustainable management of South Africa's water resources in the context of the reconstruction and development of the country.

4. NATIONAL WEB BASED ENVIRONMENTAL SCREENING TOOL

Introduction and summary of the Screening Tool and the link between this tool and the newly gazetted Protocols for specialists.

The Screening Tool, developed by the Department of Environmental Affairs ("DEA"), now Department Forestry and Fisheries of Environment, (DFFE), is a geospatial web-enabled application that aims to provide readily available information, known as 'spatial datasets', which enables applicants for Environmental Authorisation to screen their proposed site for environmental sensitivities.

The Screening Tool provides site specific information to assist an applicant throughout the EIA process. The information provided includes, for example, zoning identification, applicable Environmental Management Frameworks or bio-regional plans, project specific requirements such as specialist studies, and the minimum information to be included in the EIA report.

On 5 July 2019, the Minister of Environment, Forestry and Fisheries, Barbara Dallas Creecy, published a notice requiring that when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the Environmental Impact Assessment Regulations, 2014 (as amended) (the "EIA Regulations"), the applicant must submit the report generated by the National Web Based Screening Tool (the "Screening Tool") with the application. This notice came into effect in October 2019.

The South African National Biodiversity Institute (SANBI), through its Biodiversity and Land Use (BLU) Project and the Council for Scientific and Industrial Research (CSIR) has, since 2017, been supporting the Department of Environment Forestry and Fisheries (DEFF) in integrating biodiversity information into DEFF's web-based National Environmental Screening Tool (hereafter referred to as 'screening tool') and developing a set of biodiversity related protocols that an applicant needs to adhere to in the Environmental Authorisation (EA) process.

On 20 March 2020 the Minister of Forestry, Fisheries and the Environment gazetted Terrestrial and Aquatic Biodiversity Protocols for national implementation purposes.

The Screening Tool consists of a number of themes including agriculture, avifauna, terrestrial and aquatic biodiversity, plant and animal species, noise, defence and civil aviation. Each of the themes consists of spatial datasets that correspond to the respective theme. Each dataset within the respective theme has been assigned a sensitivity level. Most of the themes within the Screening Tool make use of a four-tier sensitivity system, where delineated areas and features are assigned a sensitivity level of either "low (L)", "medium (M)", "high (H)" or "very high (VH)". Table 3 below describes the four sensitivity classes and their definitions.

Table 3: Summary of the sensitivity classes.

Assessment	Description
VERY HIGH	Area is rates as being extremely sensitivity to development and the risk of finding sensitive biodiversity features at the site is very high. Consequently, the area will either have very high conservation or socio-economic value.

Assessment	Description
High	Area is rated as being highly sensitive to development and the risk of finding sensitive biodiversity features at the site is high. Consequently. The area will either have high conservation or socio-economic value
Medium	Area is rated as being of medium sensitivity to development and there is a medium to moderate risk of finding sensitive biodiversity features at the site. Consequently, the area will either have medium conservation or socio-economic value.
Low	Area is considered to have low levels of sensitivity and there is low risk of finding sensitive biodiversity features at the site. Consequently, the area has a low conservation or socio-economic value.

A number of datasets were used for the biodiversity related themes. Table 4 identifies the datasets that underpin the various biodiversity related themes in the Screening Tool. For the Aquatic and Terrestrial Biodiversity Themes, all features that have known mapped features of sensitive biodiversity features are assigned a "very high" sensitivity. Where there are no known sensitive biodiversity features, a "low" sensitivity is assigned. Subsequently a two-tier sensitivity system has been applied to the Terrestrial Biodiversity Themes ("very high" and "low") and are based on the presence or absence of known sensitive biodiversity features respectively. In essence the "very high" and "low" sensitivity ratings should be interpreted as there being a greater and lower risk of finding important biodiversity in these areas respectively. It is important to note that all the "very high" delineated areas and features are sensitive but the degree to which these areas can be impacted upon is different for the different "very high" delineated areas and features, depending on the development type. The degree of impact on these areas can only be assessed with the EIA process.

Table 4: Summary of the datasets used to underpin the aquatic and terrestrial biodiversity themes and the sensitivity rating of these features.

Terrestrial & Aquatic Biodiversity Themes Datasets Used	**Sensitivity**
Protected Areas (Terrestrial)	**Very High**
Critical Biodiversity Areas – CBAs (Terrestrial and Aquatic)	**Very High**
Ecological Support Areas – ESAs (Terrestrial and Aquatic)	**Very High**
Strategic Water Source Areas (Terrestrial & Aquatic)	**Very High**
National Freshwater Priority Areas (FEPA) catchments (Terrestrial & Aquatic)	**Very High**
Priority Areas for Protected Area Expansion (Terrestrial)	**Very High**
Indigenous Forest (Terrestrial)	**Very High**
Rivers (Aquatic)	**Very High**
Wetlands (Aquatic)	**Very High**
Estuaries (Aquatic)	**Very High**
Absence of above listed features	**Low**

As for the Animal and Plant Species Themes, the four-tier sensitivity system have been implemented to the various data layers underpinning these themes, namely "Low", "Medium", "High" and "Very High". Species data have been separated from ecosystem/ landscape level data to provide for huge complexities in the species data, in addition to the high numbers of threatened species within South Africa that would need to be processed for inclusion into the screening tool. As such, it was decided to keep the species data separate for simpler integration within the Screening Tool. It should also be noted that the species guilds that will be covered in the Animal Species Protocol include mammals, reptiles, amphibians, butterflies and birds. A summary of the datasets used to underpin the Animal and Plant themes and their sensitivity rating are provided in Table 5 below.

Table 5: Summary of the datasets used to underpin animal and plant themes and the sensitivity rating of these features.

Plant and/or Animal Species Theme **Data Sets Used**	**Sensitivity**
Critical habitat for range restricted species of conservation concern that have a global range of less than $10km^2$.	**Very High**
Confirmed habitat for species of conservation concern.	**High**
Suspected habitat for species of conservation concern based either on there being records for this species collected in the past prior to 2020 or being a natural area included in a habitat suitability model.	**Medium**
Areas where no natural habitat remains.	**Low**

1.1. Description of Sensitive Aquatic Features, As Identified Within the Environmental Screening Tool:

According to the Screening Report generated on the 24th of October 2023 (01:08:32) the following sensitivities (aquatic biodiversity sensitivity) were identified within the project area (Table 6 and Figure 4):

Table 6: Summary of the development site's environmental sensitivities.

Theme	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity
Aquatic Biodiversity Theme	X			

Figure 4: DFFE Screening Tool extract for the proposed Collector Substation: Aquatic Biodiversity Sensitivity.

A description of the applicable theme (aquatic biodiversity theme) and their sensitivities are provided below in Table 7. Take note that this study and report addresses the only the aquatic biodiversity theme, the terrestrial biodiversity, plant and animal themes are dealt with in a separate report.

Table 7: Applicable themes and their listed sensitivities for the proposed Collector Substation.

Sensitivity	Feature(s) in Proximity
THEME: Animal Species	
Low Sensitivity	Present
Medium Sensitivity	None
High Sensitivity	None
Very High Sensitivity	Present: » ESA 1 (Natural Modelled Instream Wetland) » ESA 2 (Transformed, Un-natural Modelled Instream Wetland)

The following is deduced from the DFFE National Environmental Screening Tool:

» The Aquatic Biodiversity Theme is mostly "Low" (96.2%) with a small portion of the grid corridor that will traverse a "Very High" sensitive area (<4% ha) falling within a *W2_ESA1* and *W2_ESA2 (Modelled Instream Wetlands)*;

During the site assessment the PAOI was physically screened for the presence of these, and other possible aquatic/wetland features, or sensitivities that are not identified in the screening tool, and the findings of the site assessment will be discussed within this report.

5. DESKTOP ANALYSIS

5.1. Potential Area of Influence (PAOI)

The proposal is to develop a solar PV facility on site, along with associated infrastructure. Anticipated impacts will mostly occur during the construction phase, with few discernible effects anticipated during operation. These impacts are generally not expected to extend beyond the boundaries of the infrastructure footprint within the study area. An impact that could possibly extend beyond the study area boundary is water runoff, which usually results in hydrological changes to drainage areas and their associated habitats. Due to fairly dense vegetation coverage, as well as the flat topography of the area (slope <1%), it is unlikely that a change in runoff will impact an extensive area outside of the development footprint, and as such the potential area of influence for aquatic biodiversity are thus the development footprint as well as a buffer area of 200m, downslope of the development footprint (Figure 7).

5.2. Regional/Local Biophysical Setting

The entire study site (potential areas of influence) is located within the Crocodile (West) and Marico Water Management Area and within two Quaternary Drainage Regions (QDRs) namely:

- A22D (total size of QDR: 66474 ha); and
- A22F (total size of QDR: 168832.3 ha)

The proposed development will impact very small area of these QDRs (especially QDR A22F) (Figure 5). Almost the entire project site is located within the Sub-Quaternary Drainage Region A22D-941 with a very small portion of the grid corridor expanding into Sub-Quaternary Drainage Region A22F-867 (Figure 6).

5.2.1.1. Quaternary Drainage Region A22F

Within QDR A22F (168832.30 ha), the primary drainage feature is the Elands River flowing in an east to north-east direction to eventually feed into the Crocodile River (Figure 5). The Elands River is approximately 202.7 km in length with approximately 33 km located within the A22F QDR. The Elands River bisects the QDR in to parts namely the, southern and northern halves with the northern comprising of numerous shorter tributaries that mostly flow in a north-east to south-west direction through more undulating areas. The watercourses within the southern half of the QDR, are slightly less numerous, tend to be longer and flow in a mostly south-west to north-eastern direction. This river is seasonal to perennial, with flows likely to size for short periods of time during the driest parts of the year (CSIR, 2018) (Van Deventer, et al., 2018) ((DWAF), 2006). Furthermore, this river, in terms of its geomorphological position or zone can be classified as a lower foothill river with a gradient of between 0.001-0.005. The valley form of this river is typically V4 (confined valley floodplain) and occasionally form wider, less contained floodplains (V2: flood plain confined on one side (Rowntree & Wadeson, 1999)). The confined valley floodplains are also typically fringed by a fairly dense, wooded riparian fringe. This river also contains fairly numerous instream dams, impacting the natural flow and flooding patterns. Tree instream dams are located within QDR A22F. Furthermore, the Elands River is fed by numerous north-west to south-east and south-east to north-west flowing, intermittent watercourses.

As mentioned, the project site will impact Sub-Quaternary Drainage Region A22F-919 (8324.5 ha) (Figure 6).

The Elands River and associated tributaries have been cumulatively classified as being Moderately Modified (PESS: C) by DWS in 1999, however according to a more recent survey (NBA, 2018), using different methods and techniques[1], the Present Ecological State/Ecological Importance/Ecological Sensitivity (PESEIS) of this freshwater resource feature as well its tributaries (at a sub-quaternary level), were classified as:

» **Present Ecological State (PES)**: D - *Largely Modified* with a large loss of natural habitat, biota and basic ecosystem functions that have occurred.

  - The potential instream habitat continuity and connectivity has been largely modified through various small farm dams and weirs (physically obstructing natural flow and resulting in unnatural inundation patterns), these dam features has also resulted in flow modifications, especially in terms low flow patterns). These modifications have had, in some areas, a clear detrimental impact on habitat quality, diversity, size and variability. Large natural areas along the river, however, still persist.
  - The potential instream habitat has furthermore, been seriously impacted in some localities, with the extent and significance of the impacts on habitat quality, diversity, size and variability being fairly limited. Instream habitat types (runs, rapids, riffles, pools) may have changed in frequency (temporal and spatial). Land use/land cover (erosion, sedimentation, overgrazing and

[1] The methods used for assessing the ecological condition of the river ecosystem types differed from the NBA 2011 in that Present Ecological State (PES) categories were not modelled in the NBA 2018. The river condition data was determined by using (DWS, 2014) Present Ecological State/Ecological Importance/Ecological Sensitivity (PES/EI/ES) (also referred to as PES/EIS) data, which included mainstems and tributaries at a sub-quaternary level. These desktop data were updated with data that became available between 2011 and 2017. The ecological category was either updated or remained unchanged depending on which assessment was most recent (Van Deventer, et al., 2019)

abstraction) as well as the presence of weirs and dams indicate habitat modification.

- As mentioned, the flow and flooding character and regime have been largely impacted due to the presence of especially instream dams and weirs, as well as through water abstraction with agricultural return flows and sewage releases contributing to a lesser extent to these modifications.
- Physico-chemical (water quality) alterations are regarded as large, and these modifications have had, in some areas, a clear detrimental impact on habitat quality, diversity, size and variability. Large natural areas along the river, however, still persist. A reduction to the physico-chemical quality is mainly due to sedimentation, road runoff, effluent runoff, mining and urban activities.
- The wetland/riparian habitat have also been largely modified, within some location along the watercourse, resulting in structural and compositional changes that have had an impact on the functions and processes occurring in these zones. These modifications within these zones are mostly due to changes in inundation, flooding extent and physical changes as a result of the presence of numerous instream dams, agricultural activities, overgrazing, vegetation removal and to a lesser extent, alien invasive plants.
- In terms of riparian/wetland habitat continuity/connectivity, modifications are present at small numbers of localities and the impact on habitat quality diversity, size and variability are still fairly limited. Physical fragmentation is mainly due to the instream dams, whilst agricultural practices (cultivation, game farming), roads and urban areas have had a smaller, less significant impact on habitat fragmentation.

» **Ecological Importance (EI)**: High - According to the PES/EIS assessment this freshwater resource feature as well as its associated tributaries (within the affected Sub-Quaternary Drainage Region) are of high ecological importance (EI) comprising:

- Natural, undisturbed riparian and wetland vegetation cover, which is regarded of fairly low ecological importance (most of the aquatic and riparian flora as well as faunal species associated with these areas are common and ubiquitous within the region). Due to the fact that almost the whole Eland river is inundated, these habitats associated with the Elands River are not as sensitivity to flow changes, however, the smaller intermittent streams are more sensitive the such changes. Main habitats include:
  - Surface flows;
  - Riparian corridors; and
  - small natural areas

- A fairly high ecological importance in terms of vertebrate biodiversity (most species are fairly common and/or abundant within the region);
  - Total number of vertebrate spp. in secondary catchment: 100;
  - Total number of vertebrate spp. in sub-quaternary catchment: 16;

- Total number of invertebrate taxa in sub-quaternary catchment: 44 (high invertebrate representivity per secondary class (PSC) and very high invertebrate rarity PSC);
- Total number of fish spp. in sub-quaternary catchment: 12 (moderate representivitty PSC with a very high fish rarity PSC);

- Instream migration linkages are regarded of moderate sensitivity;
- Riparian-wetland zone migrations lingages are regarded of high sensitivity;
- Riparian-wetland zone habitat integrity area regarded of moderate Sensitivity; and
- Instream habitat integrity are regarded of low sensitivity

» **Ecological Sensitivity (ES**): Moderate - In terms of the Ecological Sensitivity (ES) this freshwater resource feature as well as its associated tributaries (within the affected Sub-Quaternary Drainage Region) are of moderate ecological sensitivity due to:

- Vertebrates (excluding fish) inhabiting the riparian-wetland-instream habitats, being of low sensitivity in terms of intolerance/tolerance towards water/flow level changes: Most of the riparian-wetland-instream vertebrates being either highly mobile or are not solely dependent on water within the region;
- Riparian-wetland vegetation being of *low* sensitivity (tolerant) towards water level changes.
  - 95 taxa have been observed;
  - 34% are marginal zone riparian obligates, permanent or seasonal wetland obligates and/or aquatic species.

- In terms of fish species, the twelve species potential inhabiting this portion of the river are regarded as:
  - High sensitive to changes in physico-chemical changes (Species that can survive and breed under moderately modified physico-chemical conditions)
  - High sensitive to changes in flow and especially no-flow (Species requiring flow during certain phases of the life-cycle - to breed in particular habitats (often fast flows) for instance, or make nursery areas with suitable cover available. Generally, increased habitat suitability and availability resulting from increased flow can be expected to benefit such species. Flow will stimulate breeding activities and stimulate migration.).

- In terms of invertebrate species, the species potential inhabiting this portion of the river are regarded as:
  - High sensitive to changes in physico-chemical changes (Species that can survive and breed under moderately modified physico-chemical conditions)
  - Very High sensitive to flow velocity as well as no-flow changes in flow and especially no-flow (Species requiring flow during all phases of the life-

cycle. Often prefer fast flow and clear water and use these conditions both for breeding and feeding purposes).

5.2.1.2. Quaternary Drainage Region A22D

Within QDR A22D (66474 ha), the primary drainage feature is the Selons River flowing in a north to north-west direction to eventually feed into the Elands River (Figure 5). The Selons River is approximately 77.1 km in length with approximately 33.5 km located within the A22DQDR. Smaller tributaries within this QDR are few with and tend to flow in north-east and north-west direction. This river is seasonal to perennial, with flows likely occurring occasionally for short periods of time during sufficient rainfall events (CSIR, 2018) (Van Deventer, et al., 2018) ((DWAF), 2006). Furthermore, this river, in terms of its geomorphological position or zone can be classified as a lower foothill river with a gradient of between 0.001-0.005. The valley form of this river is typically V4 (confined valley floodplain) and occasionally form wider, less contained floodplains (V2: flood plain confined on one side (Rowntree & Wadeson, 1999)). The confined valley floodplains are also typically fringed by a fairly dense, wooded riparian fringe. This river also contains fairly numerous instream dams, impacting the natural flow and flooding patterns. Two instream dams are located within QDR A22D.

As mentioned, the project site will impact Sub-Quaternary Drainage Region A22D-941 (4002 ha) (Figure 6).

The Selons River and associated tributaries have been cumulatively classified as being Moderately Modified (PESS: C) by DWS in 1999, this was confirmed during a more recent survey (NBA, 2018), The Present Ecological State/Ecological Importance/Ecological Sensitivity (PESEIS) of this freshwater resource feature as well its tributaries (at a sub-quaternary level), were classified as:

» **Present Ecological State (PES)**: D - *Moderately Modified* with a loss and change of natural habitat and biota that have occurred, but the basic ecosystem functions are still predominantly unchanged.

- The potential instream habitat continuity and connectivity has been moderately modified. The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are also limited. A few small farm dams, weirs as well as low water crossings (physically obstructing natural flow and resulting in unnatural inundation patterns) are present along the reaches of this river, these features have also resulted in flow modifications, especially in terms low flow patterns, as well as the moderate disturbance of the ben and channel.
- The potential instream habitat has furthermore, been moderately impacted in some localities. Instream habitat types (runs, rapids, riffles, pools) may have changed in frequency (temporal and spatial). Land use/land cover (erosion,

sedimentation, overgrazing, alien plant invasion, and abstraction) as well as the presence of weirs and dams indicate habitat modification.

- As mentioned, the flow and flooding character and regime have been largely impacted due to the presence of especially instream dams, weirs, low water crossings, as well as through water abstraction with agricultural return flows contributing to a lesser extent to these modifications.
- Physico-chemical (water quality) alterations are regarded as moderate, and these modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are also limited. A reduction to the physico-chemical quality is mainly due to sedimentation and road runoff.
- The wetland/riparian habitat have also been moderately modified, within some location along the watercourse, resulting in structural and compositional changes that have had an impact on the functions and processes occurring in these zones. These modifications within these zones are mostly due to changes in inundation, flooding extent and physical changes as a result of the presence of instream dams, agricultural activities, overgrazing, vegetation removal and to a lesser extent, alien invasive plants.
- In terms of riparian/wetland habitat continuity/connectivity, modifications are present at small numbers of localities and the impact on habitat quality diversity, size and variability are still fairly limited. Physical fragmentation is mainly due to the instream dams, whilst agricultural practices (cultivation, game farming) and roads have had a smaller, less significant impact on habitat fragmentation.

» **Ecological Importance (EI)**: Moderate - According to the PES/EIS assessment this freshwater resource feature as well as its associated tributaries (within the affected Sub-Quaternary Drainage Region) are of Moderate ecological importance (EI) comprising:

- Natural, undisturbed riparian and wetland vegetation cover, which is regarded of fairly low ecological importance (most of the aquatic and riparian flora as well as faunal species associated with these areas are common and ubiquitous within the region). Main habitats include; small stream, riparian corridor, some sand banks and grassy edges. Main adverse conditions include; dams, agriculture, vegetation removal.
- A fairly high ecological importance in terms of vertebrate biodiversity (most species are fairly common and/or abundant within the region);
  - Total number of vertebrate spp. in secondary catchment: 100;
  - Total number of vertebrate spp. in sub-quaternary catchment: 23;
  - Total number of invertebrate taxa in sub-quaternary catchment: 44 (high invertebrate representivity per secondary class (PSC) and very high invertebrate rarity PSC);
  - Total number of fish spp. in sub-quaternary catchment: 10 (moderate representivitty PSC with a very high fish rarity PSC);

- Instream migration linkages are regarded of High sensitivity;
- Riparian-wetland zone migrations linkages are regarded of High sensitivity;
- Riparian-wetland zone habitat integrity area regarded of High Sensitivity; and
- Instream habitat integrity are regarded of High sensitivity

» **Ecological Sensitivity (ES)**: Moderate - In terms of the Ecological Sensitivity (ES) this freshwater resource feature as well as its associated tributaries (within the affected Sub-Quaternary Drainage Region) are of moderate ecological sensitivity due to:

- Vertebrates (excluding fish) inhabiting the riparian-wetland-instream habitats, being of high sensitivity in terms of intolerance/tolerance towards water/flow level changes.
- Riparian-wetland vegetation being of *low* sensitivity (tolerant) towards water level changes.
  - 89 taxa have been observed;
  - 34% are marginal zone riparian obligates, permanent or seasonal wetland obligates and/or aquatic species.
- In terms of fish species, the ten species potential inhabiting this portion of the river are regarded as:
  - High sensitive to changes in physico-chemical changes (Species that can survive and breed under moderately modified physico-chemical conditions)
  - High sensitive to changes in flow and especially no-flow (Species requiring flow during certain phases of the life-cycle - to breed in particular habitats (often fast flows) for instance, or make nursery areas with suitable cover available. Generally, increased habitat suitability and availability resulting from increased flow can be expected to benefit such species. Flow will stimulate breeding activities and stimulate migration.).

- In terms of invertebrate species, the species potential inhabiting this portion of the river are regarded as:
  - High sensitive to changes in physico-chemical changes (Species that can survive and breed under moderately modified physico-chemical conditions)
  - Very High sensitive to flow velocity as well as no-flow changes in flow and especially no-flow (Species requiring flow during all phases of the life-cycle. Often prefer fast flow and clear water and use these conditions both for breeding and feeding purposes).

In terms of wetland features, the NBA Wetland Map 5 (SANBI, 2018) has mapped a total of one hundred and eighty five (185) wetland features within the affected QDRs, with seepage wetlands being the most numerous with one hundred and sixty one (161) being mapped covering a collective area of over 6123.9 Ha (Figure 5). Most of these seepage wetlands are associated with smaller tributaries of the Elands and Selons Rivers and it is likely that most of these features are intermittent watercourses or even channelled valley-bottom wetlands rather than seepage wetlands. Wetland features make up a very small total of the QDRs' land cover (<0.01%). Most of these wetland features have been significantly impacted and transformed, with one hundred and ten (110) wetland features being Largely to Critically Modified (PES D/E/F). The most significant impacts are instream dams, overgrazing and trampling, agricultural activities, roads, erosion, sedimentation and informal settlements. Only thirteen wetland features have been classified as Natural to Largely Natural (PES: A/B). Furthermore, according to SANBI's (2018) artificial wetland database, a total of seven hundred and fifteen (715) artificial wetland features were identified within the affected QDRs, with most of these features being small dam (668 small dams).

According to SANBI' River and Wetland data bases (SANBI, 2018), no watercourse or wetland features are located within the Potential Area of Influence (PAOI), with a small section of the Selons River (also classified as a channelled valley-bottom wetland) located within the DWS Regulated Area (Figure 7). It its closed point the project site is located approximately 238.3 m from the Selons River. Furthermore, according to SANBI's NWM (2018) this channelled valley-bottom wetland, associated with the Selons River, is regarded as being Largely to Critically Modified (PES: D/E/F), as mentioned mainly due to instream dams, trampling and overgrazing, erosion and roads.

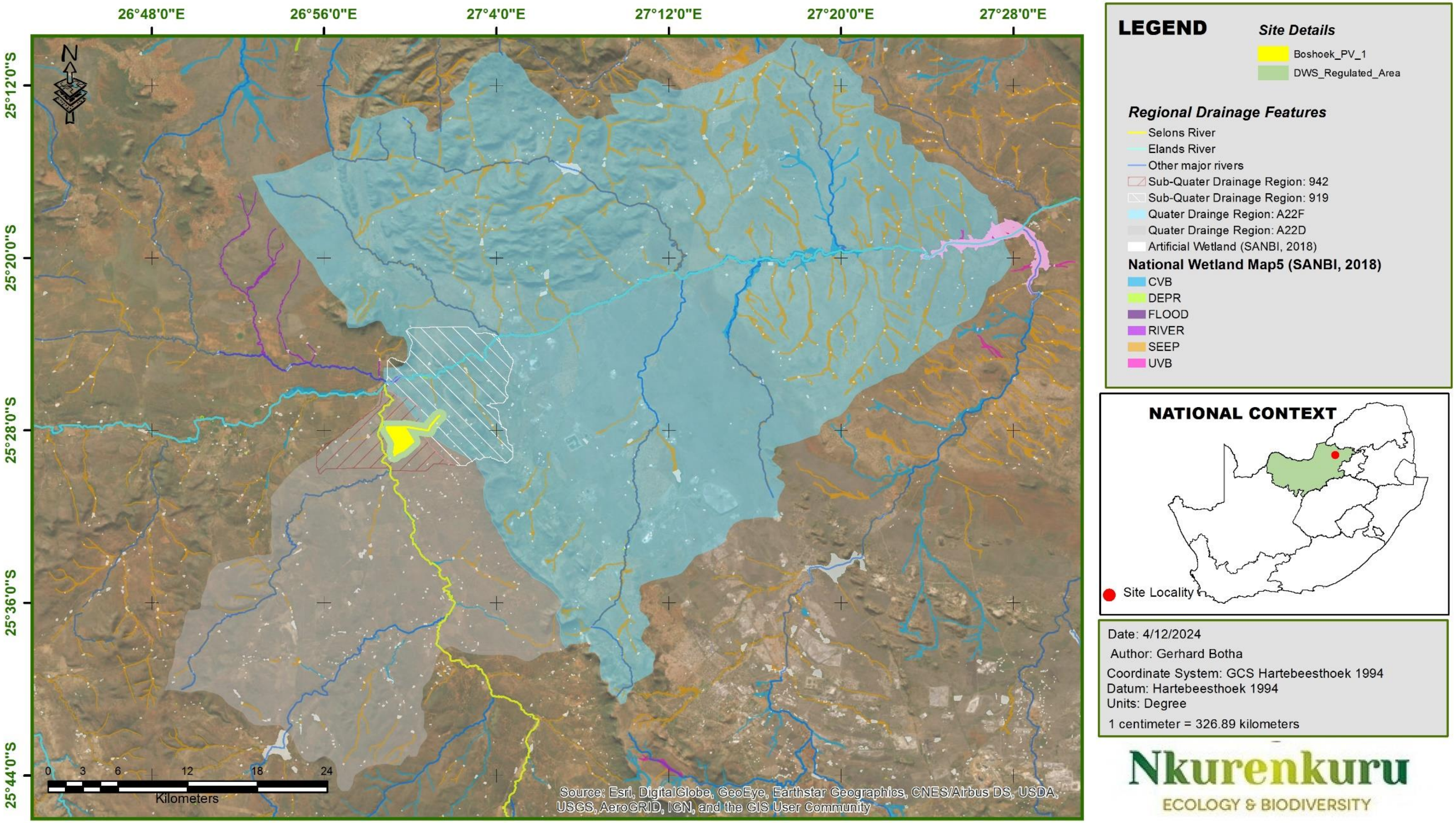

Figure 5: Regional drainage setting (Focusing on the affected Quaternary Drainage Regions).

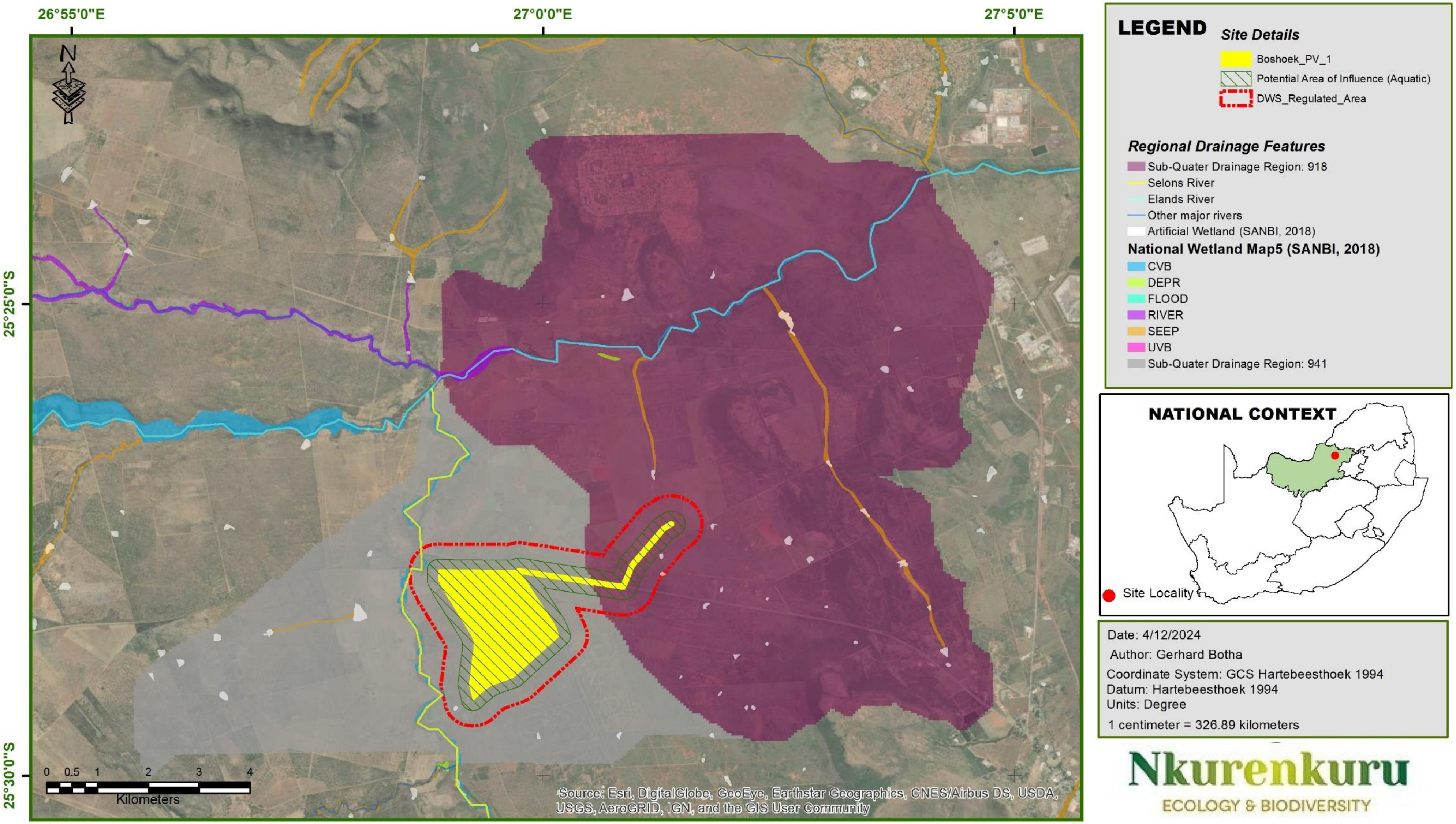

Figure 6: Regional drainage setting (Focusing on the drainage features located within the Sub-Quaternary Drainage Areas).

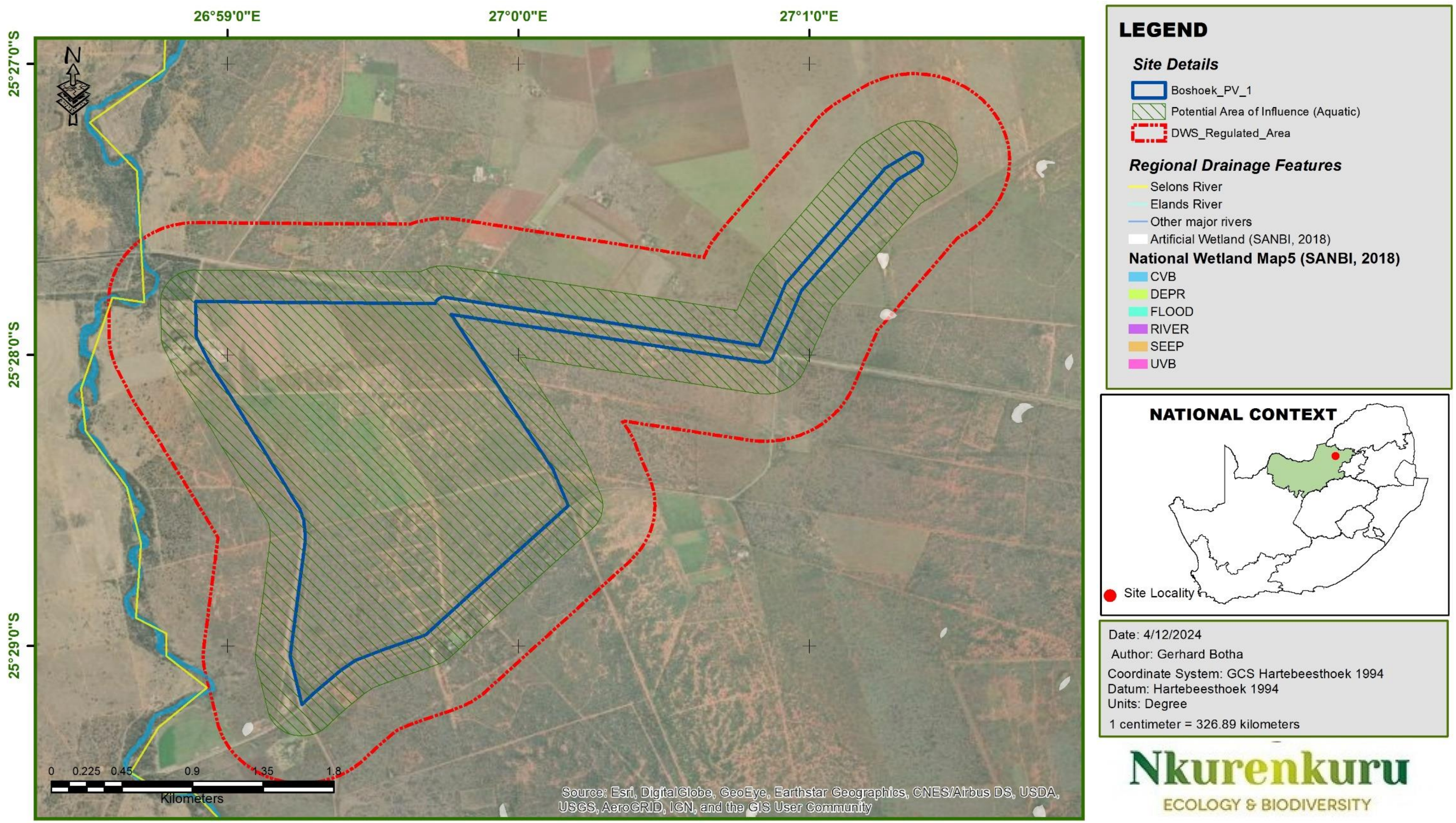

Figure 7: Regional drainage setting (Focusing on the drainage features mapped within the PAOI as well as immediate surroundings).

The Hydrological Characteristics of the project site are summarised as follows:

- Mean Annual Precipitation = Low to moderate - 592.25 mm (min: 584 mm; max: 602 mm);
- Mean Annual Runoff = Moderate-low to moderate - 13.6 mm; and
- Mean Annual Evaporation = 2200 - 2600 mm;
- Stream frequency = Low to medium

The PAOI is located across two Ecoregions, with the bulk of the PAOI located within the Western Bankenveld Level 1 Ecoregion (7.05 level 2 Ecoregion) and a small portion of the grid corridor located within the Bushveld Basin Level 1 Ecoregion (8.05 level 2 Ecoregion) (Kleynhans, et al., 2005).

Furthermore, the PAOI is located across two geomorphic provinces (Partridge, et al., 2010), with the bulk of the PAOI located within the Southern Bankenveld Geomorphic Province, whilst a small portion of the grid corridor is located within the Western Transvaal Basin Geomorphic Province (these two geomorphic provinces corresponds largely to the distribution of the two ecoregions described above).

- The Western Transvaal Basin represents the western part of the Transvaal Basin which has been intruded by the rocks of the Bushveld Complex and as a consequence, the province is characterised by considerable topographical diversity. The centripetal dip of these rocks was imparted by the emplacement of the igneous rocks that occupy much of the province’s floor. Along parts of the rim, recent faults (Partridge, 1998), some still active today and many associated with thermal springs, show that the basin floor has subsided by as much as 400 m in places (particularly in the northeast) (McCarthy & Rubidge, 2005). Much of the floor has limited relief, the landscape being dominated by a sprinkling of steep hills separated by wide, gentle pediments. The relief is particularly subdued on the Springbok Flats, where the Bushveld rocks are overlain by Karoo basalt. This low-relief area coincides with the Post-African I erosion surface (Partridge & Maud, 1987). Here, both the valley cross-sectional and longitudinal profiles of rivers are very gentle. The concave longitudinal profiles of the five main river systems (Marico, Crocodile, Elands, Mokgalakwena and Olifants) that drain the Western Transvaal Basin reflect the imprint of lithology, structure and neotectonics. There is no clear trend from west to east or north to south, although in the extreme west of the basin, flatter slopes and broader valley cross-sectional profiles are evident (Table 7). However, the rivers are uniform in their longitudinal profile, with flat or medium slopes and wide or broad valley cross-sectional profiles (Table 5), so that the sediment storage surrogate descriptors are predominantly WF (high sediment storage capability) and BM (high sediment storage capability). However, there is significant heterogeneity in terms of the BFCs, (Macro-reach Best Fit Curves) with river longitudinal profiles displaying linear, logarithmic and exponential BFCs.
- The Bankenveld Province is characterised by northern and southern arms separated by the Western Transvaal Basin. It is made up of cuestas formed by parallel quartzite ridges and shale-filled valleys the existence of which is controlled by the

contrasting resistance of strata within the Pretoria Group of rocks. The crests of the ridges probably belong to the African surface, while the valleys are Post-African I surfaces (Partridge & Maud, 1987). The ridges are asymmetrical with dip slopes towards the centre of the Western Transvaal Basin. Two main river systems, the Marico and Crocodile, cut orthogonally through the Northern and Southern Bankenveld as a result of superimposition from an original Karoo covering. A trellis drainage pattern is evident due to the erosion of the softer sediments in the valleys. The west–east orientation of the province and the north-south traverse of the rivers means that the extent of these rivers across the province is short (~15 to 57 km). The sections that traverse the Southern Bankenveld are significantly steeper and narrower than in the northern section. The rivers traversing the Southern Bankenveld have narrow and medium valley cross-sectional profiles and very steep to steep slopes. As might be expected, this is reflected in the sediment storage surrogate descriptors which are NV (very low sediment storage capability) and MS (low sediment storage capability) in the south. The Southern Bankenveld rivers are also associated with exponential and linear BFCs.

5.3. Land Use

The affected properties are almost entirely used for game ranching with very limited infrastructure, mainly restricted to access roads, bomas, kraals, water and feeding points for game and livestock, and the occasional homestead. Land-use within the surrounding properties are also similarly and predominantly utilized for game ranching.

Livestock farming was historically the main land use practise within the area, with varying stocking rates and grazing regimes implemented. It however appears that the farms were historically fairly small and utilized as grazing for predominantly cattle and occasionally a mixture between cattle and sheep. Stocking rates appears to have varied between moderate to high rates with continuous grazing to rotational grazing systems utilized, with the exclusion of fire (natural or as a management tool). This has likely resulted in the current overgrazed and transformed situation observed on certain properties, with bare, exposed soils locally present and subjected to soil capping and sheet erosion. These historical management practices have also resulted in the encroachment of small to shrubby, thorny bushes, which have been occasionally cleared and thinned out over the last 30 – 50 years (these management practices are present within almost all of the properties). However, since the transition to game breeding, large areas have been subjected to significant modifications, with the areas being cordoned off in small game breeding camps, with large scale bush clearing and in some areas the ripping, tilling and planting of palatable grasses such as Cenchrus ciliaris, *Urochloa mosambicensis, Digitaria argyrograpta* and *Dichanthium annulatum.* These areas should rather be regarded as pastures than natural grazing lands.

5.4. Conservation Planning / Context

Understanding the conservation context and importance of the study area and surroundings is important to inform decision making regarding the management of the aquatic resources in the area. In this regard, national, provincial, and regional conservation planning information available and was used to obtain an overview of the study site (Table 8).

Table 8: Information and data coverages used to inform the ecological assessment.

Conservation Planning Dataset	Relevant Conservation Feature	Location in Relationship to Project Site	Conservation Planning Status
Strategic Water Source Areas.	Areas with high groundwater and/or surface water availability and of national importance	Well outside of any Strategic Water Source Area	Not Classified
National Freshwater Ecosystem Priority Area	River FEPAs (priority sub quaternary drainage areas)	Both affected Sub Quaternary Drainage Regions (SQDRs) are regarded as Non-FEPA Catchments	Not Classified
	NFEPA Rivers	No FEPA-Priority rivers drain the affected SQDRs. » The primary drainage features within these SQDRs are the Elands River and the Selons River. » The project site is located approximately 0.36 km west of Selons River and approximately 2.62 km south-east of the Elands River. » Both of these rivers are not listed as priority rivers within the NFEPA data base. » Furthermore, both of these rivers are in a Moderately Modified condition (PES = C) and are poorly conserved (NBA, 2018). » According to the NFEPA database no watercourse features are located within the Aquatic PAOI. » A small portion of the Selons River flows through the north-western corner of the DWS Regulated Areas.	Not Classified
	NFEPA Wetlands	According to the NFEPA spatial data: » No wetland feature is located within the Aquatic PAOI; » Three artificial wetland features (dams) are however located within the DWS Regulated area; » The closes FEPA-Priority wetland is located approximately 9.7 km to the south-west of the PAOI. » The closes non-FEPA natural wetland: 2.95 km to the north-west. » The closest FEPA-priority wetland: 15.67 km to the south.	Not Classified

Conservation Planning Dataset		Relevant Conservation Feature	Location in Relationship to Project Site	Conservation Planning Status
Provincial Conservation and Distribution Context	NWBSP 2015: Aquatic Critical Biodiversity Areas and Ecological	CBA 1	No Aquatic CBA 1 features located within the PAOI or DWS Regulated Area	Not Classified
		CBA 2	No Aquatic CBA 2 features located within the PAOI or DWS Regulated Area	Not Classified
		ESA 1	W2: Modelled natural stream and wetland features. » According to the NWBSP CBA spatial data the grid corridor will cross a modelled watercourse.	ESA 1
		ESA 2	W2: Modelled non-natural/modified streams and wetland features. » Portions of the above-mentioned modelled watercourse have been modified/disturbed, and these portions will also be crossed by the proposed grid corridor.	ESA 2

5.4.1. Strategic Water Source Areas (SWSAs)

Strategic Water Source Areas (SWSAs) are defined as areas of land that either:

- supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important;
- have high groundwater recharge and where the groundwater forms a nationally important resource;
- areas that meet both criteria mentioned above.

They include transboundary Water Source Areas that extend into Lesotho and Swaziland.

The project site is located well outside of any SWSA (groundwater and surface water) and as such the proposed development will not impact such areas.

5.4.2. National Freshwater Ecosystem Priority Areas (2011) Database

The National Freshwater Ecosystems Priority Areas (NFEPA) (2011) database provides strategic spatial priorities for conserving South Africa’s freshwater ecosystems and supports the sustainable use of water resources. The spatial priority areas are known as Freshwater Ecosystem Priority Areas (FEPAs).

FEPAs were identified based on:

- Representation of ecosystem types and flagship free-flowing rivers.
- Maintenance of water supply areas in areas with high water yield.
- Identification of connected ecosystems.
- Preferential identification of FEPAs that overlapped with:
  - Any free-flowing river
  - Priority estuaries identified in the National Biodiversity Assessment 2011.

- Existing protected areas and focus areas for protected area expansion identified in the National Protected Area Expansion Strategy.

FEPA maps show various categories, each with different management implications. The categories include river FEPAs and associated sub-quaternary catchments, wetland FEPAs, wetland clusters, Fish Support Areas (FSAs) and associated sub-quaternary catchments, fish sanctuaries, phase 2 FEPAs and associated sub-quaternary catchments, and Upstream Management Areas (UMAs).

A review of the NFEPA coverage for the study area (Figure 8 and Figure 9) revealed that the PAOI will be located within two Sub-Quaternary Drainage Regions (SQDRs), both of which are **not** regarded as FEPA-priority SQDRs as they **do not** contain any FEPA-priority rivers (Nel, et al., 2011). Furthermore, the Elands River and the Selons River, both of which are Non-FEPA rivers) are the primary drainage features within these SQDRs. The closest natural freshwater feature as identified within the NFEPA data base is the Selons River (perennial river), which is located approximately 0.36 km to the west of the project site (outside of the Aquatic PAOI), flowing in a south to north direction, feeding into the Elands River (perennial river), approximately 3 km to the north of the project site (Figure 8 and Figure 9). Thus, according to the NFEPA data base, **no** watercourse features are located within the proposed PAOI, however a small portion of the Selons River flows through the northwestern corner of the DWS Regulated Area (Nel, et al., 2011).

In terms of freshwater wetlands, the NFEPA data base has listed/mapped **no** wetland features within the PAOI (Figure 9), whilst in terms of the DWS Regulated Area, three (3) artificial wetland features (dam features) are located within this area whilst no natural wetland features have been mapped within the DWS Regulated Area. This closes FEPA-priority wetland is located approximately 9.7 km to the south-west of the PAOI (Nel, et al., 2011).

It is also important to consider/compare SANBI's 2018 wetland map. This map has delineated the same aquatic features within the DWS Regulated Areas (Figure 7), namely the three artificial wetland features (dams) as well as the small portion of the Selons River. SANBI has however mapped the Selons River as a channelled valley-bottom wetland. No aquatic features have been identified within the PAOI.

During the in-field screening survey, it was confirmed that no wetland features are located within the PAOI. However, a small drainage line has been identified and delineated within the northeastern portion of the PAOI. This small drainage line flows in a northern direction towards a small a small intermittent stream, which is a small tributary of the Elands River. Only the grid corridor will potentially impact this watercourse feature. Within the DWS Regulated area nine (9) gravel dam features (non-natural wetland areas), two highly degraded drainage lens were identified and delineated. Furthermore, two small portions of the Selons River are located within the DWS regulated area (outside of the project site) (refer to Figure 9). In terms of the PAOI for the grid corridor options, no wetland features were identified. The feature mapped as a seepage wetland within the SANBI Wetland Map (2018) contained no wetland indicators (soil form and soil wetness) and should rather be classified as an intermittent stream with alluvial soils and with a clear primary channel and a riparian woodland fringe. Apart from this intermittent stream, one other intermittent stream (with less prominent channel and a narrow riparian woodlands) has been delineated within the PAOI (both grid corridor options will also cross this watercourse). Additionally, five smaller drainage lines with no riparian fringes have been delineated within the PAOI (refer to Figure 12).

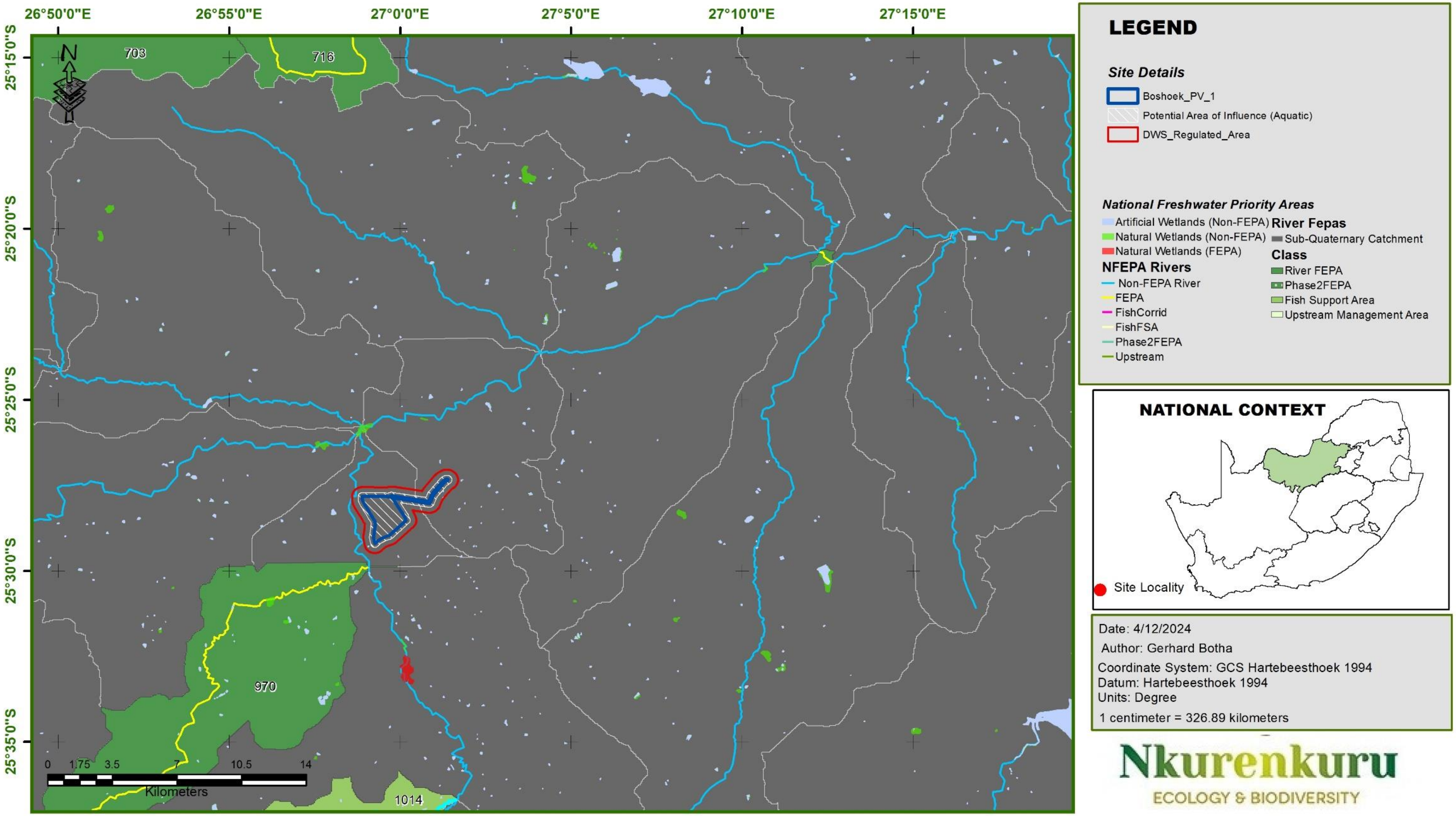

Figure 8: Map showing the location of the study site relative to the Freshwater Ecosystem Priority Areas (FEPAs).

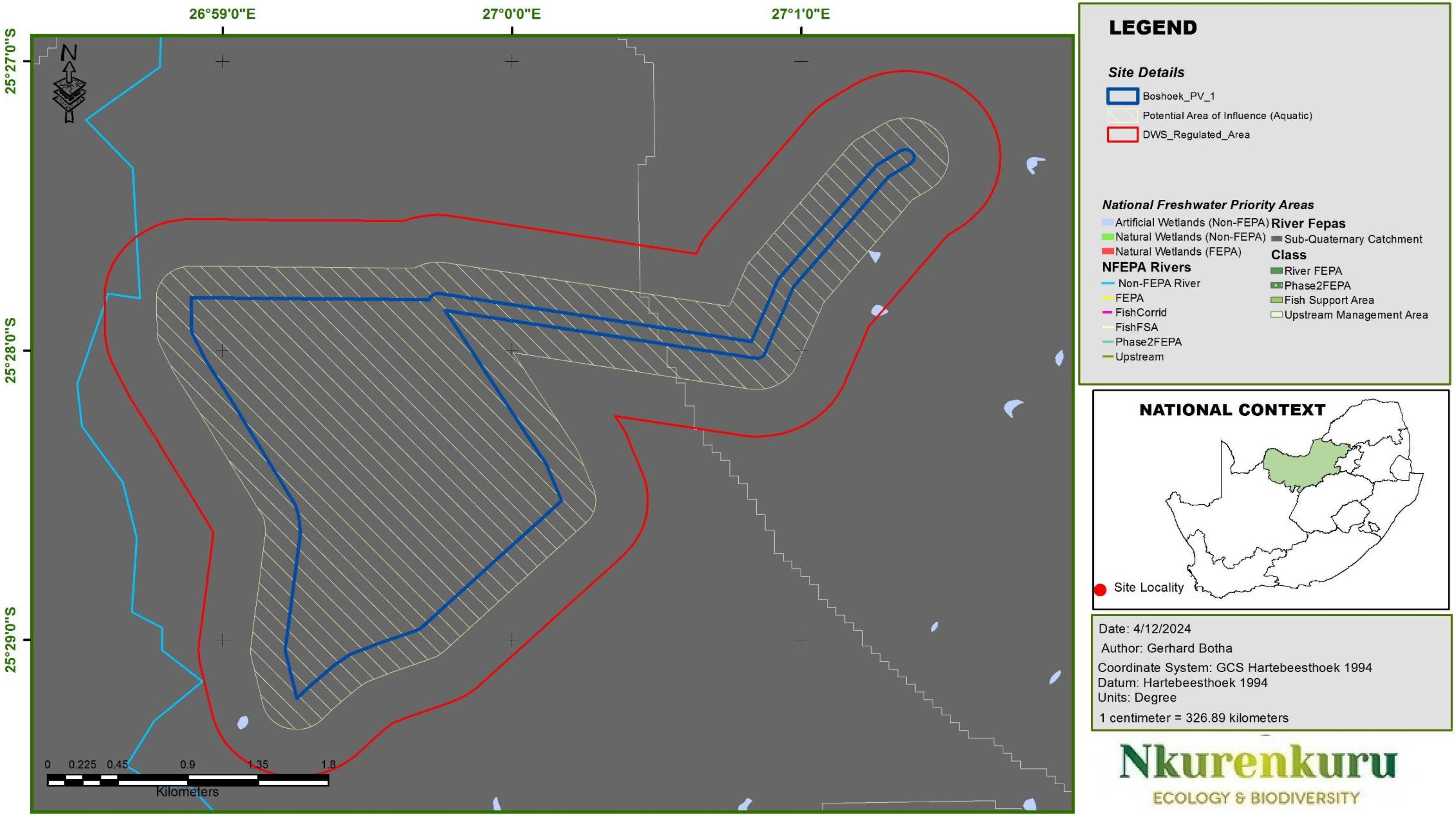

Figure 9: Map showing the location of the study site relative to the Freshwater Ecosystem Priority Areas (FEPAs) – Focused in features within the PAOI and immediate surroundings.

5.4.3. Critical Biodiversity Areas and Broad Scale Ecological Processes

The North West Biodiversity Sector Plan 2015 (NWBSP) is a plan developed by the North West Department of Rural, Environment and Agricultural Development (READ) and replaces the 2009 North West Biodiversity Conservation Assessment (DACERD, 2009). The North West Department of Rural, Environment and Agricultural Development (READ), as custodian of the environment in the North West, is the primary implementing agent of the Biodiversity Sector Plan. The spatial component of the Biodiversity Sector Plan is based on systematic biodiversity planning undertaken by READ. The purpose of a Biodiversity Sector Plan is to inform land use planning, environmental assessments, land and water use authorisations, as well as natural resource management, undertaken by a range of sectors whose policies and decisions impact on biodiversity. This is done by providing a map of biodiversity priority areas, referred to as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), with accompanying land use planning and decision-making guidelines (Schaller *et al*. 2015)

Freshwater Critical Biodiversity Areas (CBA) have been identified for the entire North West Province and are published by SANBI (http://bgis.sanbi.org/). This biodiversity assessment identifies CBAs representing biodiversity priority areas that should be maintained in a natural to near-natural state. CBA maps show the most efficient selection and classification of land portions to be safeguarded so that ecosystem functioning is maintained and national biodiversity objectives are met (see Figure 10, for a summary of the different freshwater features underpinning the various CBA maps and also refer to Table 9 for a summary of the land-use guidelines recommended for each feature).

Table 9: Relationship between Critical Biodiversity Areas categories (CBAs) and land management objectives.

CBA category	Desired State	Land Management Objective
CBA 1	Natural	***Maintain in a natural or near-natural state that maximises the retention of biodiversity pattern and ecological process:*** • Ecosystems and species fully or largely intact and undisturbed. • These are areas with high irreplaceability or low flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost then targets will not be met. • These are biodiversity features that are at, or beyond, their limits of acceptable change. » If land use activities are unavoidable in these areas, and depending on expert opinion of the condition of the site, a Biodiversity Offset must be designed and implemented. » Areas with intermediate irreplaceability or some flexibility in terms of the area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve targets. » Landscapes that are approaching but have not passed their limits of acceptable change.
CBA 2	Natural	***Maintain in a natural or near-natural state that maximises the retention of biodiversity pattern and ecological process:***

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		• Ecosystems and species fully or largely intact and undisturbed. • Areas with intermediate irreplaceability or some flexibility in terms of meeting biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve biodiversity targets, although loss of these sites would require alternative sites to be added to the portfolio of CBAs. • These are biodiversity features that are approaching but have not passed their limits of acceptable change. » If land use activities are unavoidable in these areas, and depending on the condition of the site, set-aside areas must be designed in the layout and implemented. If site specific data confirms that biodiversity is significant, unique or that a CR or EN species is present, Biodiversity Offsets must be implemented.
ESA 1	Functional	***Maintain in at least a semi-natural state as ecologically functional landscapes that retain basic natural attributes:*** • Ecosystem still in a natural, near-natural state or semi-natural state, and has not been previously developed. • Ecosystems moderately to significantly disturbed but still able to maintain basic functionality. • Individual species or other biodiversity indicators may be severely disturbed or reduced. • These are areas with low irreplaceability with respect to biodiversity pattern targets only.
ESA 2	Functional	***Maintain as much ecological functionality as possible:*** » For areas classified as ESA2, the following objectives apply • Maintain current land use or restore area to a natural state. • Ecosystem NOT in a natural or near-natural state, and has been previously developed (e.g. ploughed). • Ecosystems significantly disturbed but still able to maintain some ecological functionality. • Individual species or other biodiversity indicators are severely disturbed or reduced and these are areas that have low irreplaceability with respect to biodiversity pattern targets only. • These are areas with low irreplaceability with respect to biodiversity

Table 10: Criteria (aquatic biodiversity features) used to define the Aquatic Critical Biodiversity Area (CBA) Map categories (Desmet and Schaller, 2015).

CBA category	Criterion Name	Description Of Biodiversity Features Used To Define CBA Map Categories
Aquatic CBA 1	FEPA Rivers	All FEPA river lines (FEPA rivers, fish sanctuary and free-flowing rivers) as identified in NFEPA and modified by DWS National River Ecostatus Monitoring Program (REMP) and experts.
	Pans (modelled not from FEPA layer)	Modelled Wetlands: Pans, instream wetlands and riparian areas modelled from a digital terrain model.
	Important Habitats: Peat Wetlands	Peat wetlands as mapped by experts.
	Important Habitats: Dolomitic Eyes	Dolomitic eyes as mapped by experts.
Aquatic CBA 2	FEPA Rivers	100m buffer area surrounding all FEPA river lines (FEPA rivers, fish sanctuary and free-flowing rivers) as identified in NFEPA and modified by DWS National River Ecostatus Monitoring Program (REMP) and experts.
Aquatic ESA 1	FEPA Fish Catchments	Catchments supporting FEPA fish rivers. If natural.
	Wetland Clusters	Clusters of larger wetlands and pans and their collective buffer (500 m). If natural.
	Strategic water recharge areas (dolomite recharge areas)	Strategic Water Resource Areas) Dolomite Recharge Area: The karst landscape of central North West around which all major eyes emerge and based on topography is the most likely area for the dolomitic aquifer recharge zone. If natural.
	Dolomitic eyes and Tufa Points Buffers	500 m Buffers around dolomitic eyes and tufa points (Important Habitats as mapped by experts). If natural
	Peat Wetland Buffers	500m Buffers around peat wetlands (as mapped by experts). If natural.
	Modelled Wetlands	Pans, instream wetlands and riparian areas modelled from a SRTMv3 90m DEM. If natural.
Aquatic ESA 2	FEPA Fish Catchments	Catchments supporting FEPA fish rivers. If not-natural.
	Wetland Clusters	Clusters of larger wetlands and pans and their collective buffer (500 m). If not-natural.
	Strategic water recharge areas (dolomite recharge areas)	Strategic Water Resource Areas) Dolomite Recharge Area: The karst landscape of central North West around which all major eyes emerge and based on topography is the most likely area for the dolomitic aquifer recharge zone. If not-natural.
	Dolomitic eyes and Tufa Points Buffers	500 m Buffers around dolomitic eyes and tufa points (Important Habitats as mapped by experts). If not-natural
	Peat Wetland Buffers	500m Buffers around peat wetlands (as mapped by experts). If not-natural.
	Modelled Wetlands	Pans, instream wetlands and riparian areas modelled from a SRTMv3 90m DEM. If not-natural.

According to Figure 10 and Figure 11, **no** CBA1 or CBA2 aquatic features are located in close proximity to the project site. However, a few modelled watercourses mapped as either ESA1 or ESA2, have been mapped within the area. These ESAs are modelled stream or wetland features (based on SRTMv3 90 meter Digital Elevation Models), with ESA1 being natural features and ESA2 being non-natural/modified features. According to the NWBSP's CBA spatial data, a single modelled watercourse feature has been mapped that potentially cross the northern portion of the grid corridor. This modelled watercourse comprises of both ESA1 and ESA2. Apart from this modelled watercourse no other watercourse or wetland feature have been mapped within the PAOI. However, a few watercourses (seven features) have been mapped within the DWS Regulated area. Most of these watercourse features are small tributaries of the Selons River. The Selons River itself flows through small portions of the DWS Regulated Area.

Subsequently, based on the NWBSP's CBA spatial data, only the grid corridor will potentially impact an aquatic feature (modelled watercourse).

The following remarks should be considered regarding these modelled wetlands/streams.

"Wetland and watercourse areas within the North West Province have been delineated based on a digital terrain model and subsequently integrated into the North West Biodiversity Sector Plan as Ecological Support Areas (ESAs). These ESAs are categorized as either Ecological Support Areas 1, if they are in their natural state, or Ecological Support Area 2 if they have been transformed or are not in their natural condition. The modelling of stream wetlands predominantly relied on SRTMv3 90-meter Digital Elevation Models (DEM) and an array of modelling tools, with a primary emphasis on automation through an ArcGIS model and the ArcHydro tool, an ArcGIS plugin. Additionally, the Topographical Position Index (TPI) and Extract Valleys Tools in Whitebox GIS were employed to evaluate the "wetness" attributes of a given area, factoring in upstream contributing areas and slope. It's crucial to understand that these tools function as instruments to identify "potential" wetland and watercourse areas, and they are not without their shortcomings. Notably, they tend to introduce a level of inaccuracy, often leading to the overestimation of the size and extent of potential wetlands.

This methodology, process, and toolkit were fist developed and employed by Dr Nacelle Collins to construct a watercourse probability map for the Free State Province. This decision was driven by the inadequacies of existing wetland maps within the National Freshwater Ecosystem Priority Areas dataset and the province's updated land cover map, especially concerning the representation of long linear valley bottom wetlands. In both the North West Province and Free State cases, manual mapping of wetlands was and is not considered a practical solution.

The primary purpose of this mapping endeavour was threefold. Initially, it aimed to enhance the spatial coverage of existing wetland data. Secondly, it sought to rectify the misclassification of isolated non-wetland "headlands" according to the land cover data. Finally, the effort aimed to connect isolated and fragmented wetland units within the land cover map that were, in reality, part of a single linear wetland. The outcome of this wetland *modelling process resulted in a watercourse probability map for the Free State that significantly improved spatial coverage and connectivity among isolated wetland fragments while eliminating non-wetland "headlands." Nevertheless, despite the enhancements in spatial information, the dataset was still considered coarse and lacked attribute data essential for inclusion in the Free State Biodiversity Plan. Consequently, the aquatic component was excluded from the analysis.*

In the case of the North West Province, despite the presence of some inaccuracies, this spatial data plays a vital role as a reference for aquatic specialists, environmental impact assessment practitioners, and developers in assessing the likelihood of wetland or watercourse features within a specific area. Subsequently, the identification of potential wetland areas as Ecological Support Areas (ESAs) rather than Critical Biodiversity Areas (CBAs) is justified. Based on groundtruthing conducted by a wetland/aquatic specialist, these areas can either be excluded as Ecological Support Areas (if they lack confirmation as wetland areas without wetland indicators or characteristics) or promoted to Critical Biodiversity Areas (if the presence of wetland features is confirmed). In cases where such features are confirmed, it becomes essential for the wetland specialist to accurately determine the extent of wetlands, including their outer boundaries based on indicators such as soil wetness and soil form, as the modelled wetlands often exhibit a tendency to be highly inaccurate, primarily in terms of overestimation.”

During the risk screening and delineation process, which included on-site verification, of aquatic/freshwater resource features (as depicted in Figure 12), it has been ascertained that the watercourse indicated by the NWBSP’s CBA spatial data as flowing through the northern segment of the grid corridor indeed represents a narrow drainage line. Additionally, it has been verified that no other watercourse or wetland features exist within the project site.

Within the PAOI, aside from the aforementioned drainage line expected to traverse the northern segment of the grid corridor, one minor drainage line has been identified to the west, and four artificial gravel dam/reservoir features have been documented within the PAOI boundaries. Within the DWS Regulated area, two additional drainage lines and five artificial gravel dam/reservoir features have been delineated. Furthermore, it has been confirmed that the Selons River, predominantly riparian habitats, encroaches marginally into the DWS Regulated Area at two specific locations.

A detailed examination of the potential risks associated with these features and the subsequent level of assessment they will undergo are elaborated upon in Section 6 of this report.

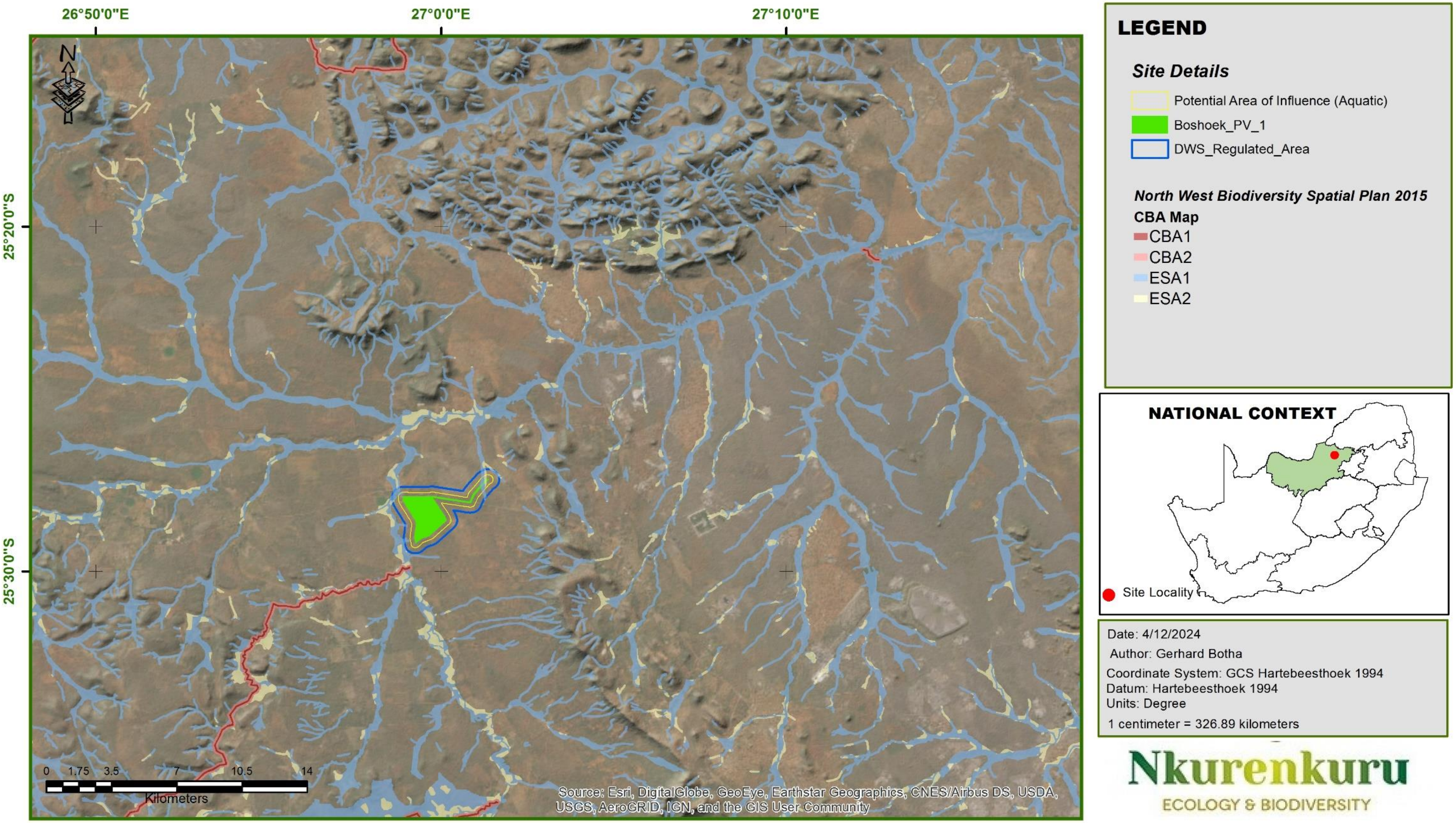

Figure 10: Provincial Level Aquatic Conservation Planning Context (Broad context).

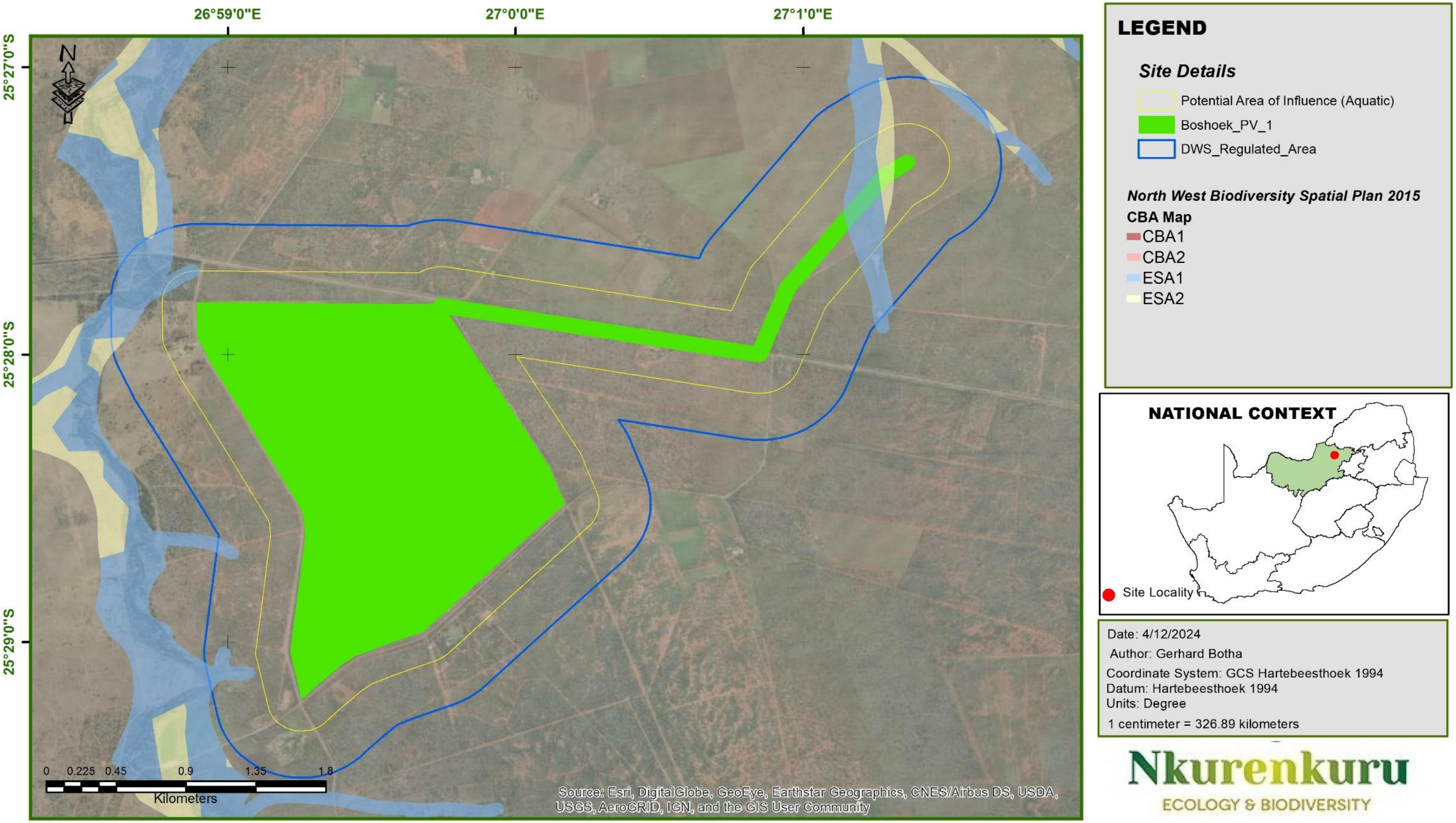

Figure 11: Provincial Level Aquatic Conservation Planning Context (Focused in on the features located within the PAOI and within the immediate surroundings).

6. AQUATIC/FRESHWATER RESOURCE BASELINE ASSESSMENT

An initial desktop mapping exercise was executed (prior to the site-visit), wherein all water resources (wetland and watercourses) within a radius of 500m around the proposed project site were mapped and classified at a desktop level followed by a desktop rating of risk associated with the proposed activities (Figure 12). This was undertaken to guide field assessments and inform water use identification for the proposed project. A number of natural water resources (intermittent streams and drainage lines), as well as artificially created dams/impoundments/reservoirs were identified and rated.

Such, intermittent drainage features dominate landscape and ranged in type, from short, small, narrow drainage lines with no riparian fringes to fairly short streams with moderately broad, wooded riparian fringes. These intermittent watercourses, located to the east, feed into the Elands River, whilst intermittent watercourses to the west and south feed into the Selons River. The Elands River is the primary drainage feature within the region and is regarded as being partially permanently inundated, flowing only occasionally in years with above average rainfall. The Selons River is the most important tributary of the Elands River, within the region, and is seasonally to temporarily/occasionally inundated flowing only occasionally in years with above average rainfall.

Following, mapping and watercourse/wetland resource risk screening exercise, a total of five (5) natural freshwater resource features were identified and delineated within the 500 m buffer area (DWS Regulated Area) and include one (1) larger intermittent to seasonal stream with a prominent wooded riparian fringe and four (4) narrow drainage lines with no riparian fringe (Figure 12 and Table 11). Furthermore, a total of nine (9) artificial freshwater resource features were identified within the 500m buffer area, all these features being small gravel dams/reservoirs, with two (2) of these being instream.

The main risks associated with the construction and operations of the proposed activities are:

- Direct physical modification / destruction of freshwater resource features within / in the vicinity of the footprint of the pylons, and the portions of the access roads that will cross the freshwater resource feature WC1.
- Direct physical loss and/or modification of watercourses within the development site, both planned and accidental (only freshwater resource feature WC1);
- Direct physical alteration of flow characteristics of watercourses within the development site and associated erosion and sedimentation impacts (only freshwater resource feature WC1);
- Alteration of catchment surface water processes / hydrological inputs and associated erosion and sedimentation impacts (freshwater resource feature WC1 and potentially WC2); and

» Surface runoff contamination and local watercourse water quality deterioration freshwater resource feature WC1 and potentially WC2).

The risk ratings for each of the mapped freshwater resource features are presented in Table 11, Figure 12) below. The proposed activities pose a potential high risk to one water resources units, which will be potentially directly impacted by the planned infrastructure (construction of pylons, access roads and spanning of power lines across watercourses). One downstream/downslope system in the vicinity of the activities (0-50m) also stand to be indirectly impacted and is generally at moderate risk of being impacted. Water resources located upstream/ upslope or within separate micro-catchments to the proposed activities were assessed as being at low or very low risk. Water resources at low to very low risk are systems that would not require further assessment.

Apart from these delineated "natural" freshwater resource features, nine artificial "non-natural" gravel dams/reservoirs/impoundments were also mapped within the DWS Regulated area with four gravel dams located within the PAOI.

Artificially created gravel dams or reservoirs, despite potentially sharing some characteristics with wetlands or natural aquatic features, should not be classified as such due to several scientific reasons:

» Firstly, these features are deliberately constructed by humans, often for purposes unrelated to natural wetland or aquatic ecosystems. The creation of gravel dams or reservoirs typically involves significant human intervention, including the placement of materials such as gravel, concrete, or other barriers to impede water flow and create storage capacity. Unlike natural wetlands or watercourses, which develop through natural processes over time, artificial gravel dams are intentionally engineered structures designed to serve specific human needs, such as flood control, water storage, or irrigation.
» Secondly, the morphology of artificial gravel dams or reservoirs typically differs significantly from that of natural wetlands or watercourses. These features are often characterized by closed contours or high bunded gravel walls, creating isolated or semi-isolated water bodies with limited connectivity to surrounding aquatic systems. Unlike natural wetlands or watercourses, which are often part of interconnected hydrological networks with continuous water flow and exchange, artificial gravel dams may have limited or no connection to important downstream wetland or watercourse features. As a result, they function as closed systems with distinct hydraulic and ecological dynamics, distinct from those of natural wetlands or watercourses.
» Furthermore, the ecological characteristics of artificial gravel dams or reservoirs often differ from those of natural wetlands or watercourses. While they may provide habitat for certain species of flora and fauna, these features typically lack the complex ecological processes and biodiversity associated with natural wetland ecosystems. The construction and management of artificial gravel dams can also lead to alterations in

hydrological regimes, sediment dynamics, and nutrient cycling, further distinguishing them from natural wetlands or watercourses.

» Subsequently, due to their human-made origin, distinct morphology, limited connectivity, and altered ecological characteristics, artificially created gravel dams or reservoirs should not be classified as wetland features or sensitive aquatic features such as natural wetlands or watercourses. Instead, they should be recognized as engineered structures with unique hydraulic and ecological properties, requiring specific management considerations distinct from those of natural wetlands or watercourses.
» Consequently, these dams/reservoirs do not require further assessment.

Note: *The risk ratings provided relates to the likelihood that a water resources unit may be measurably negatively affected to inform the Water Use License process. Thus, this is essentially risk screening,* ***not a risk assessment and risk ratings are not a representation of impact intensity / magnitude of the change.***

Table 11: Preliminary risk ratings for the mapped wetland units including rationale.

Risk Class	Wetland Unit Number	Rationale	Triggers baseline and impact assessment
High	WC1,	These water resources will be crossed by the proposed grid line and are likely to incur direct and indirect (secondary impacts). Direct impacts may include the loss or modification of freshwater habitat (i.e. within the construction servitude) whereas expected secondary impacts are likely to be linked with construction runoff, road run-off, water quality and sedimentation of freshwater habitat.	Yes
Moderate	WC2	These water resource units are located either directly downslope/downstream or directly adjacent to the proposed infrastructure. No direct impacts are expected although indirect secondary impact's linked with road run-off, water quality and sedimentation of freshwater habitat are likely to occur.	Yes
Low	WC3 (a)	These water resource units are either located in separate micro-catchments or some distance downslope or downstream of the proposed development. Risk form secondary impacts are low and measurable impacts to these water resources are unlikely.	No
Very Low	WC3 (b), WC4, WC5 & WC6	These water resource units are either located in separate micro-catchments or some distance downslope or downstream of the proposed development. Risk form secondary impacts are very low and measurable impacts to these water resources are highly unlikely.	No

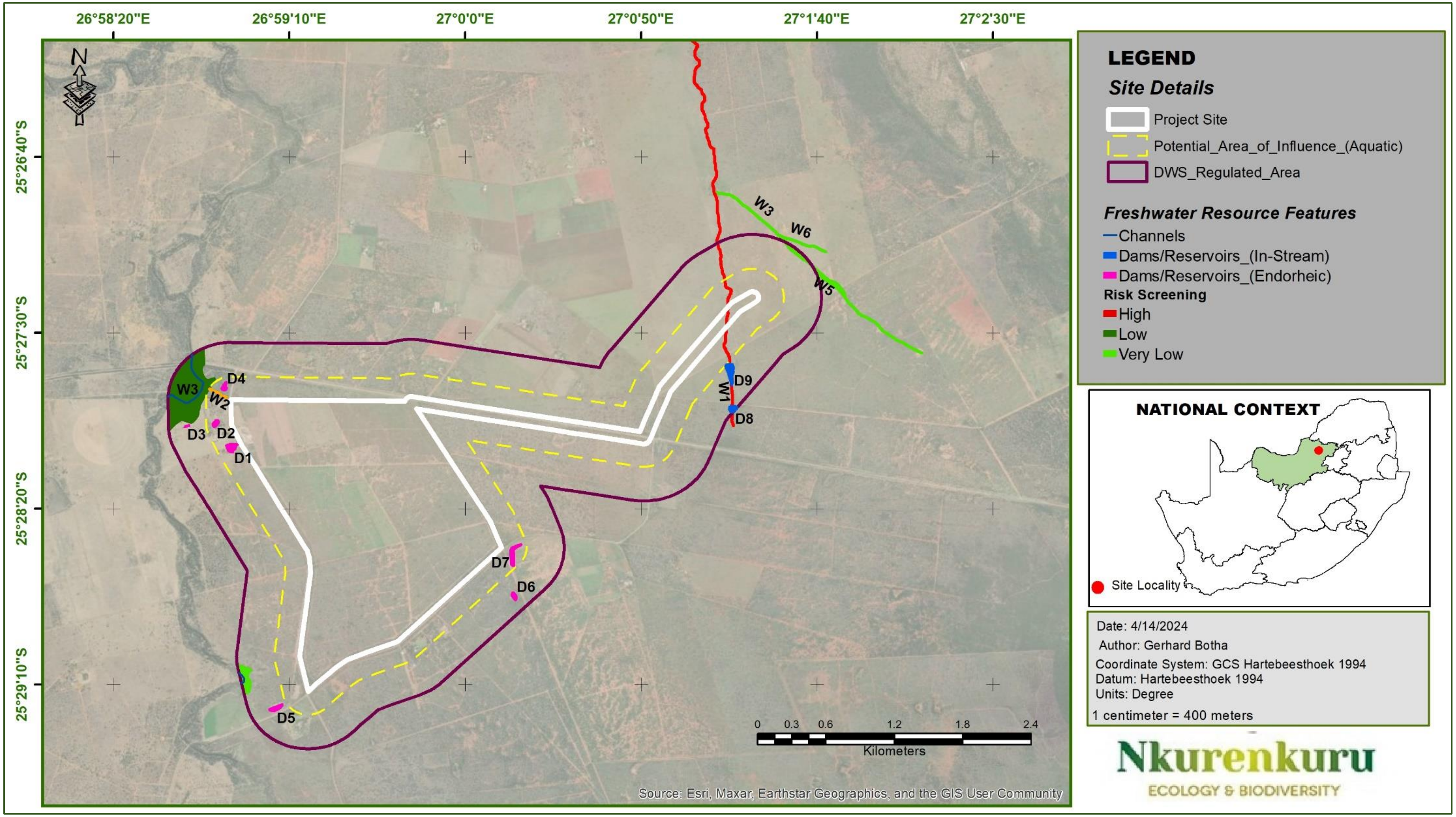

Figure 12: Initial desktop delineation and risk screening of freshwater resource features within the 500m buffer area.

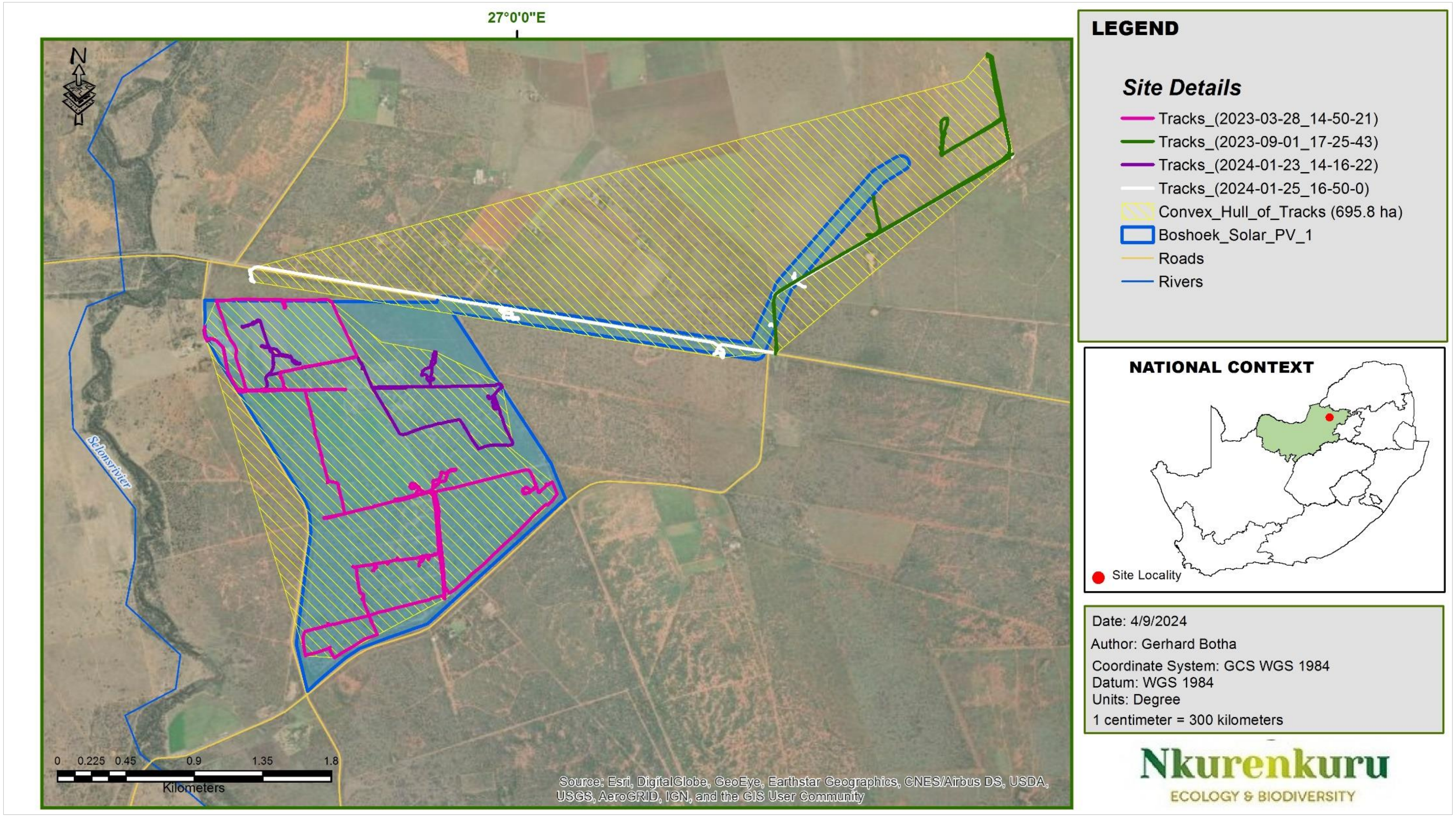

Figure 13: Tracks (relative to the project site) that were recorded during the various site visits.

The baseline habitat assessment, informed by on-site data collection, focused primarily on freshwater resource units rated as being at **Moderate to High risk** of being impacted by the proposed activities (refer to Table 11 and Figure 12).

This section sets out the findings of the baseline assessment of those water resources units and includes:

» Delineation, Classification and Habitat Descriptions;
» Present Ecological State (PES) Assessment;
» Ecological Importance and Sensitivity (EIS) Assessment;

The on-site / in-field assessment of the freshwater resource indicators, of all water resources at risk (high and moderate risk) of being impacted by the proposed development, was conducted by Gerhard Botha from Nkurenkuru Biodiversity and Ecology on the 27th to the 29th of March 2023 (early autumn) and from 23rd to 24th of January 2024 (summer) (refer to Figure 13 for GPS Tracks). Conditions during the periods of the site surveys were regarded as acceptable.

The water body delineation and classification were conducted using the standards and guidelines produced by the DWS (DWAF, 2005 & 2007), the South African National Biodiversity Institute (2009) and according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems, hereafter referred to as the "Classification System" (Ollis et al. 2013). The same approach of classifying wetlands in terms of a functional unit was followed. HGM units encompass three key elements (Kotze et al, 2005):

» <u>Geomorphic setting</u> - This refers to the landform, its position in the landscape, and how it evolved (e.g. through the deposition of river-borne sediment);
» <u>Water source</u> - There are usually several sources, although their relative contributions will vary amongst wetlands, including precipitation, groundwater flow, stream flow, etc.; and
» <u>Hydrodynamics</u> - This refers to how water moves through the wetland.

Ultimately, it was found that, of the five freshwater resource features that were identified within the 500m buffer area, one (1) features has a high risk of being impacted by the proposed development (grid infrastructure only), whilst one (1) feature has a moderate risk of being impacted (Figure 12). Of these two (2) freshwater resource features:

» one freshwater resource feature is a narrow intermittent stream (WC2) with a wooded riparian fringe being mostly absent to very narrow; and
» the second freshwater resource feature (WC2) is a narrow drainage lines with no riparian fringe.

The following buffer zones were calculated for the wetlands based on the generic risk categories for Above Ground Power Line Distribution (MacFarlane et al., 2015) (refer to Figure 17):

- » Smaller intermittent streams with no to narrow riparian fringes:
  - Electrical Grid Infrastructure Buffer: 11 m;
  - PV Solar Facility Buffer: 74 m
- » Intermittent drainage line with no riparian fringe:
  - Electrical Grid Infrastructure Buffer: 11 m;
  - PV Solar Facility Buffer: 22 m

Watercourse WC2 has been subjected to fairly little to moderate change to the hydrological and geomorphological characteristics, erosion features and farm roads being the most prominent impacts. The upper reaches of WC1 have been subjected to ripping, ploughing, re-seeding and overgrazing, as this watercourse feature form part of the pasture paddock system utilized for intensive game breeding.

Both of these freshwater resource features can be regarded as intermittent, containing surface flow for only brief periods following sufficient rainfall events, with "dry" periods that are unpredictable in duration.

6.1. Aquatic/Freshwater Resource Delineation

The water body delineation and classification were conducted using the standards and guidelines produced by the DWS (DWAF, 2005 & 2007), the South African National Biodiversity Institute (2009) and according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems, hereafter referred to as the "Classification System" (Ollis et al. 2013) (refer to Figure 14).

For the DWS definitions of different hydrological features refer to Appendix C.

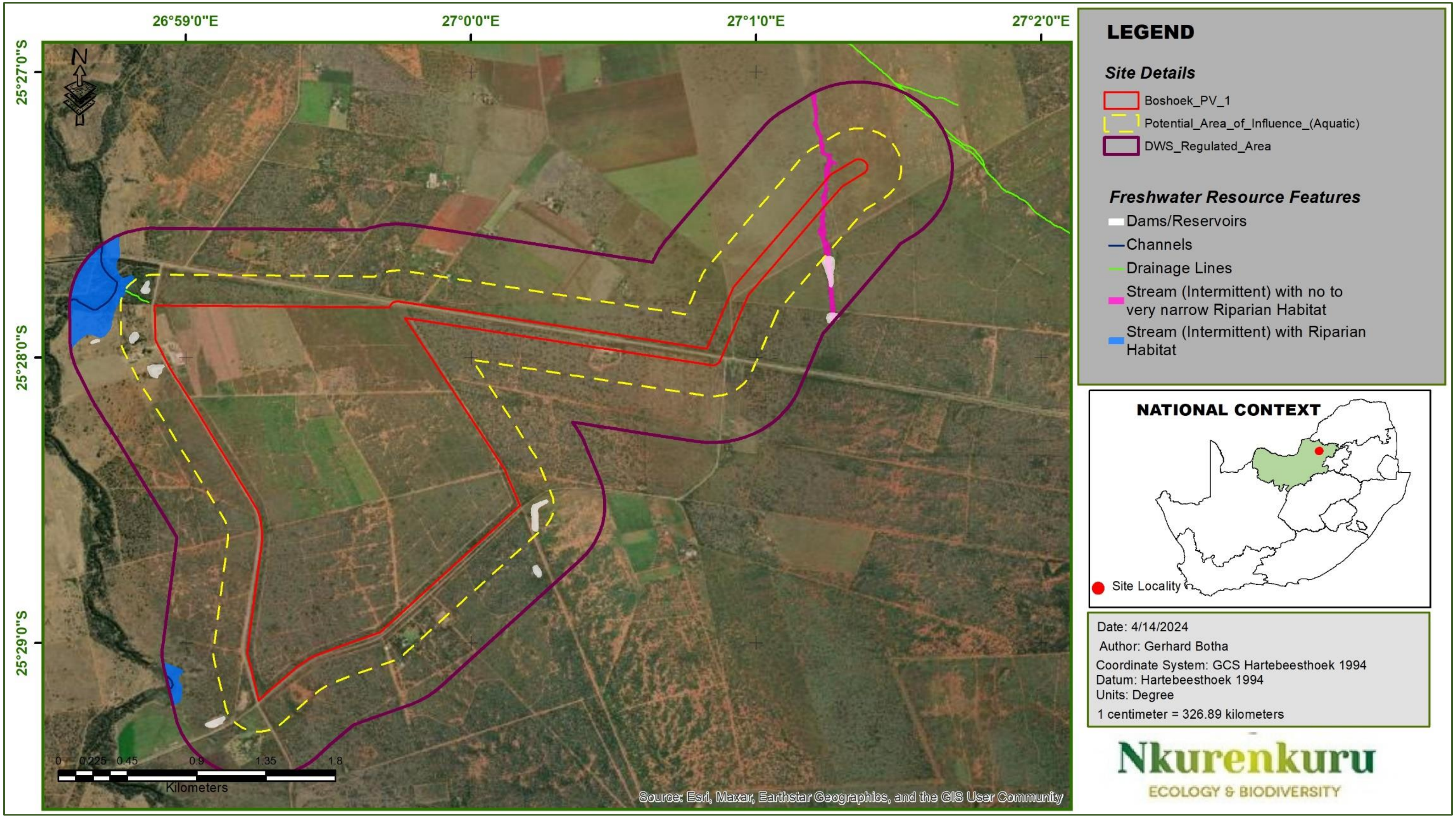

Figure 14: High to Moderate Risk Aquatic/Freshwater Resource Features delineated classified assessed infield.

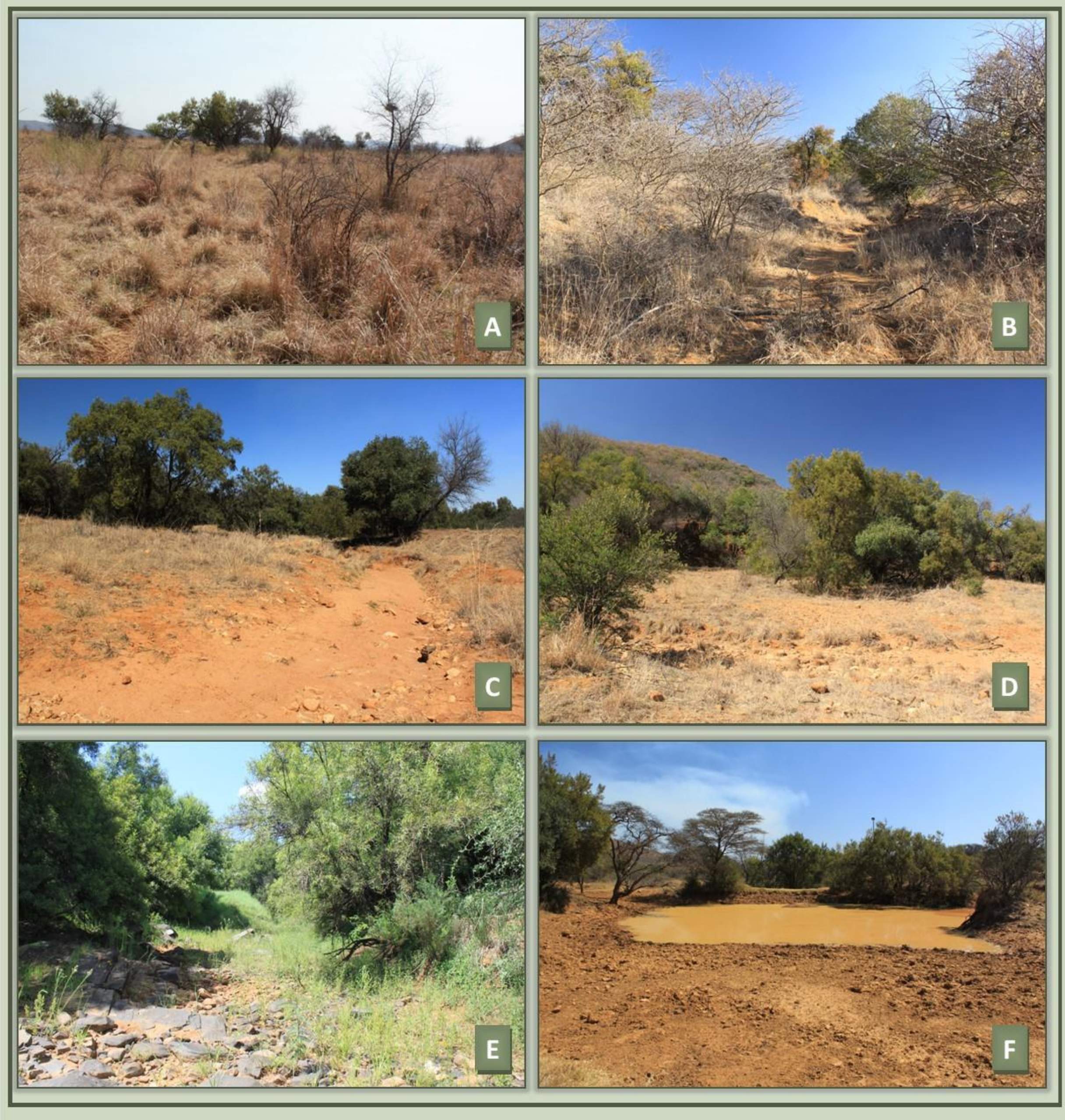

Figure 15: General characteristic of the drainage features recorded within the 500 m DWS Regulated area: A) Upper section of the narrow intermittent stream with no riparian habitat; B) Lower portion of the narrow intermittent stream with a very narrow riparian habitat; C and D) Narrow drainage line with no riparian habitat; E) Larger intermittent watercourse with fairly broad woody riparian fringe (Selons River); F) Typical gravel dam feature within the area.

6.2. Classification and Description of Surface Water Resource Features

A river or stream is a linear geographical feature with a distinct bed and banks, consistently or periodically carrying a concentrated flow of water. When referring to a river, we encompass both the active channel and the adjacent riparian zone as one entity. Figure 16 provides a conceptual representation of a river (Ollis, et al., 2013).

Primary water sources for rivers encompass concentrated surface runoff from upstream channels and tributaries. Other contributing factors can comprise diffuse surface or subsurface flow, such as that originating from an upstream seepage wetland, interflow from valley side-slopes, and groundwater inflow via springs. Water generally flows through the system as a concentrated stream and usually exits in a similar manner, unless there is a sudden decrease in gradient that causes the outflow to disperse. In such cases, the river transitions into one of the wetland categories. Other water outputs from a river include evapotranspiration and infiltration (Ollis, et al., 2013).

A river is primarily characterized by the presence of a concentrated, unidirectional flow within a well-defined active channel, which may be permanent or periodic, as depicted in Figure 17. Hence, when determining whether an Inland System qualifies as a river, look for conspicuous channel banks, which might not be easily distinguishable in densely vegetated systems, or a focused flow of water within a defined channel, assuming the river is currently flowing (Ollis, et al., 2013).

The active channel constitutes the part of the river that experiences regular inundation, ensuring the maintenance of channel structure (i.e., the presence of a distinct bed and banks) and preventing the establishment of terrestrial vegetation. Active channels are typically filled to capacity during bankfull discharge, such as the annual flood, except for intermittent rivers that do not flood yearly. Transient features like mid-channel bars and side bars are considered part of the active channel (Ollis, et al., 2013).

Active channels are generally located within a confined valley or incised macro-channel. While they are typically devoid of established terrestrial vegetation, many South African rivers have aquatic, wetland, or pioneer vegetation growing within the active channel (Ollis, et al., 2013).

The riparian zone, or the area adjacent to the active channel (i.e., the riverbanks), is subject to the influence of river-induced or river-related processes. These zones often feature alluvial soils and distinctive vegetation in terms of composition and physical structure compared to the surrounding land. The riparian zone typically spans between the outer edge of the active channel and the outer edge of the macro-channel (Ollis, et al., 2013).

While many riparian areas are well-drained and do not qualify as wetlands under the South African National Water Act, especially in the upper reaches of rivers, some riparian areas remain saturated or flooded for extended periods and should be classified as wetlands, adopting the appropriate wetland HGM Types, such as 'floodplain wetland' or 'channelled *valley-bottom wetland,' rather than being categorized as part of a river* (Ollis, et al., 2013).

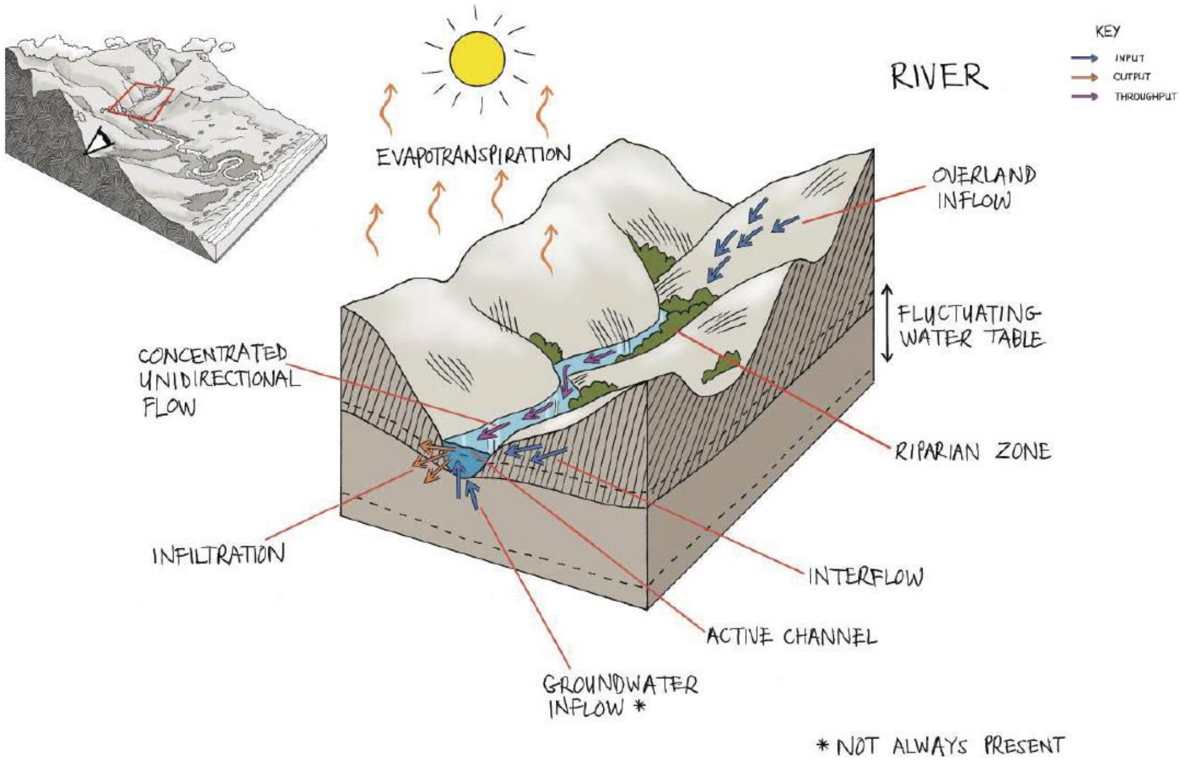

Figure 16: Conceptual illustration of a river, showing the typical landscape setting and the dominant inputs, throughputs and outputs of water (copied from Ollis et al., 2013).

The slope of the PAOI is very homogenous and comprise of flat to slightly sloping (1%≥) plains. These plains are vegetated with terrestrial savanna types varying from open savanna grasslands with a few woody species (pastures) to tree savannas comprising of predominantly thorny trees. Soil depth, form and characteristics are also very homogenous within the project site with these plains comprising moderately to deep sandy-loam soils. The plains of this region are dissected by fairly shallow, low gradient valleys drained by small intermittent, streams and drainage channels. The topography of the project site does not lend itself to the formation or persistence of wetlands, which are notably absent from the project site. Watercourses are therefore channelled systems including slightly meandering, alluvial streams and narrow, straight drainage channels. The larger streams tend to drain in a south to north or south-south-east tot north-north-west direction (towards the Elands River). The smaller, narrow drainage channels tend to flow for short distances, mostly at angles between 45° and 30°to the larger streams.

1.1.1.1. <u>Intermittent Streams:</u>

Arid streams and rivers can typically include discontinuous, ephemeral, compound, alluvial fan, anastomosing, and single-threaded channels, which vary due to a range of gradients (slopes), sediment sizes, and volumes and rates of discharge. Discontinuous ephemeral stream systems and alluvial fans are most prevalent in, but not restricted to, piedmont (foot hill) settings, while compound channels, anastomosing rivers, and single-thread *channels with adjacent floodplains generally occupy the valley bottoms (Beven &Kirby 1993). Ephemeral and intermittent streams are the dominant stream types within the arid parts of southern Africa.*

The "master variable" responsible for shaping such an ephemeral watercourse is associated with the flow regime of the system, which includes variations and patterns in surface flow magnitude, frequency, duration, and timing (Poff et al., 1997). It follows that the size and shape of a watercourse is controlled in large part by the dominant discharge in a particular region (Lichvar & Wakeley, 2004). Fluvial morphology is frequently associated with extreme discharge events; streams and floodplains trap sediments and nutrients in addition to attenuating flood waters (Graf 1988; Leopold 1994).

These delineated features within the PAOI represent larger and wider watercourses that may include varying wooded riparian fringes (in terms of width, tree size, hight and density). These watercourses are either classified as stream order 2 or 3, Lowland Rivers or Lower Foothill Rivers with low gradients in terms of the national classification system.

These freshwater resource features, within the project site, tend to comprise of intermittent streams with fairly narrow and simpler (homogenous) channel floor and bank geomorphologies.

According to the current layout, only the grid corridor will cross such an intermittent stream (Figure 14).

This smaller intermittent stream that will be crossed, is much less varying in terms of geomorphology, plant species composition and soil characteristics, when compared to other intermittent streams found within the region. This stream cuts through a fairly flat plain with sandy-loam soils. Due to the flat topography this stream contains a fairly straight channel morphology, with a fairly narrow and moderately shallow low flow channel (active channel, marginal zone) and a short active channel bank (not more than 3m wide, with an average slope of 28°). The fringing channel bars and shelves are narrow (between 4 m and 13 m) and gradually transitions into the gradual, low sloping macro-channel bank. The tree layer within this stream is sparse becoming slightly denser and more prominent downstream. Key species with the low flow channel include *Cynodon dactylon, Panicum maximum, Eragrostis lehmanniana*, *Fingerhuthia africana, Aristida congesta*, *Themeda triandra, Ziziphus mucronata* and *Searsia lancea.* The active channel bank is characterised by *Searsia lancea, Senegalia mellifera, Ziziphus mucronata, Cynodon dactylon, Eragrostis lehmanniana, Aristida congesta, Panicum maximum* and *Themeda triandra*. The channel bars and shelves of the lower zone as well as the macro-channel bank (upper zone) is characterized by a dense coverage of *Cenchrus ciliaris, Themeda triandra* and *Cymbopogon caesius*.

The potential of spanning this intermittent stream is very high, and through the use/upgrading of existing farm tracks, gravel roads and fire breaks (along boundary fences), impacts on this watercourse can be effectively and acceptably minimised.

Subsequently, the proposed development will not have a significant impact on this feature the grid corridor spanning this watercourse is regarded as acceptable.

Smaller Ephemeral Channels and Drainage Lines:

Represent linear and narrow watercourses in the form of headwater drainage lines (second order drainage lines and channels). No such features were identified within the project site, however, one such feature was partially located within the PAOI (Figure 14) This feature was captured as a line during the delineation process and is expected to be consistent with the NWA watercourse definition of 'natural channels that flow regularly or intermittently'. Such drainage lens is marginal in nature with discontinuous or poorly developed channels that represent swales due to poor channel development in arid areas with low rainfall, high evapotranspiration and high infiltration in areas with sandy soils. No hydromorphic (wetland soil) or hydrophyte (wetland plant) indicators were recorded in this watercourse. Aerial imagery interpretations identified this linear feature with a textural change that are regarded to be associated with an area of preferential flow during cyclic surface flow events that can occur at frequencies that are several years apart. This feature is considered as a drainage line and an ephemeral channel.

Such drainage systems differ from downstream reaches due to a closer linkage with hillslope processes, higher temporal and spatial variation, and their need for different protection measures from land use activities (Gomi et al. 2002). Such drainage lines are never or very seldom in connection with the zone of saturation, and they consequently never have base flow and are unlikely to support wetland conditions.

Such drainage lines can contain discontinuous channels due to lower annual rainfall, longer rainfall intervals, and low runoff versus infiltration ratio due to greater transmission losses (Lichvar et al., 2004). Discontinuous channels are more common on low gradient topographies (e.g. basins and plains) in arid and semi-arid environments, with deeper substrates that result in lower energy fluctuations and greater water recharge into the surrounding soils during flow events.

These systems form part of a continuum between hillslopes and stream channels, which can be generally classified into four topographic units (Gomi et al. 2002):

» Hillslopes have divergent or straight contour lines with no channelised flow.
» Zero-order basins have convergent contour lines and form unchannelised hollows.
» Transitional channels (temporary or ephemeral channels) can have defined channel banks, as well as discontinuous channel segments along their length, and emerge out of zero-order basin. They form the headmost definable portion of the drainage line network (first-order channels) and can have either ephemeral or intermittent flow.
» Well defined first and second-order streams that are continuous with either intermittent or perennial flow.

The vegetation and soil characteristic of this drainage line is largely shared with the surrounding "upland" vegetation with little variation between the two, apart from a slightly denser tree coverage lining the channel (mainly *Searsia lancea, Vachellia tortilis subsp. heteracantha, Senegalia mellifera* and *Vachellia karoo*), and the exposure of underlying lithic, bedrock and other subsoil layers, where the topsoil horizons have been removed through erosion (along the channels).

According to the current layout no infrastructure is planned within this drainage line or within its associated buffer area (74 m for PV Solar facility). An increase in surface water runoff from the PV facility, during rainfall events, is the most likely impact and may result in a very slight increase in water input. However, this increase is most likely not significant enough to change the general hydrological characteristics of this drainage line and downstream freshwater resources (water input patterns, and the magnitude and frequency of floodpeaks). Subsequently, the proposed development will not have a significant impact on this feature and thus the proposed development is regarded as acceptable.

6.3. Present Ecological State (PES)

The Present Ecological State (PES) refers to the health or integrity of an ecosystem defined as a measure of deviation from the reference state. The 'habitat integrity' of a river refers to the "maintenance of a balanced composition of physic-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region" (Kleynhans, 1996). It is seen as a surrogate for the assessment of biological responses to driver changes. The Index of habitat Integrity (IHI) is a measure of the Present Ecological State (PES) which infers the health or integrity of a river system and includes both in-stream habitat as well as riparian habitat adjacent to the main channel.

Habitat integrity for instream and riparian habitats was assessed separately based on the following indicators of habitat integrity:

- » Water abstraction
- » Flow modification
- » Inundation
- » Bed modification
- » Bank erosion
- » Channel modification
- » Water quality
- » Solid waste disposal
- » Vegetation removal
- » Exotic vegetation

The results of the IHI assessment are summarised in Table 12 below. The results of the IHI assessment undertaken generally reveal the following:

» The smaller intermittent watercourse with its less pronounced to locally absent riparian fringe (**WC 1**) is a fairly short stream (length = 4.9 km).

This watercourse has been severely modified in terms hydrology, geomorphology and vegetation structure/composition. A large portion of this drainage lines traverse pasture paddocks. Vegetation coverage and structure, within these areas, have been completely modified through the removal of almost all trees and shrubs and the replacement of the natural grass layer with palatable grazing species such as *Cenchrus ciliaris.* Portions of this watercourse have also been ripped and ploughed in the past (prior to initial reseeding) and are subjected to significant grazing pressure (small paddocks used for intensive game breeding, mainly grazers). Furthermore, this watercourse has been dammed upstream (two small gravel dams) and such dams have a profound impact on the hydrology of smaller systems.

Subsequently **WC1** is currently regarded as being in a **Seriously Modified conditions** (PES = "E").

» The short drainage line (**WC2**) is only 160 m in length. Limited change has occurred to the hydrological and geomorphological characteristics of this freshwater resource feature. The most significant impact is erosion, however the extent of erosion can be regarded as low to moderate-low, with isolated localities being exposed to erosion. The most likely culprit is overgrazing and the slight reduction in vegetation coverage and structure. Grazing pressure has resulted in the slight encroachment of *Senegalia mellifera,* reducing the ground cover (graminoid layer) and exposing these areas to some sheet erosion. No instream dams are present within this watercourse and as such the hydrological character of this watercourse can be regarded as natural. Watercourse crossings are very limited and restricted to tow small farm tracks.

This watercourse is currently regarded as being in **Largely Natural condition** as reflected by a "**B**" PES Category.

The results of the PES assessments are summarised in Table 12 below.

Table 12: Summary results of the river IHI (Index of Habitat Integrity) assessment.

Freshwater Resource Feature	**HABITAT COMPONENT**		
	Instream PES Category with % Intact	Riparian PES Category with % Intact	Overall PES (weighted 60:40)
Intermittent Stream WC1	E: Seriously Modified (38.6% intact)	N/A	E: Seriously Modified (38.6% intact)
Drainage Channel WC2	B: Largely Natural (80.8% intact)	N/A	B: Largely Natural (80.8% intact)

6.4. Wetland Ecological Importance and Sensitivity (EIS)

"*The Ecological Importance and Sensitivity (EIS) of a wetland is an expression of the importance of the aquatic resource for the maintenance of biological diversity and ecological functioning on local and wider scales; whilst Ecological Sensitivity (or fragility) refers to a system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (Kleynhans & Louw, 2007).*

Ecological Importance and Sensitivity is a concept introduced in the reserve methodology to evaluate a wetland in terms of:

- » Ecological Importance;
- » Hydrological Functions; and
- » Direct Human Benefits

For the purposes of this assessment, the EIS of the small stream channels and associated riparian areas was based on rating the importance and sensitivity of riparian & in-stream biota (including fauna & flora) and habitat, using available desktop information and on-site indicators/sampling undertaking during field investigations. The outcomes of a rapid instream and riparian habitat ecological importance and sensitivity assessment (using the DWAF EIS tool for rivers) is summarised below in Table 13 with an aquatic ecological sensitivity map for the site included as Figure 17.

In terms of ecosystem importance and ecological sensitivity, no "High" important and sensitive aquatic features will be impacted by the proposed development. The seriously modified WC4 was considered to be of "Moderate" importance and sensitivity, containing features that are considered to be ecologically important and sensitive at a local scale and typically having a small role in providing ecological services at the local scale. WC2 (largely natural) is considered to be of a low EI&S.

As mentioned a summary of the EI&S importance assessment scores and ratings for watercourses are provided in Table 13 below (also refer to Figure 17) and can be summarised as follows:

- » The narrow intermittent stream with a narrow to absent riparian fringe (WC2) as well as drainage line WC 5:
  - WC2 is considered to be of moderate ecologically importance and sensitivity.
  - Such smaller, valley floor and drainage systems, in general, are found to be more prone to degradation.
  - These smaller valley floor systems tend to have a fairly low apparent fauna diversity as well as utilisation by livestock and game.
  - Such systems convey floodwater into and out of the ecologically important and sensitive larger downstream watercourses and subsequently play an important role in the maintenance of these, more important, system.

- Furthermore, the vegetation of these drainage system help reduces flood damage to downstream habitats and subsequently contribute to the maintenance of biological productivity of downstream environments.

» The small intermittent drainage lines (WC2):
- WC 2 is considered to be of low ecologically importance and sensitivity.
- Such smaller drainage systems, in general, are found to be extremely prone to degradation.
- This largely natural drainage line has a very low diversity of instream and riparian habitat and are unlikely to harbour any rare or endangered, unique or endemic species.
- The small size of the drainage lines and largely intermittent nature of flows makes these ecosystems inherently vulnerable and sensitive to changes in the timing and volume of flows and water quality modifications.
- Aquatic invertebrate taxon/species richness, whilst not sampled directly, is likely to be (very) low. Furthermore, very limited instream habitat types, and the absence of riparian habitat types to support a high diversity of biota, will have a strong limiting influence on the structure and composition of invertebrate communities.
- Even though habitat connectivity is high, the role as functional migration routes/corridors is limited due to the short distance of this watercourse and the location of a major road system just upstream of this watercourse. During times of environmental stress, the instream habitat is likely to offer limited refugia for local aquatic and terrestrial wildlife only.
- This small drainage line is a small tributary of the Selons River, providing limited hydrological support and services to the Selons River.

Table 13: Score sheet for determining the ecological importance and sensitivity for the identified surface water resource features.

DETERMINANT		IMPORTANCE SCORES (0-4) AND RATINGS	
		WC1	**W2**
PRIMARY DETERMINANTS	Rare & Endangered Species	1	0
	Populations of Unique Species	1	0
	Species/taxon Richness	2	1
	Diversity of Habitat Types or Features	2	1
	Migration route/breeding and feeding site for wetland species	1	1
	Sensitivity to Changes in the Natural Hydrological Regime	4	3
	Sensitivity to Water Quality Changes	3	3
	Flood Storage, Energy Dissipation & Particulate/Element Removal	3	2
MODIFYING DETERMINANTS	Protected Status	1	1
	Ecological Integrity	4	1
TOTAL		22	13
MEDIAN		2	1
OVERALL ECOLOGICAL SENSITIVITY & IMPORTANCE		**C Moderate**	**D Low**

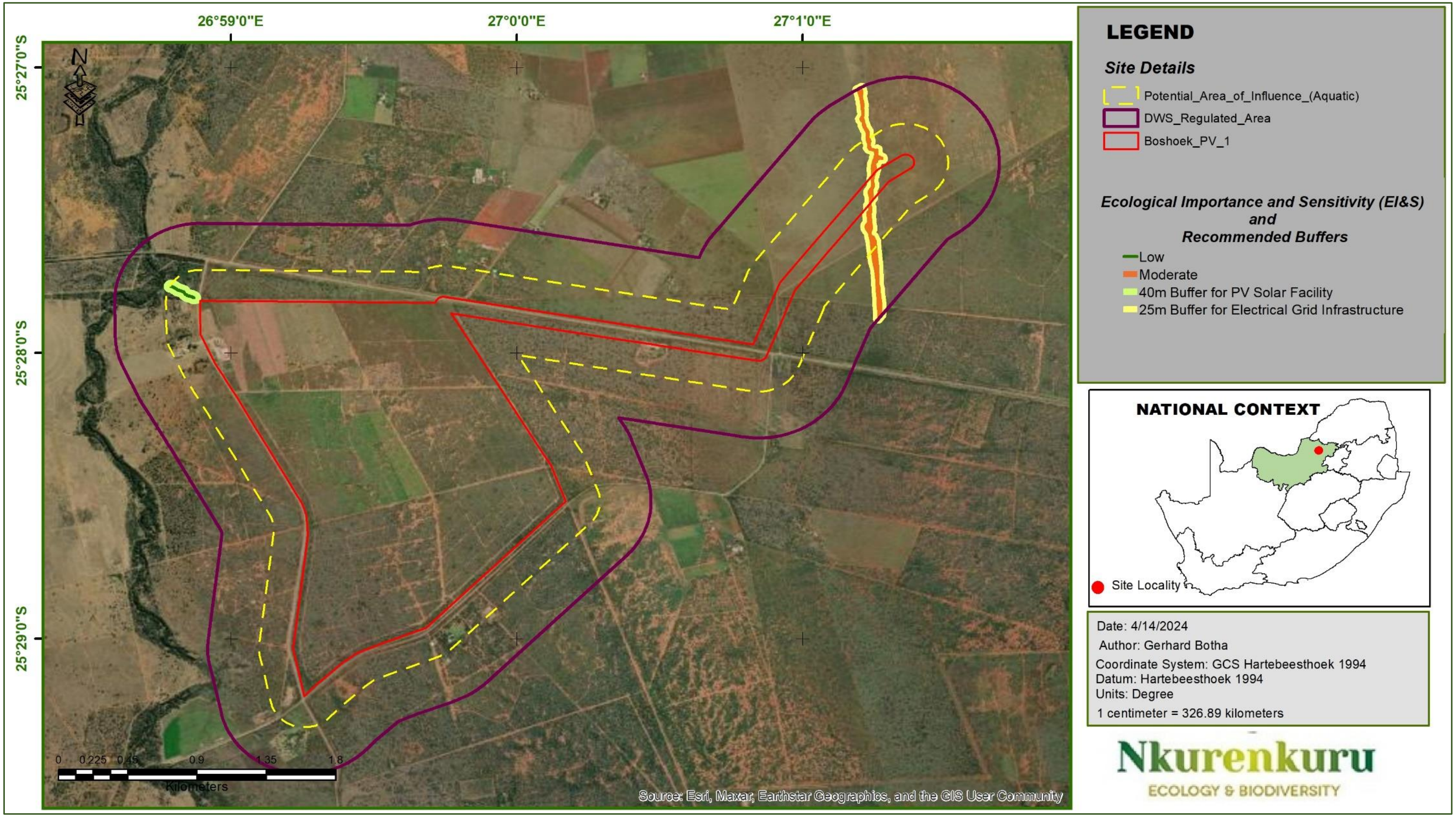

Figure 17: Aquatic/Freshwater Resource Importance and Sensitivity mapping with aquatic buffers.

6.5. Recommended Ecological Category (REC) and Management Objectives for Watercourses

The future management of the freshwater ecosystems (streams and associated aquatic habitat) within the project area should be informed by the 'Recommended Ecological Category' (REC) and associated recommended management objectives for the water resource which, in the absence of formal classification, is generally based on the Present Ecological State/ Ecological Category (PES/EC) and the Ecological Importance and Sensitivity (EIS) of water resources (DWAF, 2007) (Table 14, below). However, this idealised table needs to be interpreted in terms of the viability/feasibility for improvement in EC and the desired characteristics based on the context of the stream's catchment in terms of existing threats and future development pressures.

Table 14: Generic matrix for the determination of REC and management objectives for water resources based on their individual PES and EIS ratings.

			Ecological Importance and Sensitivity (EI&S)			
			Very High	**High**	**Moderate**	**Low/Very Low**
PES	**A**	Pristine/Natural	A Maintain	A Maintain	A Maintain	A Maintain
	B	Largely Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good to Fair	B Improve	B/C Improve	C Maintain	C Maintain
	D	Poor	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Very Poor	D Improve	E/F Improve	E/F Maintain	E/F Maintain

Based on this rating system, the recommended management objectives for both WC1 and WC2, should be to maintain the current ecological conditions of these freshwater resource features (Table 15, below).

Table 15: Recommended management objectives for the assessed freshwater resource features.

Freshwater Resource Feature	PES	EI&S	Recommended Management Objective
WC 1	Seriously Modified (E)	Moderate	Maintain at E
WC2	Largely Natural (B)	Low	Maintain at B

6.6. Freshwater Resource Buffer Zones

Buffer zones are strips of undeveloped, typically vegetated land (composed in many cases of riparian habitat or terrestrial plant communities) which separate development or adjacent land uses from aquatic ecosystems (rivers and wetlands). The primary purpose for establishing buffers in this case would be to reduce the impact of adjacent land uses on water quality and to provide habitat for aquatic and semi-aquatic species. The hydrology and the water quality of the riparian zones in the study area could change both during the construction period and after development.

In order to assess and apply the width of any buffer it is important to understand the role that buffer zones play in protecting aquatic resources with their associated biota and in mitigating anthropogenic impacts. Thus, the proposed buffer will serve to provide a wide range of buffer functions and value including (Macfarlane, et al., 2014):

» Sediment removal;
» Nutrient removal;
» Toxic removal;
» Control of microclimate and water temperature;
» Provision of habitat for wildlife;
» Screening of adjacent disturbances;
» Habitat connectivity;
» Channel stability and flood attenuation;
» Groundwater recharge; and
» Aesthetic appeal.

Despite the range of functions potentially provided by buffer zones, they are far from being a 'silver bullet' that addresses all water-resource-related problems. Indeed, buffers can do little to address some impacts such as hydrological changes caused by streamflow reduction activities (i.e. changes in flow brought about by abstractions or upstream impoundments). Buffer zones are also not the appropriate tool for mitigating point-source discharges (e.g. sewage outflows), which can be more effectively managed by targeting these areas through specific source-directed controls. Contamination or use of groundwater is also not well addressed by buffer zones and requires complementary approaches such as controlling activities in sensitive groundwater zones (Macfarlane, et al., 2014).

Anthropogenic impacts (dams, historic cultivation, roads, etc.) in and around this watercourse, emphasises the already increased impact from the larger catchment. To support the watercourses' integrity in an already disturbed environment and with the proposed development still to come, an aquatic buffer is a necessity. However, it should be noted that an aquatic surface buffer of 20-30 m is highly unlikely to protect catchment-related hydrology support such as groundwater recharge. Therefore, the identification of mitigation and management measures of the proposed development in the greater catchment should compensate for the possible loss of catchment support.

The edge of the freshwater resource features in the study area have been delineated, with the starting point for delineation of the aquatic impact buffer zones for rivers and streams, being on the outer edge of the active channel as visualised in Figure 18 (Macfarlane et al., 2014).

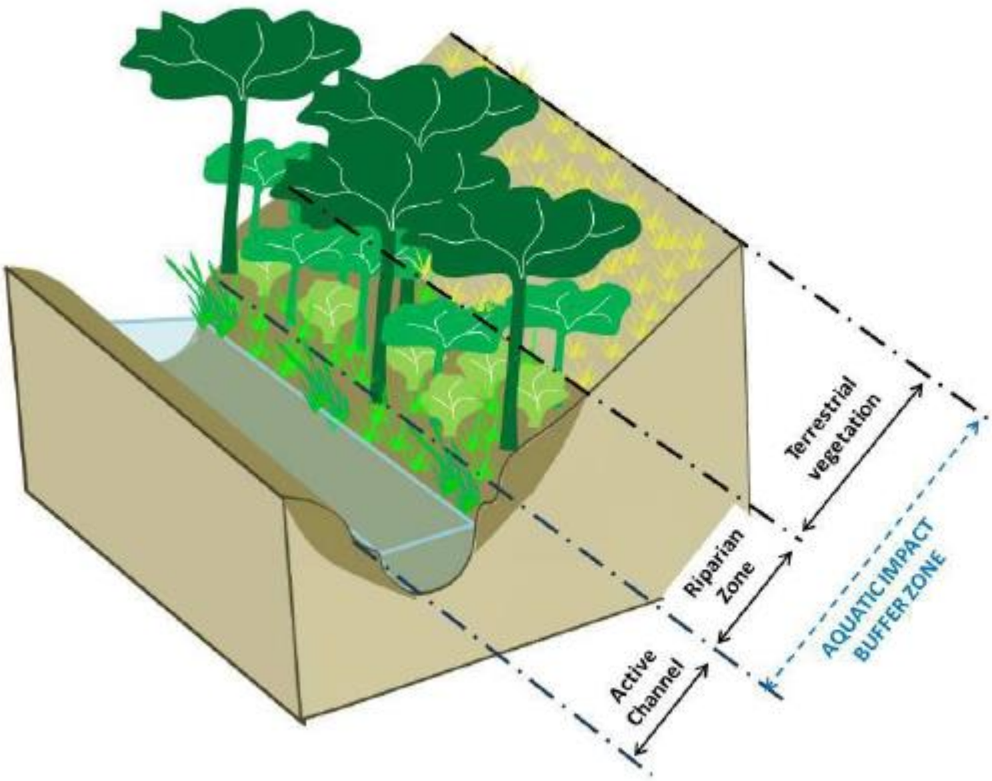

Figure 18: Schematic diagram indicating the boundary of the active channel and riparian habitat, and the areas potentially included in an aquatic impact buffer zone (Macfarlane et al., 2014).

Due to their position adjacent to water bodies, buffer zones associated with streams and rivers will typically incorporate riparian habitat. Riparian habitat, as defined by the NWA, includes the physical structure and associated vegetation of the areas linked to a watercourse. These areas are commonly characterised by alluvial soils (deposited by the current river system) and are inundated or flooded to an extent and with a frequency sufficient to support vegetation with a composition and physical structure distinct from those of adjacent land areas. However, the riparian zone is not the only vegetation type that lies in the buffer zone as the zone may also incorporate stream banks and terrestrial habitats, depending on the width of the aquatic impact buffer zone applied. There may, however, be instances in which the riparian zone extends beyond the aquatic impact buffer zone. In such instances, setback requirements include the full extent of the riparian zone and any additional requirements that may apply to managing this area. In this case the recommended buffer distances, as provided below was calculated from the outer edge of the riparian zone. This was done in order to protect the riparian habitat, and to allow for a sufficient strip of natural, terrestrial vegetation around these watercourses and riparian habitats.

» Intermittent streams with less no to narrow riparian fringes:
  - Aquatic Buffer for Electrical Grid Infrastructure: 25 m;
» Narrow drainage lines without riparian fringes:
  - Aquatic Buffer for Solar PV Facility: 40 m;

WC 2 and its associated 40m aquatic buffer is located outside of the development footprint. This watercourse as well its buffer area should be regarded as a No-Go Zone apart from the use of the existing access road. It is highly unlikely that the proposed development, with the maintenance of the buffer area, will significantly impact WC 2.

WC 1 is located within the grid corridor. WC 1 and the proposed 25 m aquatic buffer should be spanned, and no pylons may be allowed within the buffer area. Apart from the spanning of WC 2 the only other activities allowed within this watercourse are the upgrade of existing access routes/watercourse crossings and where no acceptable crossings are available the construction of a new crossing may be allowed, with the implementation of strict mitigation and monitoring measures.

7. ASSESSMENT OF PROPOSED IMPACTS

7.1. Identification of Potential Impacts and Associated Activities (General)

Freshwater ecosystems, are particularly vulnerable to human activities and these activities can often lead to irreversible damage or longer term, gradual/cumulative changes to these ecosystems. When making inferences on the impact of development activities on aquatic ecosystems it is important to understand that these impacts speak specifically to their effect on the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) or functional importance/value of aquatic ecosystems. All of these are linked to the physical components and processes of aquatic ecosystems, including hydrology, geomorphology and vegetation as well as the biota that inhabit these ecosystems. Anthropogenic activities can generally impact either directly (e.g. physical change to habitat) or indirectly (e.g. changes to water quantity & quality). Figure 19 shows how impacts to aquatic ecosystems such as habitat loss, flow modification and pollution can have a number of negative ecological consequences for the receiving aquatic environment, ranging from loss of sensitive species to reduced ecosystem goods & services provision.

Freshwater resource ecological impacts associated specifically with the proposed PV solar development is discussed below. Potential impacts have been split into Construction- and Decommissioning Phase Impacts and Operational Phase Impacts.

According to the proposed layout, construction, operation and decommission will lead to potential direct and potential indirect loss of / or damage to freshwater resource features. This may potentially lead to localised loss of freshwater resources and may in-turn lead to downstream impacts that affect a greater extent of freshwater resources or impact on function and biodiversity. Where these habitats are already stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Physical alteration to freshwater resource features can have an impact on the functioning of those features.

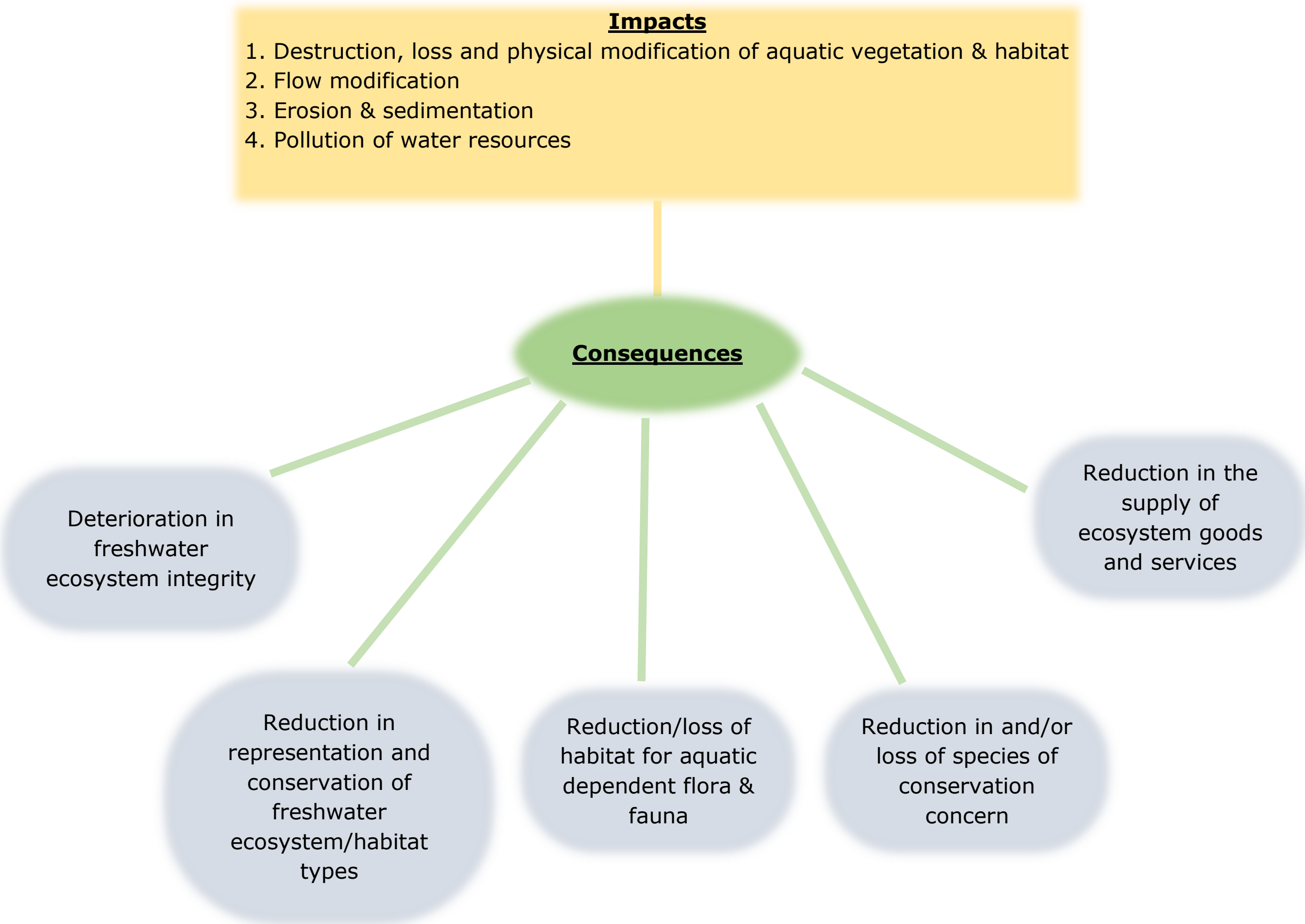

Figure 19: Negative ecological consequences for Freshwater Resource Features as a result of direct and indirect anthropogenic impacts

7.2. Impacts of Proposed Boshoek PV 1 Solar Facility

For the PV Solar Facility and associated infrastructure (apart from the EGI).

- The proposed development footprint of the PV Solar Facility and associated infrastructure (apart from the EGI) are located outside of any freshwater resource features. As such, potential impacts associated with the construction, operation and decommission phases will very similar, with activities potentially leading to a small increase in water input and a potential indirect loss of / or damage to nearby/downslope freshwater resource features.

For the associated EGI infrastructure.

- The proposed grid corridor will cross a single narrow stream and subsequently the watercourse will likely be spanned by the power line and crossed by a service road.

Construction and Planning Phase

SEFs require an initial high intensity disturbance of a fairly large surface area including the clearance of the vegetation cover and the levelling of earth on different terraces where necessary and the compaction of local soil within the development footprint. Concrete foundations for the framework on which the PV panels will be mounted. Soil disturbance, vegetation clearance and hardened surfaces will also be associated with the construction of access and internal roads within the PV solar facility. Electrical grid infrastructure would also need to be constructed within the site. Temporary laydown and storage areas would need to be placed within the site for the construction works.

In terms of the delineated aquatic features, the current layout of the PV solar field will avoid construction within any freshwater resource feature, however the development will still none the less occur in fairly close proximity to such freshwater resource features. In terms of the electrical grid infrastructure, a single freshwater resource feature will be crossed. Subsequently, according to the current layout of the proposed development, potential impacts on these freshwater resource features will mostly be of an indirect nature apart from the construct of the electrical grid line which may lead to some minor directs impacts.

However, the electrical grid line component of the development typically only requires an initial high intensity disturbances and vegetation clearance within a fairly small surface areas around the pylon locations. Disturbances and vegetation clearance within the remainder of the servitude (right of way) will be minimal and mostly restricted to the twin tracks/service routes. Due to the fact that pylons can span watercourses/wetlands without any placement of pylons within the watercourses themselves, direct impacts relating to the construction of the pylons are also potentially avoidable/unlikely. However, during the spanning process some direct impacts/damage may occur to the watercourse/wetland vegetation, however this is expected to be minimal. The most likely direct impact to the delineated freshwater resource feature (to be spanned) will be as a result of watercourse crossings, especially if new crossings will have to be created.

Impacts that may occur during the construction phase of this development may include:

- The increase in surface runoff and sediments carried into these freshwater resource features, subsequently potentially impacting local hydrological character of these wetlands (e.g. water quality and hydro-geomorphological character).
- Change in vegetation structure and composition due a change in the hydro-geomorphological character (increase in inundated area and the permanent and seasonal saturated zones, to the cost of the temporary saturated zone.
- The potential spread of erosion from the source (within the development footprint area), into the wetland features, subsequently disturbing wetland soils, vegetation cover and local biota.

There is also the potential for some water quality impacts associated with the batching of concrete, from hydrocarbon spills or associated with other construction activities on the site. Only a limited amount of water is utilised during construction for the batching of cement and other construction activities.

Generally, with mitigation measures in place, including the micro-placing of infrastructure, outside of any sensitive features (freshwater resource features and associated buffer areas), impacts will be localised, short-term and of low intensity and is expected to have a moderate-low to low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Operation Phase:

During the operation phase the facility will operate continuously, mostly unattended and with low maintenance required for the duration of the SEFs life (±20 years). The SEF is likely to be monitored and controlled remotely, with maintenance only taking place when required.

The PV panels, substation, around the pylon locations, along the access routes, as well as within and around other hard surfaces created by the development may lead to increased runoff (reduction in infiltration) and the potential interception and channelling of surface runoff, particular on surfaces with a steeper gradient. This may potentially lead to:

- A modification to the water input characteristic (input in quantity and a change in water input pattern);
- Increased erosion;
- Sedimentation of the downslope areas; and
- Impairment of wetland functions and services

Subsequently, a localised long-term impact (more than 20 years) of low intensity (depending on the distance between the PV panels and the freshwater features) could be expected that would have a very low overall significance post-mitigation in terms of its impact on the identified freshwater resource features in the area.

Decommission Phase:

During decommissioning, the potential freshwater impacts will be very similar to that of the Construction Phase, although the potential for water quality and flow related risks will be lower.

Cumulative impacts

According to the REEA database (May 2023), only one REF apart from the proposed Boshoek Solar 2 and 3 Renewable Energy Facilities (REFs) is located within the 30 km cumulative radius. In terms of a 50 km cumulative radius, three additional REFS, apart from the aforementioned REFs will be considered. Existing renewable energy projects that were considered in terms of their potential cumulative terrestrial ecological impacts, that are in an approximate 50 km radius of the Boshoek Solar 1 Energy Facility, are illustrated below in Figure 20.

Thus, as mentioned, apart from the other two Boshoek SEF projects (Boshoek Solar PV 2 and 3), only four other REFs are currently included within the REEA database (May 2023), and which are located within the 50 km radius. Subsequently, the cumulative impact in the area is expected to be relatively low at this point.

Of these REFs only the Boshoek PV Solar developments (all three facilities) is located within the same quaternary catchment region, primarily drained by the Selons River and the Elands River. Subsequently the other SEFs will not contribute to the cumulative impacts on the Selons River's and Elands River's catchments and tributaries and subsequently the only SEFs likely to contribute to cumulative impacts, are the three Boshoek Solar PV projects.

Freshwater Resource Studies and Assessments was also undertaken, as part of the EIA processes, for the other two Boshoek PV Solar projects (Boshoek PV 1 and 2) and these assessments also recommend the avoidance of any freshwater resource features and furthermore has also recommended aquatic buffers. The conclusions drawn from the other two Boshoek PV Solar developments are very similar to that drawn for this study/assessment in that the proposed layouts of these facilities indicated limited impacts on their aquatic environments as the proposed structures for the most part, have avoided the delineated freshwater resource features (apart from the spanning of electrical grid lines across watercourses). Based on the findings of the other two Boshoek PV Solar developments' aquatic assessments, the relevant specialists found no objection to the authorisation of any of these SEFs, inclusive of provided recommended mitigation measures and alternatives.

Probably the most significant potential impact associated with these projects are the modification of roughage (vegetation cover) and the creation of compacted and hard engineered surfaces with the catchment areas, leading to:

- Reduced infiltration; and
- The increase in surface runoff and sediments carried into downstream freshwater resource features.

For these projects concerned, the micro-placing of infrastructure in order to avoid direct impacts on delineated freshwater resources, and to accommodate for recommended buffers, are highly possible and will allow for the avoidance of freshwater resource features, furthermore, reducing the impacts on the aquatic ecosystems.

All three of these projects have indicated that this is their intention with regard to mitigation, i.e. selecting the best possible layout to minimise the local and regional impacts.

Subsequently it can be concluded that the cumulative impact of the proposed project would not be significant provided mitigation measures are implemented.

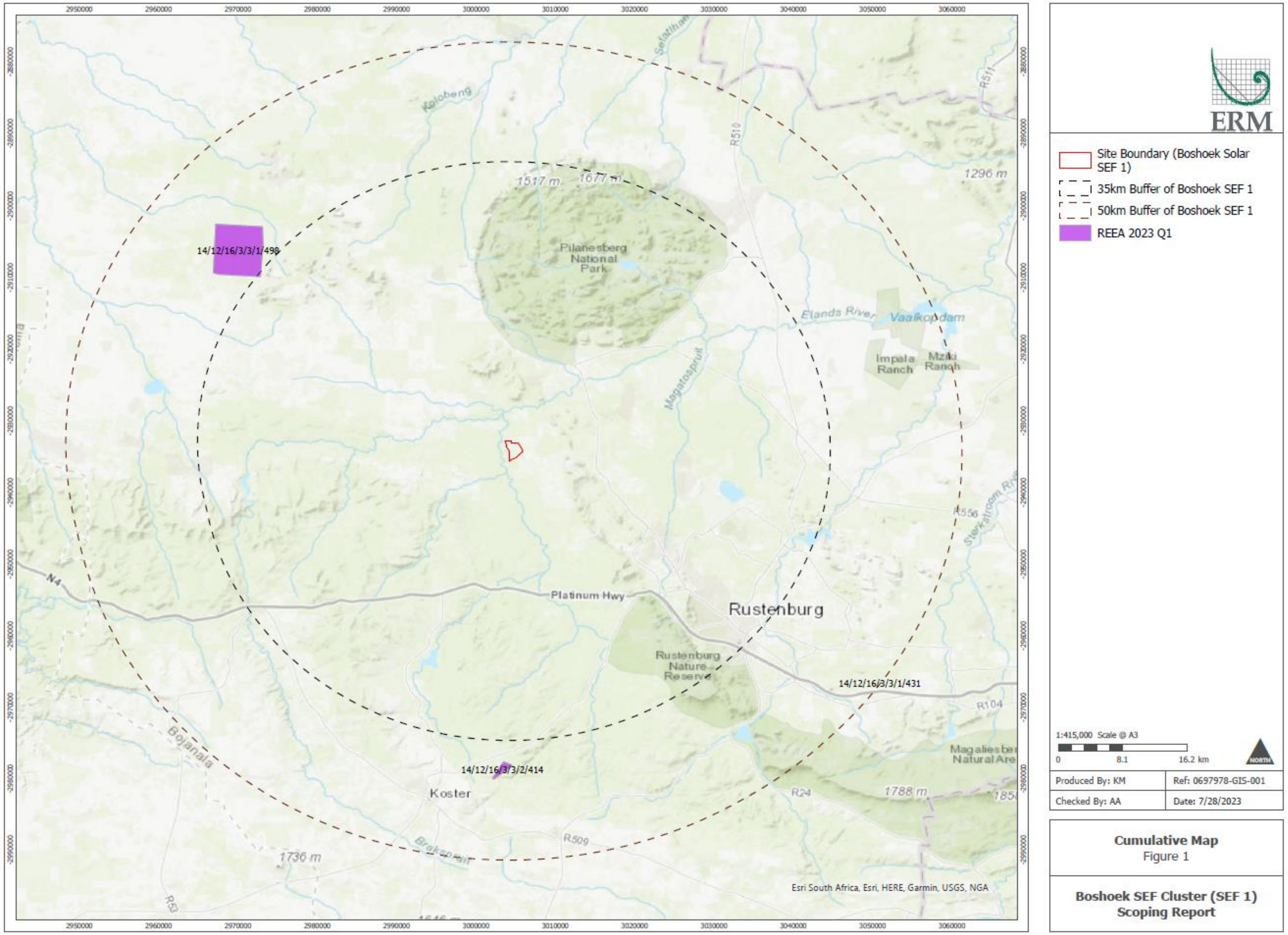

Figure 20: Location Map of the proposed Boshoek PV 1 Solar Facility relative to the other renewable facilities planned within a 30 km radius (Map provided by ERM).

7.2.1. Assessments of Impacts

CONSTRUCTION PHASE

Impact 1: Impact on freshwater resource systems through the increase in surface runoff on form and function during the construction

The proposed PV Solar Project will involve the addition of hardened areas through the establishment of solar panel foundations while some compaction of soils may occur due to site works. Service roads have the potential to further increase areas of hardening as do the temporary construction area. The substation, hardened areas around the pylons and additional support buildings will increase hardened surfaces. The aforementioned will increase the runoff generated on site due to the addition of areas of hard surfaces and could lead to the alteration in the quantity, timing and distribution of water inputs into the downstream freshwater resource features, increased flood peaks downstream with increased flood risk and erosion risk, potentially reducing or disturbing important/sensitive downstream freshwater resource habitats.

Possible ecological consequences associated with this impact may include:

- Deterioration in freshwater ecosystem integrity.
- Reduction/loss of habitat for aquatic dependent flora & fauna; and
- Reduction in the supply of ecosystem goods & services.

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Medium	Medium	Medium	Negative	High	Medium	High
With Mitigation	Low	Medium	Low	Neutral	Medium	Medium	High

Can the impact be reversed?	Partially Reversible. Through a rehabilitation and revegetation program which will be implemented during the decommissioning phase.
Will impact cause irreplaceable loss or resources?	With the implementation of mitigation measures there will not be any irreplaceable loss of freshwater recourses.
Can impact be avoided, managed or mitigated?	The impact can be largely mitigated and, in some areas, completely avoided (see mitigation measures below).

Mitigation measures to reduce residual risk or enhance opportunities:

- All watercourse features and their associated buffer areas should be regarded as No-Go areas for all construction activities, apart from the spanning of the electrical grid line and the use/upgrade of watercourse crossings along the electrical grid corridor.
- The recommended buffer areas between the delineated freshwater resource features and proposed project activities should be maintained.
- Vegetation clearing within the development footprint to be kept to a minimum. No unnecessary vegetation to be cleared.
- Vegetation clearing should occur in in a phased manner to minimise erosion and/or run-off.
- Infrastructure footprint and associated area of disturbance should be minimised as far as practically possible.
- Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities
- Stormwater from the substation and hard stand areas, must be managed using appropriate channels and swales when located within steeper areas.
- The runoff should be dissipated over a broad area covered by natural vegetation or managed using appropriate channels and swales.
- Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the Solar PV site.
- The existing road infrastructure should be utilised as far as possible to minimise the overall disturbance.

- Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated in order to reduce total area of hardened, bare areas within the property.
- No stormwater runoff must be allowed to discharge directly into freshwater resource features along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation.

Residual impact	A slight increase in water input (quantity), however, with mitigation measures in place this increase in water input would not impact the general hydrological characteristics of the downslope freshwater resource features.

CONSTRUCTION PHASE

Impact 2: Increase in sedimentation and erosion.

For the construction phase this refers to the alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition, caused by soil erosion and earthworks, within the watercourse features' catchments, that are associated with construction activities. Possible ecological consequences associated with this impact may include:

- Deterioration in freshwater ecosystem integrity; and
- Reduction/loss of habitat for aquatic dependent flora & fauna.

This may furthermore, influence water quality

The proposed development will require clearing of existing vegetation and disturbance of soils, specifically for the installation of foundations for PV modules, access roads, electrical cabling, substation, buildings, and laydown areas. The solar panels will increase shading of the surface and may result in a decrease in vegetation cover. Disturbed or exposed soils will increase the likelihood of soil erosion and subsequent potential sedimentation of downstream water courses during significant rainfall events. The study by Cook and McCuen (2013) found that the runoff from individual solar panels resulted in greater kinetic energy which increased potential soil erosion below panels (this potential erosion may be enhanced by panel maintenance which includes regular washing). The site is, however, located in a low rainfall area of South Africa which will reduce the potential impact with the mild topography also reducing the erosivity of runoff.

	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Medium	Negative	Medium	Medium	High
With Mitigation	Low	Low	Low	Negative	Low	Low	High

Can the impact be reversed?	Largely reversible, with the implementation of appropriate mitigation measures.
Will impact cause irreplaceable loss or resources?	No irreplaceable loss of freshwater resource features with the implementation of appropriate mitigation measures.
Can impact be avoided, managed or mitigated?	The impact can be avoided (see mitigation measures below).

Mitigation measures to reduce residual risk or enhance opportunities:

- All wetland features and their associated buffer areas should be regarded as No-Go areas for all construction activities apart from the spanning of the electrical grid line and the use/upgrade of existing watercourse crossings.
- The recommended buffer areas between the delineated freshwater resource features and proposed project activities should be maintained.
- Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
- Vegetation clearing should occur in in a phased manner to minimise erosion and/or run-off.
- Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
- All bare areas, as a result of the development, should be revegetated with locally occurring species, to bind the soil and limit erosion potential.

» Site rehabilitation should aim to restore surface drainage patterns, natural soil, and vegetation as far as is feasible. » An erosion control management plan should be utilised to prevent erosion. » Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities. » Stormwater from hard stand areas, buildings and substation must be managed using appropriate channels and swales when located within steep areas. » Erosion control measures such as silt fences (for areas of works) and gravel strips may be considered at the impact zone where water falls from the solar panels onto the soil surface (due to deterioration in natural grassland because of poor maintenance or lack of solar radiation). » Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the Solar PV site. » The existing road infrastructure should be utilised as far as possible to minimise the overall disturbance created by the proposed Solar PV Facility. » Silt traps should be used where there is a danger of topsoil eroding and entering lower lying wetland resources. » Construction of gabions and other stabilisation features to prevent erosion, if deemed necessary. » No stormwater runoff must be allowed to discharge directly into any wetland feature along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation.							
Residual impact	With the implementation of appropriate mitigation measures the only residual impact would be a slight increase in water inputs, without an increase in sediments carried into downslope freshwater resource features or the spread of erosion features into downslope freshwater resource features.						
CONSTRUCTION PHASE							
***Impact 3:* Potential impact on localised surface water quality.** Alteration or deterioration in the physical, chemical and biological characteristics of water resources (i.e. water quality) such as wetlands & rivers as a result of water/soil pollution. The term ‘water quality’ must be viewed in terms of the fitness or suitability of water for a specific use (DWAF, 2001). In the context of this impact assessment, water quality refers to its fitness for maintaining the health of aquatic ecosystems. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and » Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species).							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Low	Negative	Low	Low	High
With Mitigation	Low	Low	Low	Negative	Low	Low	High
Can the impact be reversed?			Highly Reversible with the implementation of appropriate mitigation measures.				
Will impact cause irreplaceable loss or resources?			No irreplaceable loss of freshwater resource features with the implementation of appropriate mitigation measures.				
Can impact be avoided, managed, or mitigated?			The impact can be avoided (see mitigation measures below).				
Mitigation measures to reduce residual risk or enhance opportunities							
» No activities may be allowed outside of the development areas, and especially within the identified downstream freshwater resource features and their associated buffer areas as these areas are regarded as no-go areas. » Implement appropriate measures to ensure strict use and management of all hazardous materials used on site							

» Implement appropriate measures to ensure Strict management of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.)
» Store hydrocarbons off site where possible, or otherwise implement hydrocarbon storage using impermeable floors with appropriate bunding, sumps and roofing.
» Implement appropriate measures to ensure containment of all contaminated water by means of careful run-off management on the development site.
» Implement appropriate measures to ensure strict control over the behavior of construction workers.
» Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.
» Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the substations.
» Waste should be stored on site in clearly marked containers in a demarcated area.
» All waste material should be removed at the end of every working day to designated waste facilities at the main construction camp/suitable waste disposal facility.
» All waste must be disposed of offsite.
» Ensure vehicles are regularly serviced so that hydrocarbon leaks are limited.
» Designate a single location for refueling and maintenance, outside of any freshwater resource features.
» Keep a spill kit on site to deal with any hydrocarbon leaks.
» Remove soil from the site which has been contaminated by hydrocarbon spillage.

Residual impact	Residual impacts will be negligible after appropriate mitigation.

CONSTRUCTION

Impact 4: Loss of freshwater resource features during the construction.

Direct physical destruction or disturbance of narrow strips of aquatic/wetland habitat by pylon construction and road crossings, being replaced by hard engineered surfaces during construction of the electrical grid infrastructure. This biological impact would however be localised, as a large portion of the remaining catchment and watercourses would remain intact.

Possible ecological consequences may include:

» Reduction in representation and conservation of freshwater ecosystem/habitat types;
» Reduction in the supply of ecosystem goods & services.
» Reduction/loss of habitat for aquatic dependent flora & fauna; and
» Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species).

As already mentioned, only the gridline and associated service/access route will have a potential direct impact on watercourse habitats.

These disturbances will be the greatest during the construction and again in the decommissioning phases as the related disturbances could result in the loss and/or damage to vegetation and alteration of natural geomorphological and hydrological processes within the freshwater resource features. Compacted soils are also not ideal for supporting vegetation growth as they inhibit seed germination.

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	High	Medium	Medium	Negative	High	Medium	High
With Mitigation	Low	Medium	Low	Negative	Low	Low	High
Can the impact be reversed?			Partially Reversible. Through a rehabilitation and revegetation program which will be implemented during the decommissioning phase.				

Will impact cause irreplaceable loss or resources?	With the implementation of mitigation measures there will not be any irreplaceable loss of freshwater recourses.
Can impact be avoided, managed, or mitigated?	The impact can be largely mitigated and, in some areas, completely avoided (see mitigation measures below).

Mitigation measures to reduce residual risk or enhance opportunities

- No pylons may be placed within the delineated freshwater resource features as well as their associated buffer areas; however, the pylons may span these features.
- Use as far as possible the existing roads.
- No activities or movement shall be allowed outside of the approved development footprint.
- Any erosion problems observed, to be associated with the relating activity, should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
- Any disturbed areas should be monitored to ensure that these areas do not become subject to invasive alien plant growth.
- No unnecessary vegetation clearance may be allowed.
- No vehicles may refuel within watercourses/wetlands/riparian vegetation.
- Vegetation clearing should occur in in a phased manner to minimise erosion and/or run-off.
- Where no existing wetland road crossings are available the construction of new crossings can be considered.
  - Where new watercourse/wetland crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (reduce footprint as much as possible).
  - All crossings over watercourses/wetlands should be such that the flow within the channels is not impeded and should be constructed perpendicular to the river/wetland channel.
  - The erosion and stormwater management measures included in the stormwater management plan for the EGI must be implemented.
  - Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated to reduce the disturbance of the area within the watercourses.
  - During the construction phase, monitor culverts to see if erosion issues arise and if any erosion control is required.
  - Where possible, culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.
  - Vegetation clearing should occur in a phased manner to minimise erosion and/or run-off.
  - Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and were deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).
- All alien plant re-growth must be monitored, and should it occur, these plants should be eradicated.

Residual impact	Residual impacts are unlikely to occur within these freshwater resource habitats, with the implementation of appropriate mitigation measures.

OPERATIONAL PHASE

Impact 5: Impact on watercourse/wetland systems through the possible increase in surface runoff on watercourse/wetland form and function during the operation and decommissioning phases.

This might occur during the operation phase, when hard or compacted surfaces (hard engineered surfaces, roads etc.) increase the volume and velocity of the surface runoff. This could impact the hydrological regime through the increase in flows that are concentrated in certain areas. If flows are too concentrated with high velocities, scour and erosion may occur, with a complete reduction or disturbance of riparian habitat.

	Severity	Extent	Duration	Status	Probability	Significance	Confidence

Without Mitigation	Medium	Medium	Medium	Negative	High	Medium	High
With Mitigation	Low	Medium	Low	Neutral	Medium	Medium	High
Can the impact be reversed?			Highly Reversible with the implementation of appropriate mitigation measures.				
Will impact cause irreplaceable loss or resources?			No irreplaceable loss of freshwater resource features with the implementation of appropriate mitigation measures.				
Can impact be avoided, managed, or mitigated?			The impact can be avoided (see mitigation measures below).				
Mitigation measures to reduce residual risk or enhance opportunities:							
» Any storm-water within the site must be handled in a suitable manner as per the management measures in stormwater management plan » Stormwater from hardstand areas, buildings and the substation must be managed using appropriate channels and swales when located within steep areas. » No stormwater runoff must be allowed to discharge directly into the watercourses. o The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate channels and swales when located within steep embankments. » Stormwater run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any stormwater leaving the WEF site.							
Residual impact	A slight increase in water input (quantity), however, with mitigation measures in place this increase in water input would not impact the general hydrological characteristics of the downslope freshwater resource features.						
OPERATIONAL PHASE							
Impact 6: Increase in sedimentation and erosion. For the operation phase, this refers to the alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition, caused by soil erosion, as well as instability and collapse of unstable soils during project operation. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and » Reduction/loss of habitat for aquatic dependent flora & fauna.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Medium	Negative	Medium	Medium	High
With Mitigation	Low	Low	Low	Negative	Low	Low	High
Can the impact be reversed?			Highly Reversible with the implementation of appropriate mitigation measures.				
Will impact cause irreplaceable loss or resources?			No irreplaceable loss of freshwater resource features with the implementation of appropriate mitigation measures.				
Can impact be avoided, managed, or mitigated?			The impact can be avoided (see mitigation measures below).				
Mitigation measures to reduce residual risk or enhance opportunities:							
» All freshwater resource habitats and their associated buffer areas are regarded as "No-Go" areas apart from the use of service and access roads. » Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur. » All bare areas, as a result of the development, should be revegetated with locally occurring species, to bind the soil and limit erosion potential. » Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities							

» Stormwater from hardstand areas, and the substation must be managed using appropriate channels and swales when located within steep areas.
» Stormwater run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the WEF site.

Residual impact	With the implementation of appropriate mitigation measures the only residual impact would be a slight increase in water inputs, without an increase in sediments carried into downslope freshwater resource features or the spread of erosion features into downslope freshwater resource features.

DECOMMISSIONING PHASE

Impact 7: Impact on freshwater resource systems through the increase in surface runoff on form and function during decommissioning.

The decommissioning of the proposed PV solar facility will involve high intensity disturbance of a fairly large surface area at and around the site and associated temporary laydown area. As already described the proposed PV Solar facility (apart from the gridline which will span a single watercourse feature) is located outside of any freshwater resource features and subsequently the potential impacts on freshwater resources will potentially be of an indirect nature due to disturbances (removal of vegetation, compaction of soil and a reduction in roughage) within their catchment areas.

Severe cases of erosion may potentially threaten the integrity of local and adjacent ecosystems and impact service provision such as grazing and clean water.

These modifications within the catchment areas may result in the alteration in the quantity, timing, and distribution of water inputs into the downstream freshwater resource features.

Possible ecological consequences associated with this impact may include:

» Deterioration in freshwater ecosystem integrity;
» Reduction/loss of habitat for aquatic dependent flora & fauna; and
» Reduction in the supply of ecosystem goods & services

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Medium	Medium	Medium	Negative	High	Medium	High
With Mitigation	Low	Medium	Low	Neutral	Medium	Medium	High

Can the impact be reversed?	Partially Reversible. Through a rehabilitation and revegetation program which will be implemented during the decommissioning phase.
Will impact cause irreplaceable loss or resources?	With the implementation of mitigation measures there will not be any irreplaceable loss of freshwater recourses.
Can impact be avoided, managed or mitigated?	The impact can be largely mitigated and, in some areas, completely avoided (see mitigation measures below).

Mitigation measures to reduce residual risk or enhance opportunities:

» All freshwater resource habitats and their associated buffer areas are regarded as "No-Go" areas apart from the decommissioning of the grid line.
» Infrastructure footprints and associated areas of disturbance should be minimised as far as practically possible.
» All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable.
» Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities
» No stormwater runoff must be allowed to discharge directly into any water course from the decommissioning site, and flows from these areas should be allowed to dissipate over a broad area covered by natural vegetation.

Residual impact	If the above recommended mitigation measures are strictly implemented, the residual impact will be very low.						
DECOMMISSIONING PHASE							
Impact 8: Increase in sedimentation and erosion. Alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and » Reduction/loss of habitat for aquatic dependent flora & fauna. This may furthermore, influence water quality downstream.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Medium	Negative	Medium	Medium	High
With Mitigation	Low	Low	Low	Negative	Low	Low	High
Can the impact be reversed?			Largely reversible, with the implementation of appropriate mitigation measures.				
Will impact cause irreplaceable loss or resources?			No irreplaceable loss of freshwater resource features with the implementation of appropriate mitigation measures.				
Can impact be avoided, managed or mitigated?			The impact can be avoided (see mitigation measures below).				
Mitigation measures to reduce residual risk or enhance opportunities							
» All freshwater resource habitats and their associated buffer areas are regarded as "No-Go" areas, apart from the decommission of the electrical grid line. » Any erosion problems observed should be rectified immediately and monitored thereafter to ensure that they do not re-occur. » There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures. » All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable. » There should be reduced activity at the site after large rainfall events when the soils are wet. No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.							
Residual impact	If the above recommended mitigation measures are strictly implemented, the residual impacts will be avoided.						
DECOMMISSIONING PHASE							
***Impact 9:* Potential impact on localised surface water quality.** Alteration or deterioration in the physical, chemical and biological characteristics of water resources (i.e. water quality) such as wetlands & rivers as a result of water/soil pollution. The term 'water quality' must be viewed in terms of the fitness or suitability of water for a specific use (DWAF, 2001). In the context of this impact assessment, water quality refers to its fitness for maintaining the health of aquatic ecosystems. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity; and							

» Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species).							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Low	Negative	Low	Low	High
With Mitigation	Low	Low	Medium	Negative	Low	Low	High
Can the impact be reversed?			Highly Reversible with the implementation of appropriate mitigation measures.				
Will impact cause irreplaceable loss or resources?			No irreplaceable loss of freshwater resource features with the implementation of appropriate mitigation measures.				
Can impact be avoided, managed, or mitigated?			The impact can be avoided (see mitigation measures below).				
Mitigation measures to reduce residual risk or enhance opportunities							

- No activities may be allowed outside of the development areas, and especially within the identified downstream freshwater resource features and their associated buffer areas as these areas are regarded as no-go areas.
- Implement appropriate measures to ensure strict use and management of all hazardous materials used on site.
- Implement appropriate measures to ensure Strict management of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.)
- Store hydrocarbons off site where possible, or otherwise implement hydrocarbon storage using impermeable floors with appropriate bunding, sumps and roofing.
- Implement appropriate measures to ensure containment of all contaminated water by means of careful run-off management on the development site.
- Implement appropriate measures to ensure strict control over the behavior of construction workers.
- Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.
- Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the substations.
- Waste should be stored on site in clearly marked containers in a demarcated area.
- All waste material should be removed at the end of every working day to designated waste facilities at the main construction camp/suitable waste disposal facility.
- All waste must be disposed of offsite.
- Ensure vehicles are regularly serviced so that hydrocarbon leaks are limited.
- Designate a single location for refueling and maintenance, outside of any freshwater resource features.
- Keep a spill kit on site to deal with any hydrocarbon leaks.
- Remove soil from the site which has been contaminated by hydrocarbon spillage.

Residual impact	Residual impacts will be negligible after appropriate mitigation.

CUMULATIVE IMPACT PHASE

Impact 10: Compromise ecological processes as well as ecological functioning of important freshwater resource habitats.

Transformation of intact freshwater resource habitat could potentially compromise ecological processes as well as ecological functioning of important habitats and would contribute to habitat fragmentation and potentially disruption of habitat connectivity and furthermore impair their ability to respond to environmental fluctuations. This is especially of relevance for larger watercourses and wetlands serving as important groundwater recharge and floodwater attenuation zones, important microhabitats for various organisms and important corridor zones for faunal movement.

	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**

Without Mitigation	Medium	Medium	High	Negative	High	High	High
With Mitigation	Low	Medium	Medium	Negative	Low	Low	High
Can the impact be reversed?			Moderate to high reversibility. By implementing appropriate mitigation measures including an effective rehabilitation and re-vegetation plan during the decommission phase.				
Will impact cause irreplaceable loss or resources?			No irreplaceably loss of freshwater resources as all facilities mostly exclude any freshwater resource features from their layouts apart from the occasional spanning of electrical gridlines.				
Can impact be avoided, managed, or mitigated?			Impacts can be largely avoided.				
Mitigation measures to reduce residual risk or enhance opportunities:							
» Use existing service roads as far as possible when crossing any watercourses. » No infrastructure may be placed within the delineated watercourses and their associated buffer areas; however, the electrical gridlines may span these features. » Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared. » The potential stormwater impacts of the proposed developments areas should be mitigated on-site to address any erosion or water quality impacts. » Where watercourse crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (small footprint). » Good housekeeping measures as stipulated in the EMPr for the project should be in place where construction activities take place to prevent contamination of any freshwater features. » Disturbed areas should be rehabilitated through reshaping of the surface to resemble that prior to the disturbance and vegetated with suitable local indigenous vegetation.							
Residual impact	If the above recommended mitigation measures are strictly implemented, the residual impacts will be **very low,** with functions and ecological processes associated with the freshwater resource features being preserved.						

8. CONCLUSION AND RECOMMENDATIONS

Nkurenkuru Ecology and Biodiversity was commissioned to undertake a freshwater resource and biodiversity study and assessment for the proposed Boshoek PV 1 Solar Facility and associated infrastructure. The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW. The development area is situated approximately 33 km north west of Rustenburg within the Kgetlengrivier and Rustenburg Local Municipalities and the Bojanala District Municipality, in the North West Province.

An assessment area of approximately 290 ha has been assessed as part of this EIA process

This study has been commissioned to meet the requirements of the EIA process in the form of an Aquatic Ecological and Biodiversity Study and Impact Assessment as set out by the National Environmental Management Act (1998) and a Water Use Licence Application as set out by the National Water Act (Act 36 of 1998). Furthermore, this study should and has been done in accordance with the "newly" Gazetted Protocols 3(a),(c) and (d) in terms of Section 24(5)(a) and 24(5)(h) of NEMA (Published on the 20th of March 2020); and meet the requirements as set out within the Aquatic Biodiversity Protocol published in GN NO. 1105 of 30 October 2020.

An initial desktop mapping exercise was executed (prior to the site-visit), wherein all water resources (wetland and watercourses) within a radius of 500m around the proposed SEF were mapped and classified at a desktop level followed by a desktop rating of risk associated with the proposed activities. This was undertaken to guide field assessments and inform water use identification for the proposed project.

Freshwater Resource Delineation and Classification:

a total of five (5) natural freshwater resource features were identified and delineated within the 500 m buffer area (DWS Regulated Area) and include one (1) larger intermittent to seasonal stream with a prominent wooded riparian fringe and four (4) narrow drainage lines with no riparian fringe. Furthermore, a total of nine (9) artificial freshwater resource features were identified within the 500m buffer area, all these features being small gravel dams/reservoirs, with two (2) of these being instream.

Ultimately, it was found that, of the five freshwater resource features that were identified within the 500m buffer area, one (1) feature has a high risk of being impacted by the proposed development (grid infrastructure only), whilst one (1) feature has a moderate risk of being impacted. Of these two (2) freshwater resource features:

» one freshwater resource feature is a narrow intermittent stream (WC2) with a wooded riparian fringe being mostly absent to very narrow; and
» the second freshwater resource feature (WC2) is a narrow drainage lines with no riparian fringe.

These two freshwater resource features were assessed and delineated “in-field” by Gerhard Botha from Nkurenkuru Biodiversity and Ecology on the 27th to the 29th of March 2023 (early autumn) and from 23rd to 24th of January 2024 (summer). Conditions during the periods of the site surveys were regarded as acceptable.

All of the freshwater resource features can be regarded as intermittent, containing surface flow for only brief periods following sufficient rainfall events, with “dry” periods that are unpredictable in duration.

Present Ecological Condition:

The aquatic report's assessment of the Present Ecological State (PES) focused on evaluating the health and integrity of river ecosystems by measuring their deviation from the reference state. This evaluation considered the concept of "habitat integrity," which involves maintaining a balanced composition of physical, chemical, and habitat characteristics comparable to natural habitats in the region. The Index of Habitat Integrity (IHI) was used as a measure of PES, covering both in-stream and riparian habitats.

The assessment involved separate evaluations of habitat integrity for in-stream and riparian habitats, based on various indicators, including water abstraction, flow modification, inundation, bed modification, bank erosion, channel modification, water quality, solid waste disposal, vegetation removal, and exotic vegetation.

The results of the IHI assessment highlighted several key findings:

- » The small intermittent stream (WC1) are at high risk of impact due to the fact that this watercourse is crossed by the proposed electrical grid corridor. This watercourse has been severely modified in terms hydrology, geomorphology and vegetation structure/composition. A large portion of this drainage lines traverse pasture paddocks. Vegetation coverage and structure, within these areas, have been completely modified through the removal of almost all trees and shrubs and the replacement of the natural grass layer with palatable grazing species such as *Cenchrus ciliaris*. Portions of this watercourse have also been ripped and ploughed in the past (prior to initial reseeding) and are subjected to significant grazing pressure (small paddocks used for intensive game breeding, mainly grazers). Furthermore, this watercourse has been dammed upstream (two small gravel dams) and such dams have a profound impact on the hydrology of smaller systems. Subsequently WC1 is currently regarded as being in a Seriously Modified conditions (PES = "E").
- » The short drainage line (WC2 located to the west of the project site, is at moderate risk of being impacted by the proposed development due to its close proximity to the proposed development. Limited change has occurred to the hydrological and geomorphological characteristics of this freshwater resource feature. The most significant impact is erosion, however the extent of erosion can be regarded as low to moderate-low, with isolated localities being exposed to erosion. The most likely culprit is overgrazing and the slight reduction in vegetation coverage and structure. Grazing pressure has resulted in the slight encroachment of *Senegalia mellifera*, reducing the ground cover (graminoid layer) and exposing these areas to some sheet erosion. No instream dams are present within this watercourse and as such the hydrological character of this watercourse can be regarded as natural. Watercourse crossings are very limited and restricted to tow small farm tracks. This watercourse is currently regarded as being in Largely Natural condition as reflected by a "B" PES Category.

In summary, the report's findings indicate that various watercourses and drainage lines within the study area exhibit different levels of modification, influenced by a range of natural and anthropogenic factors. Understanding these variations in habitat integrity and ecological state is essential for making informed decisions regarding conservation and management strategies for these ecosystems.

Ecological Importance and Sensitivity:

The results and findings of the Ecological Importance and Sensitivity (EI&S) assessment of the freshwater resource features reveals varying degrees of significance across the surveyed watercourses.

The small intermittent stream with a less prominent to absent riparian fringes, exhibit moderate ecological importance and sensitivity. While such systems play a crucial role in maintaining larger watercourses and reducing flood damage downstream, they are more susceptible to degradation. They support fairly low fauna diversity and are susceptible to livestock and game utilization.

The small intermittent drainage line is deemed of low ecological importance and sensitivity. This largely natural drainage line has a very low diversity of instream and riparian habitat and are unlikely to harbour any rare or endangered, unique or endemic species. The small size of the drainage lines and largely intermittent nature of flows makes this ecosystem inherently vulnerable and sensitive to changes in the timing and volume of flows and water quality modifications. Furthermore, very limited instream habitat types, and the absence of riparian habitat types to support a high diversity of biota, will have a strong limiting influence on the structure and composition of invertebrate and vertebrate communities. Even though habitat connectivity is high, the role as functional migration routes/corridors is limited due to the short distance of this watercourse and the location of a major road system just upstream of this watercourse. During times of environmental stress, the instream habitat is likely to offer limited refugia for local aquatic and terrestrial wildlife only.

In summary, the assessment underscores the ecological significance and sensitivity of different watercourses, emphasizing the importance of preserving and managing these vital habitats based on their unique characteristics and roles in supporting local ecosystems.

Recommended Ecological Category (REC) and Management Objectives for Watercourses:

The future management of the freshwater ecosystems in the project area should be guided by the 'Recommended Ecological Category' (REC) and the associated recommended management objectives for water resources. These objectives are typically based on the Present Ecological State/Ecological Category (PES/EC) and the Ecological Importance and Sensitivity (EIS) of water resources, as outlined by the Department of Water Affairs (DWAF) in 2007.

The management strategy should be tailored to the specific characteristics and context of each watercourse, considering both existing threats and potential future development pressures. Based on the rating system, the recommended management objective for both WC1 and WC2, should be to maintain the current ecological conditions of these freshwater resource features.

Freshwater Resource Buffer Zones

Buffer zones, which are typically strips of undeveloped and vegetated land, serve a crucial role in separating development or adjacent land uses from aquatic ecosystems, including rivers and wetlands. The primary purpose of these buffers is to mitigate the impact of adjacent land uses on water quality and to provide habitat for aquatic and semi-aquatic species. They play a vital role in protecting aquatic resources and mitigating anthropogenic impacts.

The proposed buffer zones in the study area are designed to offer a wide range of functions and values, including sediment, nutrient, and toxic removal, control of microclimate and water temperature, provision of habitat for wildlife, screening of disturbances, habitat connectivity, channel stability, flood attenuation, groundwater recharge, and aesthetic appeal. However, it's important to note that buffer zones cannot address all water resource-related problems. They may not be effective in mitigating certain impacts like changes in flow caused by abstractions or point-source discharges, such as sewage outflows.

Given the existing anthropogenic impacts in and around the watercourses, along with the forthcoming development, an aquatic buffer is deemed essential to maintain watercourse integrity. However, it's important to acknowledge that a 20-30m aquatic surface buffer might not fully protect catchment-related hydrology, such as groundwater recharge. Therefore, mitigation and management measures for the proposed development in the larger catchment should also be considered to compensate for potential losses.

The recommended buffer distances are based on the delineation of aquatic impact buffer zones, beginning from the outer edge of the active channel. These buffer zones may encompass riparian habitats, stream banks, and terrestrial habitats, depending on their width. The calculated buffer distances vary for different watercourses, taking into account the presence of riparian fringes:

- » Intermittent streams with less no to narrow riparian fringes:
  - Aquatic Buffer for Electrical Grid Infrastructure: 25 m;
- » Narrow drainage lines without riparian fringes:
  - Aquatic Buffer for Solar PV Facility: 40 m;

WC 2 and its associated 40m aquatic buffer is located outside of the development footprint. This watercourse as well its buffer area should be regarded as a No-Go Zone apart from the use of the existing access road. It is highly unlikely that the proposed development, with the maintenance of the buffer area, will significantly impact WC 2.

WC 1 is located within the grid corridor. WC 1 and the proposed 25 m aquatic buffer should be spanned, and no pylons may be allowed within the buffer area. Apart from the spanning of WC 2 the only other activities allowed within this watercourse are the upgrade of existing access routes/watercourse crossings and where no acceptable crossings are available the construction of a new crossing may be allowed, with the implementation of strict mitigation and monitoring measures.

This approach ensures that management efforts are aligned with the ecological condition of each watercourse, promoting conservation and sustainable use of these vital aquatic habitats within the project area.

General Recommendations

The following recommendation should be taken into account during the planning and refining phase of the proposed wind energy facility:

» All delineated freshwater resource features as well as their recommended buffer areas are regarded as No-Go areas apart from the spanning of the electrical gridline and the use/upgraded of existing watercourse crossings.

Impacts and Mitigation

With mitigation, potential impacts on freshwater resource features as a result of the proposed development, during the construction, operation and decommissioning phases will mainly be low, apart from the potential slight increase in water input into the delineated freshwater resource features. However, this increase is most likely not significant enough to change the general hydrological characteristics of these freshwater resource features and downstream freshwater resources (water input patterns, and the magnitude and frequency of floodpeaks). Subsequently, it is unlikely that this impact will affect the freshwater resource features, with the implementation of mitigation measures, in a negative manner, but impacts will largely be of neutral manner.

One can also expect that the cumulative impact of the proposed project would not be significant (of a moderate impact) provided mitigation measures are implemented.

Recommended mitigation measures to be included in the environmental authorisation are as follows:

» All freshwater resource features and their associated buffer areas should be regarded as NO-GO areas apart from the spanning of WC1 and the use/upgrade of existing watercourse crossings.
» In order to avoid any indirect impacts on these freshwater resource features as a result of the construction and operation of the SEF:
  - No activities may be allowed outside of the development areas.
  - Implement appropriate measures to ensure strict use and management of all hazardous materials used on site.
  - Implement appropriate measures to ensure strict management of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.).

- Working protocols incorporating pollution control measures and approved method statements for the project must be strictly enforced and implemented by the contractor/s.
- Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
- All bare areas, as a result of the development, should be revegetated with locally occurring species, to bind the soil and limit erosion potential.
- Site rehabilitation should aim to restore surface drainage patterns, natural soil and vegetation as far as is feasible.
- Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities
- Stormwater from the substations and other hard stand areas, must be managed using appropriate channels and swales when located within steep areas.
- No stormwater runoff must be allowed to discharge directly into any wetland feature, and flows from these substations should be allowed to dissipate over a broad area covered by natural vegetation.
- Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the switching station sites.
- Silt traps should be used where there is a danger of topsoil eroding and entering streams and other sensitive areas.
- Construction of gabions and other stabilisation features to prevent erosion, if deemed necessary.

With mitigation measures in place, impacts on surface water resource integrity and functioning can be reduced to a sufficiently low level. This would be best achieved by incorporating the recommended management & mitigation measures into an Environmental Management Programme (EMPr) for the site, together with appropriate rehabilitation guidelines and ecological monitoring recommendations.

Based on the outcomes of this study it is my considered opinion that the proposed project detailed in this report could be authorised from a surface water resource perspective.

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10. APPENDICES

10.1. Methodology: Freshwater Resource Assessment

10.1.1. Survey methods

The assessment was initiated with a survey of the pertinent literature, past reports, and the various conservation plans that exist for the study region. Maps and Geographical Information Systems (GIS) were then employed to ascertain, which portions of the proposed development, could have the greatest impact on the wetlands and associated habitats.

The desktop delineation of all surface water resources (i.e. rivers, streams, and wetlands) within 500m of the proposed development (i.e. the DWS regulated area for Water Use in terms of Section 21 of the National Water Act) was undertaken by analysing available contour data and colour aerial photography, supplemented by Google EarthTM imagery where applicable. Digitization and mapping were undertaken using ArcMap GIS software. All of the mapped watercourses were then broadly subdivided into distinct resource units (i.e. classified as either riverine or wetland systems/habitat) based on professional experience, topographical setting, and drainage patterns. Following the mapping of water resource units within 500m of the proposed development, the risk posed by the development to freshwater ecosystems was screened at a desktop level and ascribed a qualitative risk rating. The potential risks were also identified based on the nature of the proposed development and professional experience with similar developments, as well as based on ground-truthing of mapped watercourses in the field.

A two-day site visit was then conducted to ground-truth the above findings, thus allowing critical comments of the development when assessing the possible impacts and delineating the freshwater resource areas.

» The following equipment was utilized during fieldwork.
  - Canon EOS 450D Camera
  - Garmin Etrex Legend GPS Receiver
  - Soil Auger
  - Munsell Soil Colour Chart (2000)
  - Braun-Blanquet Data Form (for vegetation recording and general environmental recordings).

Freshwater resource areas were then assessed on the following basis:

» Identification and delineation of wetlands and riparian areas according to the procedures specified by DWAF (2005a).

- Vegetation type – verification of type and its state or condition-based, supported by species identification using Germishuizen and Meyer (2003), Vegmap (Mucina and Rutherford, 2006 as amended), and the South African Biodiversity Information Facility (SABIF) database.
- Plant species were further categorised as follows:
  - Terrestrial/Upland: species are rarely found within the riparian zone (<25% probability) and characterize the terrestrial landscape that borders the riparian zones. Upland species usually occur naturally in the upper parts of the riparian zone, but with low relative abundance (DWAF, 2008).
  - Facultative riparian: species may occur in either riparian zones or the upland (25>% probability of occurrence in the riparian zone). They can habituate to more mesic conditions with a high probability of survival, or can tolerate higher levels of flooding disturbance or soil moisture. They are not good national indicators, but rather circumstantial indicators good for particular regions (DWAF, 2008).
  - Preferential riparian: these area species that are preferentially, but not exclusively, found in the riparian zone (>75% probability). They may be found in non-riparian areas as indicators of wetness. Where they do occur in the upland, they show progressive reductions in abundance, statue, and vigour farther from the riparian zone. Preferential riparian species may harden to drought conditions, but will always indicate sites with increased moisture availability, and are therefore consistent indicators across geographic boundaries (DWAF, 2008).
  - Obligate: these species occur almost exclusively in the riparian zone (>90% probability). They are seldom found in non-riparian areas, but where they are outside of riparian areas, they still indicate wetness. They are not likely to occur in the upland. Obligate riparian species are conservative as such i.e. an obligate will remain obligate throughout all geographic regions (DWAF, 2008).
- Assessment of the freshwater resources based on the method discussed below and the required buffers.
- Mitigation or recommendations required.

Classification System for Wetlands and other Aquatic Ecosystems in South Africa System (SANBI, 2013)

Since the late 1960's, wetland (including other freshwater ecosystems) classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith et al., 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects.

The South African National Biodiversity Institute (SANBI) in collaboration with several specialists and stakeholders developed in 2010 the newly revised accepted National Wetland Classification Systems (NWCS, 2010). In 2013 however, this classification system (National Wetland Classification System) underwent a name change to now be known as the 'Classification System for Wetlands and other Aquatic Ecosystems in South Africa'. This was done to avoid confusion around the term 'wetland' which is defined differently by the RAMSAR Convention and the South Africa National Water Act (Act No. 36 of 1998). The scope of the Classification System has not been changed, however, in that it still includes all ecosystems that the RAMSAR Convention is concerned with.

This classification system includes and distinguishes between three broad types of inland aquatic/freshwater systems namely:

» Rivers, which are 'lotic' aquatic ecosystems with flowing water concentrated within a distinct channel, either permanently or periodically.
» Open water bodies, which are permanently inundated 'lentic' aquatic ecosystems where standing water is the principal medium within which the dominant biota live. In this system, open water bodies with a maximum depth of greater than 2m are called limnetic (lake-like) systems.
» Wetlands are transitional between aquatic and terrestrial systems and are generally characterised by (permanently to temporarily) saturated soils and hydrophytic vegetation. These areas are, in some cases, periodically covered by shallow water and/or may lack vegetation.

The basis upon which this classification system is based on is the principles of the Hydrogeomorphic (HGM) approach at higher levels, including structural features at the finer or lower levels of classification (SANBI, 2013) (Table 16).

Table 16: Hydrogeomorphic (HGM) Units for Inland Systems, showing the primary HGM Types at Level 4A and sub-categories at Levels 4B to 4C.

Level 4: Hydrogeomorphic (HGM) Units		
HGM Type	**Longitudinal zonation/Landform/Outflow drainage**	**Landform/Inflow drainage**
River	Mountain headwater stream	Active channel
		Riparian Zone
	Mountain Stream	Active channel
		Riparian Zone
	Transitional	Active channel
		Riparian Zone
	Upper foothills	Active channel
		Riparian Zone
	Lower foothills	Active channel
		Riparian Zone
	Lowland river	Active channel
		Riparian Zone

	Rejuvenated bedrock fall	Active channel
		Riparian Zone
	Rejuvenated foothills	Active channel
		Riparian Zone
	Upland floodplain	Active channel
		Riparian Zone
Channeled valley-bottom wetland	N/A	N/A
Unchanneled valley-bottom wetland	N/A	N/A
Floodplain	Floodplain depression	N/A
	Floodplain flat	N/A
Depression	Exorheic	With channeled inflow
		Without channeled inflow
	Endorheic	With channeled inflow
		Without channeled inflow
	Dammed	With channeled inflow
		Without channeled inflow
Seep	With channeled outflow	N/A
	Without channeled outflow	N/A
Wetland Flat	N/A	N/A

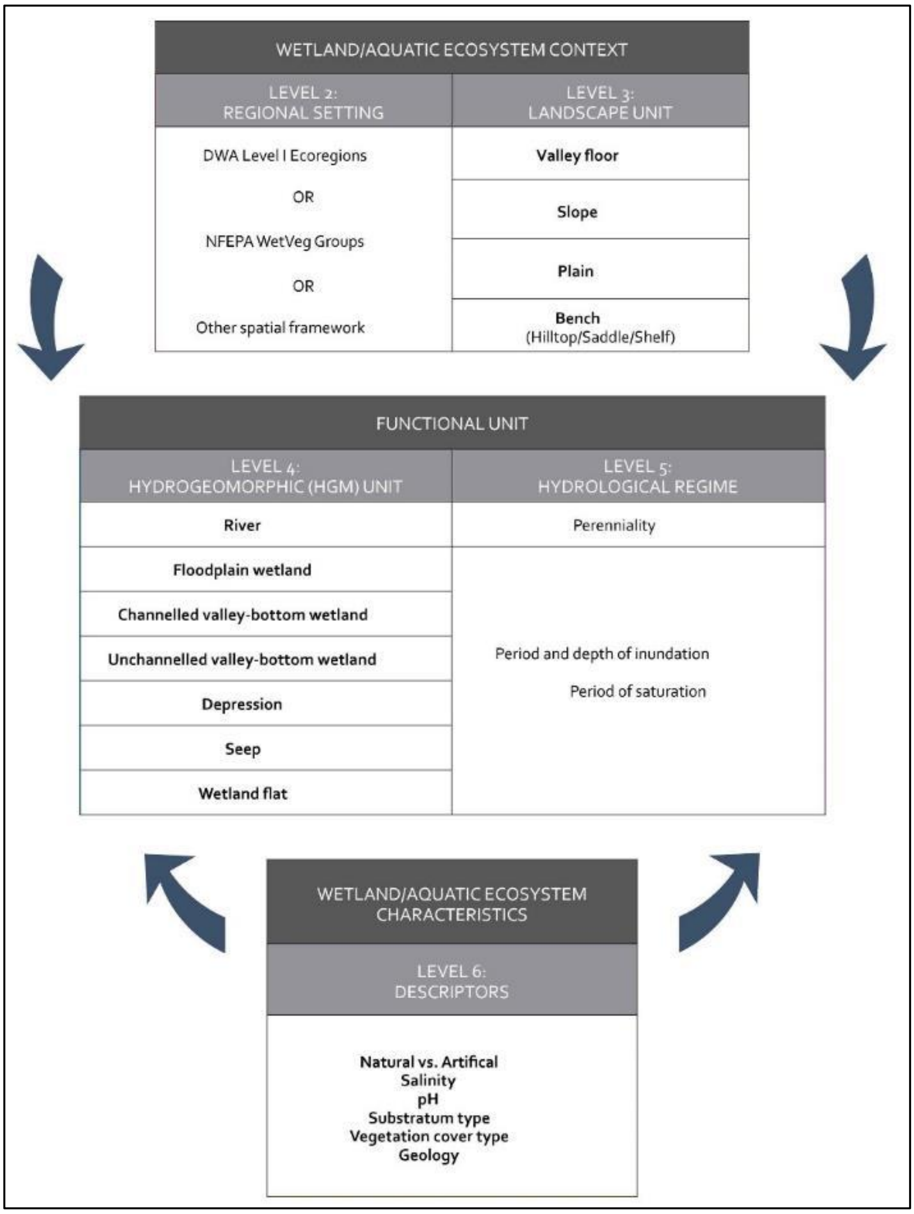

Figure 21: Basic structure of the National Wetland Classification System, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the hydrological regime, and 'descriptors' applied at Level 6 to categorise the characteristics of wetlands classified up to Level 5 (From SANBI, 2009).

It is widely accepted that hydrology (i.e. the presence or movement of water) and geomorphology (i.e. landform characteristics and processes) are the two fundamental features that determine the way in which an inland aquatic ecosystem functions, regardless of climate, soils, vegetation or origin. Subsequently, it is significant that the HGM approach has now been included in wetland classification as the HGM approach has been adopted throughout the water resources management realm with regard the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) and WET-Health assessments for aquatic environments. All of these systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the Department of Water Affairs.

In summary, the overall structure of this classification system comprises six tiers. This tiered structure is summarised in Figure 21 with Level 4 tier (HGM Units), as mentioned, forming the focal point of this system together with Level 5 tier (hydrological regime).

Some of the terms and definitions used in this document are present below:

Wetland definition

Although the National Wetland Classification System (SANBI, 2009) is used to classify wetland types it is still necessary to understand the definition of a wetland. Wetland definitions as with classification systems have changed over the years. Terminology currently strives to characterise a wetland not only on its structure (visible form) but also to relate this to the function and value of any given wetland.

The Ramsar Convention definition of a wetland is widely accepted as "**areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres**" (Davis 1994). South Africa is a signatory to the Ramsar Convention and therefore its extremely broad definition of wetlands has been adopted for the proposed NWCS, with a few modifications.

Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised seaward boundary of the shallow photic zone (Lombard et al., 2005). An additional minor adaptation of the definition is the removal of the term 'fen' as fens are considered a type of peatland. The adapted definition for the NWCS is, therefore, as follows (SANBI, 2009):

WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten meters. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are defined as "land which is transitional between terrestrial and aquatic systems, where the water table is usually at, or near the surface, or the land is periodically covered with shallow water and which land in normal circumstances supports, or would support, vegetation adapted to life in saturated soil."

This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the later as a watercourse (SANBI, 2009). The DWA is however reconsidering this position concerning the management of estuaries due to the ecological needs of these systems concerning water allocation. Table 17 provides a comparison of the various wetlands included within the main sources of wetland definition used in South Africa.

Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. "wetlands", as defined by the National Water Act, together with open water bodies), it is understood that subsequent versions of the Inventory include the full suite of Ramsar-defined wetlands to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (SANBI, 2009).

Wetlands must, therefore, have one or more of the following attributes to meet the above definition (DWAF, 2005):

» A high-water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil.
» Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils
» The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water-loving plants).

It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with the drainage lines.

Table 17: Comparison of ecosystems considered to be 'wetlands' as defined by the proposed NWCS, the National Water Act (Act No. 36 of 1998), and ecosystems are included in DWAF's (2005) delineation manual.

Ecosystem	NWCS "wetland"	National Water Act wetland	DWAF (2005) delineation manual
Marine	YES	NO	NO
Estuarine	YES	NO	NO
Waterbodies deeper than 2 m (i.e. limnetic habitats often describe as lakes or dams)	YES	NO	NO
Rivers, channels and canals	YES	NO[2]	NO

[2] Although river channels and canals would generally not be regarded as wetlands in terms of the National Water Act, they are included as a 'watercourse' in terms of the Act.

Inland aquatic ecosystems that are not river channels and are less than 2 m deep	YES	YES	YES
Riparian[3] areas that are permanently / periodically inundated or saturated with water within 50 cm of the surface	YES	YES	YES3
Riparian areas that are not permanently / periodically inundated or saturated with water within 50 cm of the surface	NO	NO	YES[4]

Rivers: a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow (unidirectional) of water. A river is taken to include both the active channel and the riparian zone as a unit (SANBI, 2013).

Dominant water sources for rivers include concentrated surface flow from upstream channels and tributaries. Other inputs can include diffuse surface or subsurface flow (e.g. from an upstream seepage wetland), interflow (e.g. from an upstream seepage wetland), interflow (e.g. from valley side-slopes), and/or groundwater inflow (e.g. from springs). Water moves through the system, at least periodically, as concentrated flow and usually exits as such, except where there is a sudden decrease in gradient causing the outflow to become diffuse (in which case the river would grade into one of the wetland types). Other water outputs from a river include evapotranspiration and infiltration (SANBI, 2013) (refer to Figure 22).

[3] According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods would be considered riparian wetlands, opposed to non –wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many meters below the surface.

[4] The delineation of 'riparian areas' (including both wetland and non-wetland components) is treated separately to the delineation of wetlands in DWAF's (2005) delineation manual.

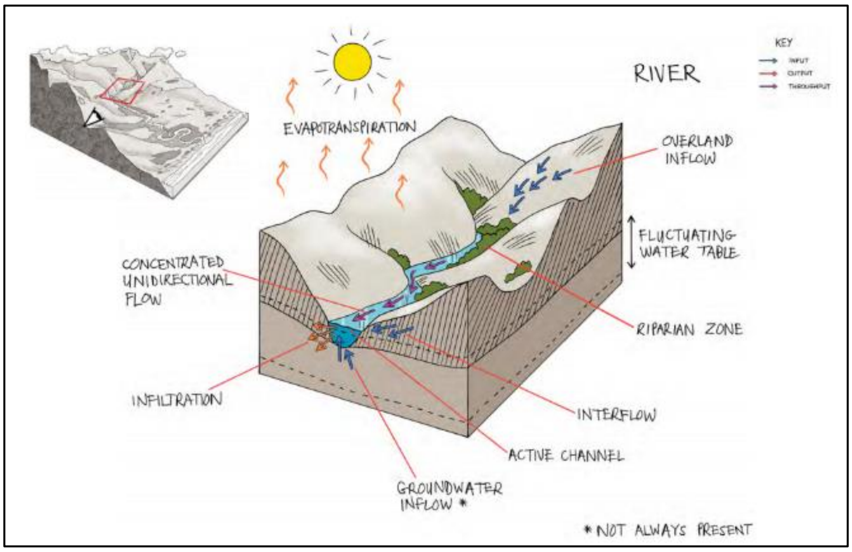

Figure 22: A conceptual illustration of a river as provided by SANBI, 2013.

Riparian zone: According to the definition provided by DWAF (2008), a riparian zone can be described as:

"*the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas*"

Furthermore, DWAF (2008) states that:

"*unlike wetland areas, riparian zones are usually not saturated for a long enough duration for redoxymorphic features to develop. Riparian zones instead develop in response to (and are adapted to) the physical disturbances caused by frequent overbank flooding from the associated river or stream channel*."

Riparian vegetation may be associated with both perennial and non-perennial watercourses/rivers. Riparian areas furthermore represent the transitional area between aquatic and terrestrial habitats. The vegetation associated with riparian zones typically require ample water and are adapted to shallow water table conditions as well as periodical flooding. Due to water availability and rich alluvial soils, riparian areas are usually very productive. Tree growth rate is high and the vegetation under the trees is usually lush in comparison to the upland terrestrial vegetation (refer to Figure 23).

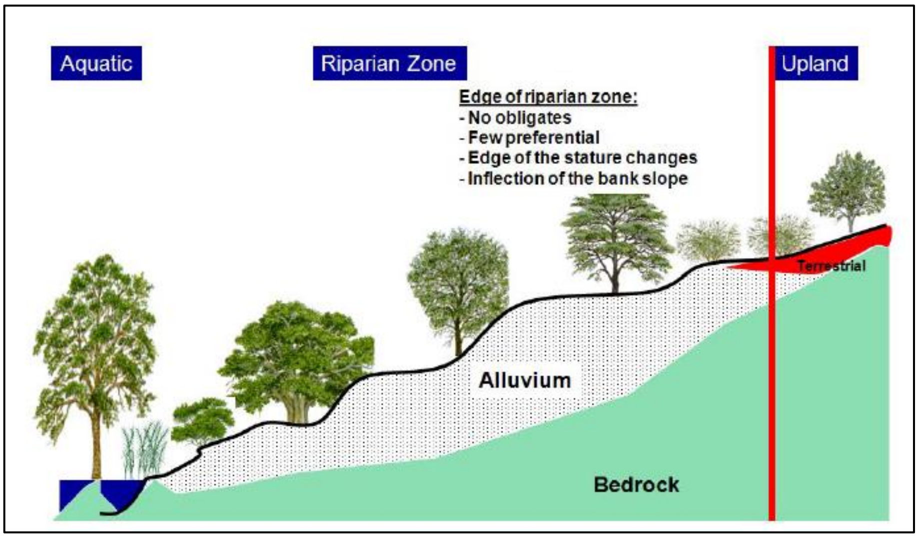

Figure 23: A schematic diagram illustrating the edge of the riparian zone on one bank of a large river (DWAF, 2008).

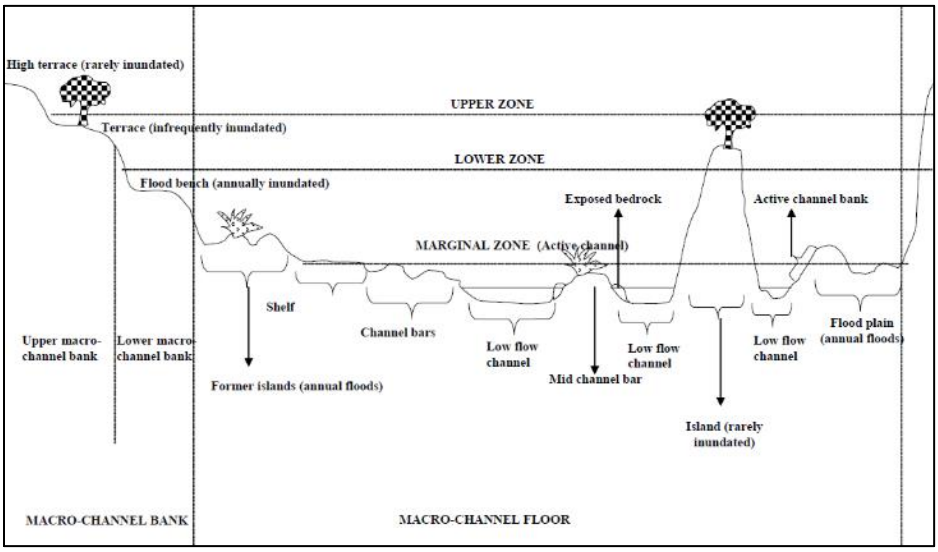

Figure 24: A schematic diagram illustrating (example) the different riparian zones relative to the different geomorphic zones typically associated with a river (Kleynhans *et al*., 2008).

The structure and dynamics of riparian zones are highly variable and are mostly an expression of the hydrological and geomorphological nature of watercourse (Figure 24 and Table 18). As such DWAF (2008) has recommended that the type of river or stream channel with which the riparian zone is associated be considered (Table 19).

Indicators of riparian areas include:

» Landscape position:
  - Riparian areas are associated with valley bottom landscape units (i.e. adjacent to the river/stream channel and floodplains).

» Alluvial soils and recently deposited material:
  - Alluvial soils are soils derived from material deposited by flowing water.

- Alluvial soils cannot always be used as a primary indicator to accurately delineate riparian areas but it can be used to confirm the topographical and vegetative indicators.

» Topography:
- The National Water Act definition of riparian zones refers to the structure of the banks and likely the presence of alluvium.
- A good indicator of the presence of riparian zones is the presence of alluvial deposited material adjacent to the active channel (such as benches and terraces), as well as the wider incised "macro-channels" which are typical of many of southern Africa's eastern seaboard rivers.
- Recently deposited alluvial material outside of the main active channel banks can indicate a currently active flooding area; and thus, the likely presence of wetlands.

» Vegetation:
- The identification of riparian areas relies heavily on vegetative indicators (Unlike wetland delineation which relies on redoximorphic features in soil).
- Using vegetation, the outer boundary of a riparian area can be defined as the point where a distinctive change occurs:
  - in species composition relative to the adjacent terrestrial area; and
  - in the physical structure, such as vigour or robustness of growth forms of species similar to that of adjacent terrestrial areas. Growth form refers to the health, compactness, crowding, size, structure, and/or numbers of individual plants.
- In addition to indicators of structural differences in vegetation, indicator species themselves can be used to denote riparian areas (e.g. Obligate-, Preferential- and Facultative riparian species).

Table 18: Geomorphological longitudinal river zones for South African rivers as characterized by Rowtree & Wadeson (2000) (SANBI, 2013).

Longitudinal Zone (and zone class)	Characteristic gradient	Diagnostic channel characteristics
Zonation associated with a normal profile		
Source zone	Not specified	Low-gradient, upland plateau or upland basin able to store water. Spongy or peaty hydromorphic soils.
Mountain headwater stream	>0.1	A very steep-gradient stream dominated by vertical flow over bedrock with waterfalls and plunge pools. Normally first or second order. Reach types include bedrock fall and cascades.
Mountain stream	0.040-0.099	Steep-gradient steam dominated by bedrock and boulders, locally cobble or coarse gravels in pools. Reach types include cascades, bedrock fall, step-pool, plane bed. Approximate equal distribution of 'vertical' and 'horizontal' flow components.
Transitional	0.020-0.039	Moderately steep stream dominated by bedrock or boulders. Reach types include plane bed, pool-rapid, or pool-riffle. Confident or semi-confined valley floor with limited floodplain development.

Upper foothills	0.005-0.019	Moderately steep cobble-bed or mixed bedrock-cobble bed channel, with plane bed, pool-riffle reach types. Length of pools and riffles/rapids similar. Narrow floodplain of sand, gravel, or cobble often present.
Lower foothills	0.001-0.005	Lower gradient, mixed-bed alluvial channel with sand and gravel dominating the bed, locally may be bedrock-controlled. Reach types typically include pool-riffle or pool-rapid, sand bars common in pools. Pools of a significantly greater extent than rapids or riffles. Floodplain often present.
Lowland River	0.0001-0.0010	Low-gradient, alluvial sand-bed channel, typically regime reach type. Often confined, but fully developed meandering pattern within a distinct floodplain develops in unconfined reaches where there is an increase in silt content in bed or banks.
B. Additional zones associated with a rejuvenated profile		
Rejuvenated bedrock fall/cascades	>0.02	Moderate to steep gradient, often confined channel (gorge) resulting from uplift in the middle to lower reaches of the long profile, limited lateral development of alluvial features, reach types include bedrock fall, cascades and pool-rapid.
Rejuvenated foothills	0.001-0.020	Steepened section within middle reaches of the river caused by uplift, often within or downstream of gorge; characteristic similar to foothills (gravel/cobble-bed rivers with pool-riffle/pool-rapid morphology) but of a higher order. A compound channel is often present with an active channel contained within a micro-channel activated only during infrequent flood events. A floodplain may be present between the active and macro-channel.
Upland floodplain	<0.005	An upland low-gradient channel, often associated with uplifted plateau areas as occurring beneath the eastern escarpment.

Table 19**:** A description of the different riparian vegetation zones typically associated with a river/stream system (Kleynhans *et al*., 2008).

	Marginal	**Lower**	**Upper**
Alternative Description	Active features (Wet bank)	Seasonal features (Wet bank)	Ephemeral features (Dry bank)
Extends from	Water level at low flow	Marginal Zone	Lower Zone
Extends to	Geomorphic features/substrates that are hydrologically activated (inundated or moistened) for the greater part of the year	Usually a marked increase in lateral elevation.	Usually a marked decrease in lateral elevation
Characterized by	See above; Moist substrates next to water's edge; water loving-species usually vigorous due to near-permanent access to soil moisture	Geomorphic features that are hydrologically activated (inundated or moistened) on a seasonal basis. May have different species than marginal zone	Geomorphic features that are hydrological activated (inundated or moistened) on an ephemeral basis. Presence of riparian and terrestrial species with increased stature.

Importance and functions of riparian areas

Riparian areas perform a variety of functions that are of value to society, especially the protection and enhancement of water resources, and the provision of habitat for plant and animal species.

Riparian areas can variously:
- store water and help reduce flood peaks;
- stabilize stream banks;
- improve water quality by trapping sediment and nutrients;
- maintain natural water temperature through shading for aquatic species;
- provide shelter, food and migration corridors for the movement of both aquatic and terrestrial species;
- act as a buffer between aquatic ecosystems and adjacent upslope land uses;
- can be used as recreational sites; and
- provide material for building, muti, crafts, and curios.

However, as mentioned, the structure and dynamics of riparian zones are highly variable and as such not all riparian areas are capable of fulfilling all of these functions or to the same extent.

Habitat Integrity and Condition of the Affected Freshwater Resources:

To assess the Present Ecological State (PES) or condition of the observed wetlands, a modified Wetland Index of Habitat Integrity (DWAF, 2007) was used. The Wetland Index of Habitat Integrity (WETLAND-IHI) is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The output scores from the WETLAND-IHI model are presented in the standard DWAF A-F ecological categories (Table 13), and provide a score of the Present Ecological State of the habitat integrity of the wetland system being examined. The author has included additional criteria into the model-based system to include additional wetland types. This system is preferred when compared to systems such as WET-Health – wetland management series (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind, and is not always suitable for impact assessments. This coupled to the degraded state of the wetlands in the study area, a complex study approach was not warranted, i.e. conduct a Wet-Health Level 2 and WET-Ecosystems Services study required for an impact assessment.

Table 20: Description of A – F ecological categories based on Kleynhans et al., (2005).

<table>
<tr><th>ECOLOGICAL CATEGORY</th><th>ECOLOGICAL DESCRIPTION</th><th>MANAGEMENT PERSPECTIVE</th></tr>
<tr><td>A</td><td>Unmodified, natural.</td><td>Protected systems; relatively untouched by human hands; no discharges or impoundments allowed</td></tr>
<tr><td>B</td><td>Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.</td><td>Some human-related disturbance, but mostly of low impact potential</td></tr>
<tr><td>C</td><td>Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.</td><td rowspan="2">Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation</td></tr>
<tr><td>D</td><td>Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.</td></tr>
<tr><td>E</td><td>Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.</td><td rowspan="2">Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality</td></tr>
<tr><td>F</td><td>Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.</td></tr>
</table>

The WETLAND-IHI model is composed of four modules. The "Hydrology", "Geomorphology" and "Water Quality" modules all assess the contemporary driving processes behind wetland formation and maintenance. The last module, "Vegetation Alteration", provides an indication of the intensity of human land use activities on the wetland surface itself and how these may have modified the condition of the wetland. The integration of the scores from these 4 modules provides an overall Present Ecological State (PES) score for the wetland system being examined. The WETLAND-IHI model is an MS Excel-based model, and the data required for the assessment are generated during a rapid site visit.

Additional data may be obtained from remotely sensed imagery (aerial photos; maps and/or satellite imagery) to assist with the assessment. The interface of the WETLAND-IHI has been developed in a format that is similar to DWAF's River EcoStatus models which are currently used for the assessment of PES in riverine environments.

Conservation importance of the individual wetlands was based on the following criteria:
Habitat uniqueness
Species of conservation concern
Habitat fragmentation concerning ecological corridors
Ecosystem service (social and ecological)

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetland was found in a near-natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a species of conservation concern were observed (HIGH). Any systems that were highly modified (low PES) or had none of the above criteria, received a LOW conservation importance rating.

Wetland Ecological Importance and Sensitivity (EIS)

The outcomes of the wetland functional assessment were used to inform an assessment of the importance and sensitivity of wetland systems using the Wetland EIS (Ecological Importance and Sensitivity) assessment tool. The Wetland EIS tool includes an assessment of three components:

- Biodiversity support;
- Landscape-scale importance;
- Sensitivity of the wetland to floods and water quality changes.

The maximum score for these components was taken as the importance rating for the wetland which is rated using Table 21.

Table 21: Rating table used to rate level of ecosystem supply.

RATING	IMPORTANCE OR LEVEL OF SUPPLY OF ECOSYSTEM SERVICES
None, Rating=0	Rarely sensitive to changes in water quality/hydrological regime.
Low, Rating=1	One or a few elements sensitive to changes in water quality/hydrological regime.
Moderate, Rating=2	Some elements sensitive to changes in water quality/hydrological regime.
High, Rating=3	Many elements sensitive to changes in water, quality/hydrological regime.
Very High, Rating=4	Vary many elements sensitive to changes in water quality/hydrological regime.

Methodology: Freshwater Resource Assessment

The impact assessment methodology is in accordance with the recently revised 2014 EIA regulations (as specified within the protocols for the applicable themes) and is based on the significance ranking approach as described by Hacking. The significance of environmental impacts is a function of the present environmental aspects that are to be impacted on, the probability of an impact occurring, and the consequence of such an impact occurring before, and after, implementation of proposed mitigation measures.

The determination and ranking of the importance of environmental factors can be achieved by evaluating the criteria outlined in Table 22. In certain instances, conducting an impact assessment may be required to establish the significance of a specific factor. Consequently, a reasonable amount of iteration is an integral part of the assessment procedure.

The process of identifying and prioritizing aspects primarily serves as a screening procedure, aiming to exclude aspects with minimal potential for causing significant impacts. Aspects categorized as "high" or "moderate" are considered significant, necessitating a thorough assessment of their potential impacts. On the other hand, aspects rated as "low" are not deemed worthy of further scrutiny.

When determining the significance of these aspects, it's crucial to base the ranking on the assumption that the recommended management practices outlined in the Environmental Impact Assessment (EIA) will be in place. This assumption reflects the scenario the project proponent intends to have considered for approval. Additionally, it's essential to identify the environmental aspects linked to the proposed project activities across various phases, such as construction, operation, and closure where applicable. The assessment should also consider how different project alternatives might influence the significance of these aspects.

While it may be advantageous to conduct a ranking exercise without assuming any management practices, as it highlights the sensitivity of key risk areas to management decisions and priorities, it presents a dilemma. Deciding on the extent of management to include in this scenario is challenging. For instance, in the case of a mining project, should one assume the complete absence of a tailings dam or merely poor operation? A general guideline is to presume that all the management required for operational purposes will be in place, while any management specifically dedicated to environmental control will be absent. However, it's important to note that presenting a ranking scenario without any management in an EIA report may not align with the scenario the project proponent seeks approval for.

Table 22: Criteria used to determine the significance of environmental aspects.

Significance Ranking	Negative Aspects	Positive Aspects
H **(High)**	Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.	Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.
M **(Moderate)**	Has characteristics that could cause negative impacts.	Has characteristics that could cause positive impacts.
L **(Low)**	Will never exceed legislation or standards. Unlikely to cause significant negative impacts.	Will always comply with all legislation and standards. Unlikely to cause significant positive impacts.

The significance of environmental impacts is to be assessed by means of the criteria of nature (descriptive), extent (scale), duration, magnitude (severity), probability (certainty), and direction (negative, neutral, or positive). Summarized briefly:

NATURE (IMPACT DESCRIPTION)		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced[5].		
Low	Localised	The impact will only affect the area within the site boundary.
Medium	Local/district	Will affect a fairly widespread area (local) beyond the site boundary.
High	Province/regional/national	Will affect the entire province or region. Widespread, far beyond the site boundary.
PROBABILITY		
This describes the chance of occurrence of an impact.		
Low	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
Medium	Possible to Probable	The impact may or will likely occur (Between a 25% to 70% chance of occurrence).
High	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
Low	Short term	Quickly reversible. The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for a period less than the project life (typically for a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years)).
Medium	Medium term	Reversible over time. The impact will continue for the duration of the project life.
High	Long term	The impact and its effects will last beyond site closure or even risk being permanent.
SEVERITY		
The severity of an environmental impact refers to the extent and degree of harm or adverse changes that a particular activity, project, or event can cause to the environment. It encompasses the magnitude of the negative effects on ecosystems, natural resources, human health, and overall environmental quality.		

[5] Where the severity of an impact varies with distance, the severity should be determined at the point of compliance or the point at which sensitive receptors will be encountered. This position corresponds to the spatial extent of the impact.

Assessing the severity helps in understanding and prioritizing the potential consequences and determining appropriate mitigation measures to minimize harm and promote sustainable practices.[6]		
Bio-physical Environment (Ecology and Biodiversity)	Low	Disturbance of areas that are degraded, have little conservation value or are unimportant to humans as a resource. Minor change in species variety or prevalence.
	Medium	Disturbance of areas that have some conservation value or are of some potential use to humans. Complete change in species variety or prevalence.
	High	Disturbance of areas that are pristine, have conservation value or are an important resource to humans. Destruction of rare or endangered species.
CONSEQUENCE		
The consequence of impacts can be described by considering the severity, spatial extent and duration of the impact. Having ranked the severity, duration and spatial extent, the overall consequence of impacts can be determined using the following qualitative guidelines:		

Severity			**Low (L)**			**Medium (M)**			**High (H)**		
Spatial Scale			**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**
Duration	Long Term	H	M	M	M	M	H	H	H	H	H
	Medium Term	M	L	L	M	M	M	H	M	M	H
	Short Term	L	L	L	M	L	M	M	M	M	H

Significance	
The significance of the impacts associated with the significant aspects can be determined by considering the risk: Significance of Environmental Impact (Risk) = Probability x Consequence Subsequently, the overall significance of impacts can be determined using the following qualitative guidelines:	

CONSEQUENCE			**Low (L)**	**Medium (M)**	**High (H)**
PROBABILITY	Definite/Continuous	H	M	M	H
	Possible/Frequent	M	M	M	H
	Unlikely/Seldom	L	L	L	M

[6] Only the severity of impacts on the biophysical environment, and more specifically the ecological and biodiversity aspects pertaining to the biophysical environment, will be addressed during this assessment. The severity of impacts on aquatic/wetland drivers, functions and services will be addressed within a separate assessment.

1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

10.2. Specialist Curriculum Vitae

CURRICULUM VITAE:

Gerhard Botha

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Profession/Specialisation	:	Ecological and Biodiversity Consultant
Nationality:	:	South African
Years Experience:	:	8
Bilingualism	:	Very good – English and Afrikaans

Professional Profile:

Gerhard is a Managing Director of Nkurenkuru Ecology and Biodiversity (Pty) Ltd. He has a BSc Honours degree in Botany from the University of the Free State Province and is currently completing a MSc Degree in Botany. He began working as an environmental specialist in 2010 and has since gained extensive experience in conducting ecological and biodiversity assessments in various development field, especially in the fields of conventional as well as renewable energy generation, mining and infrastructure development. Gerhard is a registered Professional Natural Scientist (Pr. Sci. Nat.)

Key Responsibilities:

Specific responsibilities as an Ecological and Biodiversity Specialist include, inter alia, professional execution of specialist consulting services (including flora, wetland and fauna studies, where required), impact assessment reporting, walk through surveys/ground-truthing to inform final design, compilation of management plans, compliance monitoring and audit reporting, in-house ecological awareness training to on-site personnel, and the development of project proposals for procuring new work/projects.

Skills Base and Core Competencies

- Research Project Management
- Botanical researcher in projects involving the description of terrestrial and coastal ecosystems.

- Broad expertise in the ecology and conservation of grasslands, savannahs, karroid wetland, and aquatic ecosystems.
- Ecological and Biodiversity assessments for developmental purposes (BAR, EIA), with extensive knowledge and experience in the renewable energy field (Refer to Work Experiences and References)
- Over 3 years of avifaunal monitoring and assessment experience.
- Mapping and Infield delineation of wetlands, riparian zones and aquatic habitats (according to methods stipulated by DWA, 2008) within various South African provinces of KwaZulu-Natal, Mpumalanga, Free State, Gauteng and Northern Cape Province for inventory and management purposes.
- Wetland and aquatic buffer allocations according to industry best practice guidelines.
- Working knowledge of environmental planning policies, regulatory frameworks, and legislation
- Identification and assessment of potential environmental impacts and benefits.
- Assessment of various wetland ecosystems to highlight potential impacts, within current and proposed landscape settings, and recommend appropriate mitigation and offsets based on assessing wetland ecosystem service delivery (functions) and ecological health/integrity.
- Development of practical and achievable mitigation measures and management plans and evaluation of risk to execution
- Qualitative and Quantitative Research
- Experienced in field research and monitoring
- Working knowledge of GIS applications and analysis of satellite imagery data
- Completed projects in several Provinces of South Africa and include a number of projects located in sensitive and ecological unique regions.

Education and Professional Status

Degrees:

- *2015:* Currently completing a M.Sc. degree in Botany (Vegetation Ecology), University of the Free State, Bloemfontein, RSA.
- *2009:* B.Sc. Hons in Botany (Vegetation Ecology), University of the Free State, Bloemfontein, RSA.
- *2008:* B.Sc. in Zoology and Botany, University of the Free State, University of the Free State, Bloemfontein, RSA.

Courses:

- *2013*: Wetland Management (ecology, hydrology, biodiversity, and delineation) – University of the Free State accredited course.
- *2014*: Introduction to GIS and GPS (Code: GISA 1500S) – University of the Free State accredited course.

Professional Society Affiliations:

- The South African Council of Natural Scientific Professions: Pr. Sci. Nat. Reg. No. 400502/14 (Botany and Ecology).

Employment History

- December 2017 – Current: Nkurenkuru Ecology and Biodiversity (Pty) Ltd
- 2016 – November 2017: ECO-CARE Consultancy
- *2015 - 2016*: Ecologist, Savannah Environmental (Pty) Ltd
- *2013 – 2014*: Working as ecologist on a freelance basis, involved in part-time and contractual positions for the

following companies

- Enviroworks (Pty) Ltd
- GreenMined (Pty) Ltd
- Eco-Care Consultancy (Pty) Ltd
- Enviro-Niche Consulting (Pty) Ltd
- Savannah Environmental (Pty) Ltd
- Esicongweni Environmental Services (EES) cc

- *2010 - 2012*: Enviroworks (Pty) Ltd

Publications

Publications:

- Botha, G.A. & Du Preez, P.J. 2015. A description of the wetland and riparian vegetation of the Nxamasere palaeo-river's backflooded section, Okavango Delta, Botswana. S. *Afr. J. Bot*., **98**: 172-173.

Congress papers/posters/presentations:

- Botha, G.A. 2015. A description of the wetland and riparian vegetation of the Nxamasere palaeo-river's backflooded section, Okavango Delta, Botswana. 41st Annual Congress of South African Association of Botanists (SAAB). Tshipise, 11-15 Jan. 2015.
- Botha, G.A. 2014. A description of the vegetation of the Nxamasere floodplain, Okavango Delta, Botswana. 10st Annual University of Johannesburg (UJ) Postgraduate Botany Symposium. Johannesburg, 28 Oct. 2014.

Other

- Guest speaker at IAIAsa Free State Branch Event (29 March 2017)
- Guest speaker at the University of the Free State Province: Department of Plant Sciences (3 March 2017):

References:

- Christine Fouché
  Manager: GreenMined (Pty) LTD
  Cell: 084 663 2399
- Professor J du Preez
  Senior lecturer: Department of Plant Sciences
  University of the Free State
  Cell: 082 376 4404

10.3. Specialist Work Experience and References

WORK EXPERIENCES

&

References

Gerhard Botha

ECOLOGICAL RELATED STUDIES AND SURVEYS

Date Completed	Project Description	Type of Assessment/Study	Client
2019	Sirius Three Solar PV Facility near Upington, Northern Cape	Ecological Assessment (Basic Assessment)	Aurora Power Solutions
2019	Sirius Four Solar PV Facility near Upington, Northern Cape	Ecological Assessment (Basic Assessment)	Aurora Power Solutions
2019	Lichtenburg 1 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Lichtenburg 2 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Lichtenburg 3 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Ecological Assessment (Basic Assessment)	Moeding Solar
2019	Expansion of the Raumix Aliwal North Quarry, Eastern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	GreenMined
2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Faunal and Flora Rescue and Protection Plan	Zevobuzz
2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Zevobuzz
2018	Proposed Kruisvallei Hydroelectric Power Generation Scheme in the Ash River, Free State Province	Ecological Assessment (Basic Assessment)	Zevobuzz
2018	Proposed Zonnebloem Switching Station (132/22kV) and 2X Loop-in Loop-out Power Lines (132kV), Mpumalanga Province	Ecological Assessment (Basic Assessment)	Eskom
2018	Clayville Thermal Plant within the Clayville Industrial Area, Gauteng Province	Ecological Comments Letter	Savannah Environmental
2018	Iziduli Emoyeni Wind Farm near Bedford, Eastern Cape Province	Ecological Assessment (Re-assessment)	Emoyeni Wid Farm Renewable Energy
2018	Msenge Wind Farm near Bedford, Eastern Cape Province	Ecological Assessment (Re-assessment)	Amakhala Emoyeni Renewable Energy

2017	H2 Energy Power Station near Kwamhlanga, Mpumalanga Province	Ecological Assessment (Scoping and EIA phase assessments)	Eskom
2017	Karusa Wind Farm (Phase 1 of the Hidden Valley Wind Energy Facility near Sutherland, Northern Cape Province)	Ecological Assessment (Re-assessment)	ACED Renewables Hidden Valley
2017	Soetwater Wind Farm (Phase 2 of the Hidden Valley Wind Energy Facility near Sutherland, Northern Cape Province)	Ecological Assessment (Re-assessment)	ACED Renewables Hidden Valley
2017	S24G for the unlawful commencement or continuation of activities within a watercourse, Honeydew, Gauteng Province	Ecological Assessment	Savannah Environmental
2016 - 2017	Noupoort CSP Facility near Noupoort, Northern Cape Province	Ecological Assessment (Scoping and EIA phase assessments)	Cresco
2016	Buffels Solar 2 PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Kabi Solar
2016	Buffels Solar 1 PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Kabi Solar
2016	132kV Power Line and On-Site Substation for the Authorised Golden Valley II Wind Energy Facility near Bedford, Eastern Cape Province	Ecological Assessment (Basic Assessment)	Terra Wind Energy
2016	Kalahari CSP Facility: 132kV Ferrum–Kalahari–UNTU & 132kV Kathu IPP–Kathu 1 Overhead Power Lines, Kathu, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Kathu Solar Park
2016	Kalahari CSP Facility: Access Roads, Kathu, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Kathu Solar Park
2016	Karoshoek Solar Valley Development – Additional CSP Facility including tower infrastructure associated with authorised CSP Site 2 near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Karoshoek Solar Valley Development –Ilanga CSP 7 and 8 Facilities near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Karoshoek Solar Valley Development –Ilanga CSP 9 Facility near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Lehae Training Academy and Fire Station, Gauteng Province	Ecological Assessment	Savannah Environmental
2016	Metal Industrial Cluster and Associated Infrastructure near Kuruman, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Northern Cape Department of Economic Development and Tourism
2016	Semonkong Wind Energy Facility near Semonkong, Maseru District, Lesotho	Ecological Pre-Feasibility Study	Savannah Environmental
2015 - 2016	Orkney Solar PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Genesis Eco-Energy
2015 - 2016	Woodhouse 1 and Woodhouse 2 PV Facilities near Vryburg, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Genesis Eco-Energy
2015	CAMCO Clean Energy 100kW PV Solar Facility, Thaba Eco Lodge near Johannesburg, Gauteng Province	Ecological Assessment (Basic Assessment)	CAMCO Clean Energy
2015	CAMCO Clean Energy 100kW PV Solar Facility, Thaba Eco Lodge near Johannesburg, Gauteng Province	Ecological Assessment (Basic Assessment)	CAMCO Clean Energy

2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Aurora Power Solutions
2015	Sirius 2 Solar PV Project near Upington, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Invasive Plant Management Plan	Aurora Power Solutions
2015	Sirius 2 Solar PV Project near Upington, Northern Cape Province	Invasive Plant Management Plan	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Plant Rehabilitation Management Plan	Aurora Power Solutions
2015	Sirius Phase 2 Solar PV Project near Upington, Northern Cape Province	Plant Rehabilitation Management Plan	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Plant Rescue and Protection Plan	Aurora Power Solutions
2015	Sirius Phase 2 Solar PV Project near Upington, Northern Cape Province	Plant Rescue and Protection Plan	Aurora Power Solutions
2015	Expansion of the existing Komsberg Main Transmission Substation near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ESKOM
2015	Karusa Wind Farm near Sutherland, Northern Cape Province)	Invasive Plant Management Plan	ACED Renewables Hidden Valley
2015	Proposed Karusa Facility Substation and Ancillaries near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ACED Renewables Hidden Valley
2015	Eskom Karusa Switching Station and 132kV Double Circuit Overhead Power Line near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ESKOM
2015	Karusa Wind Farm near Sutherland, Northern Cape Province)	Plant Search and Rescue and Rehabilitation Management Plan	ACED Renewables Hidden Valley
2015	Karusa Wind Energy Facility near Sutherland, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	ACED Renewables Hidden Valley
2015	Soetwater Facility Substation, 132kV Overhead Power Line and Ancillaries, near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ACED Renewables Hidden Valley
2015	Soetwater Wind Farm near Sutherland, Northern Cape Province)	Invasive Plant Management Plan	ACED Renewables Hidden Valley
2015	Soetwater Wind Energy Facility near Sutherland, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	ACED Renewables Hidden Valley
2015	Soetwater Wind Farm near Sutherland, Northern Cape Province	Plant Search and Rescue and Rehabilitation Management Plan	ACED Renewables Hidden Valley
2015	Expansion of the existing Scottburgh quarry near Amandawe, KwaZulu-Natal	Botanical Assessment (for EIA)	GreenMined Environmental
2015	Expansion of the existing AFRIMAT quarry near Hluhluwe, KwaZulu-Natal	Botanical Assessment (for EIA)	GreenMined Environmental
2014	Tshepong 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy
2014	Nyala 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy
2014	Eland 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy
2014	Transalloys circulating fluidised bed power station near Emalahleni, Mpumalanga Province	Ecological Assessment (for EIA)	Trans-Alloys
2014	Umbani circulating fluidised bed power station near Kriel, Mpumalanga Province	Ecological Assessment (Scoping and EIA)	Eskom
2014	Gihon 75MW Solar Farm: Bela-Bela, Limpopo Province	Ecological Assessment (for EIA)	NETWORX Renewables

2014	Steelpoort Integration Project & Steelpoort to Wolwekraal 400kV Power Line	Fauna and Flora Pre-Construction Walk-Through Assessment	Eskom
2014	Audit of protected *Acacia erioloba* trees within the Assmang Wrenchville housing development footprint area	Botanical Audit	Eco-Care Consultancy
2014	Rehabilitation of the N1 National Road between Sydenham and Glen Lyon	Peer review of the ecological report	EKO Environmental
2014	Rehabilitation of the N6 National Road between Onze Rust and Bloemfontein	Peer review of the ecological report	EKO Environmental
2011	Illegally ploughed land on the Farm Wolwekop 2353, Bloemfontein	Vegetation Rehabilitation Plan	EnviroWorks
2011	Rocks Farm chicken broiler houses	Botanical Assessment (for EIA)	EnviroWorks
2011	Botshabelo 132 kV line	Ecological Assessment (for EIA)	CENTLEC
2011	De Aar Freight Transport Hub	Ecological Scoping and Feasibility Study	EnviroWorks
2011	The proposed establishment of the Tugela Ridge Eco Estate on the farm Kruisfontein, Bergville	Ecological Assessment (for EIA)	EnviroWorks
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Vegetation Rehabilitation Plan for illegally cleared areas	NEOTEL
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Invasive Plant Management Plan	NEOTEL
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Protected and Endangered Species Walk-Through Survey	NEOTEL
2011	Optic Fibre Infrastructure Network, Swartland Municipality	Botanical Assessment (for EIA) - Assisted Dr. Dave McDonald	Dark Fibre Africa
2011	Optic Fibre Infrastructure Network, City of Cape Town Municipality	Botanical Assessment (for EIA) - Assisted Dr. Dave McDonald	Dark Fibre Africa
2010	Construction of an icon at the southernmost tip of Africa, Agulhas National Park	Botanical Assessment (for EIA)	SANPARKS
2010	New boardwalk from Suiderstrand Gravel Road to Rasperpunt, Agulhas National Park	Botanical Assessment (for EIA)	SANPARKS
2010	Farm development for academic purposes (Maluti FET College) on the Farm Rosedale 107, Harrismith	Ecological Assessment (Screening and Feasibility Study)	Agri Development Solutions
2010	Basic Assessment: Barcelona 88/11kV substation and 88kV loop-in lines	Botanical Assessment (for EIA)	Eskom Distribution
2011	Illegally ploughed land on the Farm Wolwekop 2353, Bloemfontein	Vegetation Rehabilitation Plan	EnviroWorks

WETLAND DELINEATION AND HYDROLOGICAL ASSESSMENTS

Date Completed	Project Description	Type of Assessment/Study	Client
In progress	Steynsrus PV 1 & 2 Solar Energy Facilities near Steynsrus, Free State Province	Wetland Assessment	Cronimet Mining Power Solutions
2019	Lichtenburg 1 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Lichtenburg 2 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Lichtenburg 3 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Wetland Assessment (Basic Assessment)	Moeding Solar
2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Wetland Assessment (Basic Assessment	Zevobuzz
2017	Nyala 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Wetland Assessment	BBEnergy

2017	Eland 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Wetland Assessment	BBEnergy
2017	Olifantshoek 10MVA 132/11kV Substation and 31km Power Line	Surface Hydrological Assessment (Basic Assessment)	Eskom
2017	Expansion of the Elandspruit Quarry near Ladysmith, KwaZulu-Natal Province	Wetland Assessment	Raumix
2017	S24G for the unlawful commencement or continuation of activities within a watercourse, Honeydew, Gauteng Province	Aquatic Assessment & Flood Plain Delineation	Savannah Environmental
2017	Noupoort CSP Facility near Noupoort, Northern Cape Province	Surface Hydrological Assessment (EIA phase)	Cresco
2016	Wolmaransstad Municipality 75MW PV Solar Energy Facility in the North West Province	Wetland Assessment (Basic Assessment)	BlueWave Capital
2016	BlueWave 75MW PV Plant near Welkom Free State Province	Wetland Delineation	BlueWave Capital
2016	Harmony Solar Energy Facilities: Amendment of Pipeline and Overhead Power Line Route	Wetland Assessment (Basic Assessment)	BBEnergy

AVIFAUNAL ASSESSMENTS

Date Completed	Project Description	Type of Assessment/Study	Client
2019	Sirius Three Solar PV Facility near Upington, Northern Cape	Avifauna Assessment (Basic Assessment)	Aurora Power Solutions
2019	Sirius Four Solar PV Facility near Upington, Northern Cape	Avifauna Assessment (Basic Assessment)	Aurora Power Solutions
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Avifauna Assessment (Basic Assessment)	Moeding Solar
2018	Proposed Zonnebloem Switching Station (132/22kV) and 2X Loop-in Loop-out Power Lines (132kV), Mpumalanga Province	Avifauna Assessment (Basic Assessment)	Eskom
2017	Olifantshoek 10MVA 132/11kV Substation and 31km Power Line	Avifauna Assessment (Basic Assessment)	Eskom
2016	TEWA Solar 1 Facility, east of Upington, Northern Cape Province	Wetland Assessment (Basic Assessment	Tewa Isitha Solar 1
2016	TEWA Solar 2 Facility, east of Upington, Northern Cape Province	Wetland Assessment	Tewa Isitha Solar 2

ENVIRONMENTAL IMPACT ASSESSMENT

- Barcelona 88/11kV substation and 88kV loop-in lines – BA (for Eskom).
- Thabong Bulk 132kV sub-transmission inter-connector line – EIA (for Eskom).
- Groenwater 45 000 unit chicken broiler farm – BA (for Areemeng Mmogo Cooperative).
- Optic Fibre Infrastructure Network, City of Cape Town Municipality – BA (for Dark Fibre Africa (Pty) Ltd).
- Optic Fibre Infrastructure Network, Swartland Municipality – BA (for Dark Fibre Africa).
- Construction and refurbishment of the existing 66kV network between Ruigtevallei Substation and Reddersburg Substation – EMP (for Eskom).
- Lower Kruisvallei Hydroelectric Power Scheme (Ash river) – EIA (for Kruisvallei Hydro (Pty) Ltd).
- Construction of egg hatchery and associated infrastructure – BA (For Supreme Poultry).

- Construction of the Klipplaatdrif flow gauging (Vaal river) – EMP (DWAF).

ENVIRONMENTAL COMPLIANCE AUDITING AND ECO

- National long haul optic fibre infrastructure network project, Bloemfontein to Laingsburg – ECO (for Enviroworks (Pty) Ltd.).
- National long haul optic fibre infrastructure network project, Wolmaransstad to Klerksdorp – ECO (for Enviroworks (Pty) Ltd.).
- Construction and refurbishment of the existing 66kV network between Ruigtevallei Substation and Reddersburg Substation – ECO (for Enviroworks (Pty) Ltd.).
- Construction and refurbishment of the Vredefort/Nooitgedacht 11kV power line – ECO (for Enviroworks (Pty) Ltd.).
- Mining of Dolerite (Stone Aggregate) by Raumix (Pty) Ltd. on a portion of Portion 0 of the farm Hillside 2830, Bloemfontein – ECO (for GreenMined Environmental (Pty) Ltd.).
- Construction of an Egg Production Facility by Bainsvlei Poultry (Pty) Ltd on Portions 9 & 10 of the farm, Mooivlakte, Bloemfontein – ECO (for Enviro-Niche Consulting (Pty) Ltd.).
- Environmental compliance audit and botanical account of Afrisam's premises in Bloemfontein – Environmental Compliance Auditing (for Enviroworks (Pty) Ltd.).

OTHER PROJECTS:

- Keeping and breeding of lions (*Panthera leo*) on the farm Maxico 135, Ficksburg – Management and Business Plan (for Enviroworks (Pty) Ltd.)
- Keeping and breeding of lions (*Panthera leo*) on the farm Mooihoek 292, Theunissen – Management and Business Plan (for Enviroworks (Pty) Ltd.)
- Keeping and breeding of wild dogs (*Lycaon pictus*) on the farm Mooihoek 292, Theunissen – Management and Business Plan (for Enviroworks (Pty) Ltd.)
- Existing underground and aboveground fuel storage tanks, TWK AGRI: Pongola – Environmental Management Plan (for TWK Agricultural Ltd).
- Existing underground fuel storage tanks on Erf 171, TWK AGRI: Amsterdam – Environmental Management Plan (for TWK Agricultural Ltd).
- Proposed storage of 14 000 L of fuel (diesel) aboveground on Erf 32, TWK AGRI: Carolina – Environmental Management Plan (for TWK Agricultural Ltd).
- Proposed storage of 23 000 L of fuel (diesel) above ground on Portion 10 of the Farm Oude Bosch, Humansdorp – Environmental Management Plan (for TWK Agricultural Ltd).
- Proposed storage of 16 000 L of fuel (diesel) aboveground at Panbult Depot – Environmental Management Plan (for TWK Agricultural Ltd).
- Existing underground fuel storage tanks, TWK AGRI: Mechanisation and Engineering, Piet Retief – Environmental Management Plan (for TWK Agricultural Ltd).
- Existing underground fuel storage tanks on Portion 38 of the Farm Lothair, TWK AGRI: Lothair – Environmental Management Plan (for TWK Agricultural Ltd).

forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE
The Proposed Boshoek Solar 1 Energy Facility and Associated Infrastructure near Boshoek, North West Province.

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Freshwater Resource Assessment (Aquatic Ecology and Biodiversity)
Specialist Company Name	Nkurenkuru Ecology and Biodiversity (Pty) Ltd.
Specialist Name	Gerhard Botha
Specialist Identity Number	8604115136088
Specialist Qualifications:	BSc Zoology & BSc (Hons) Botany
Professional affiliation/registration:	SACNASP Pr Sci Nat 400502/14 Ecological and Botany
Physical address:	2 Jock Meiring Street, Park West, Bloemfontein, 9324
Postal address:	PO Box 12500, Brandhof, 9324
Postal address	9324
Telephone	-
Cell phone	084 207 3454
E-mail	gabotha11@gmail.com

2. DECLARATION BY THE SPECIALIST

I, Gerhard Botha declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

Nkurenkuru Ecology and Biodiversity (Pty) Ltd

Name of Company:

28 Aug 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Gerhard Botha________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Nkurenkuru Ecology and Biodiversity (Pty) Ltd

Name of Company

28 Aug 2024

Date

Signature of the Commissioner of Oaths

28 Jul 2024

Date

ROSS SUTTNER
Commissioner Of Oaths (RSA)
Chartered Accountant (SA)
Registration Number 20039986
101, Block A, West Quay Building
7 West Quay Road, Waterfront
Cape Town, 8001
Tel: +27 82 502 2021

AVIFAUNA IMPACT ASSESSMENT– BOSHOEK SOLAR 1 PHOTOVOLTAIC (PV) FACILITY

Rustenburg, North West Province, South Africa

December 2023

CLIENT

Boshoek Solar 1 (Pty) Ltd

Report Name	**AVIFAUNA IMPACT ASSESSMENT– BOSHOEK SOLAR 1 PHOTOVOLTAIC (PV) FACILITY**
Submitted to	Boshoek Solar 1 (Pty) Ltd
Fieldwork	**Ernest Porter**
	Ernest has gained birding experience in the Northern Cape, North West, Mpumalanga, Limpopo, KwaZulu Natal, Free State, Western Cape and also Gauteng. He is a qualified FGASA NQF2 Field Guide and a committee member of Black Eagle Project Roodekrans and The Botanical Society of South Africa (Bankenveld Branch).
Fieldwork	**Liam Taylor**
	Liam has a BSc Honours in Animal, Plant and Environmental Sciences from the University of the Witwatersrand and has a background in theoretical, practical, and statistical approaches to various fields of ecology. Hiis Honours project was geared towards entomology, where he studied how insect diversity responds to forest encroachment, and achieved the best project in my cohort. He is now completing my Master's degree investigating how avian diversity and populations will respond to the loss of baobab trees in landscapes with large elephant populations. He is passionate about nature and is working towards a future in conservation. He spends almost all his time outside, with a camara and binoculars at the ready, behind the wheel of a 4x4 or hiking, stopping at every flower or animal he can find. When he is not somewhere wild, he his planning (or dreaming) about my next adventure.
Report Writing	**Bianca Coulson**
	Avifaunal subcontractor Bianca Coulson is a final year Master of Science in Zoology student at the University of Pretoria. She is specialising in Ornithology with the Hot Birds Research Project with a main focus on the effects of climate change in large forest hornbills and holds a Bachelor of Science (Honours) in Zoology as well as a Bachelor of Science in Zoology. Her interests lie in ecology and animal responses to their environment and has since been qualified with Diploma's in Ecological Impacts and Studies, Remote Sensing as well as Geographic Information Sciences to further her skills. She is a very capable person in and out of the field. Furthermore, Bianca enjoys birding in her spare time and continues to improve her skills.
Report Writing	**Ryno Kemp**
	Ryno Kemp is Pr Sci Nat registered (117462/17) in Zoological Science and is finalising his PhD in Zoology from the University of Pretoria. Ryno is a qualified Avifauna specialist with just over two year's experience, three years of experience in conservation and more than eight years of scientific research experience across South Africa.
Report Reviewer	**Andrew Husted**
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests

	in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

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List of Acronyms and Abbreviations

%	Percent
ADU	Animal Demography Unit
BESS	Battery Energy Storage System
BI	Biodiversity Importance
CAR	Coordinated Avifaunal Roadcounts
CBA	Critical Biodiversity Area
CI	Conservation Importance
CR	Critically Endangered
CWAC	Coordinated Waterbird Counts
DC	Direct Current
EAP	Environmental Assessment Practitioner
EGI	Electricity Grid Infrastructure
EI	Ecological Importance
EIA	Environmental Impact Assessment
EMPr	Environmental Management Plan report
EN	Endangered
EOO	Extent of occurrence
ESA	Ecological Support Area
EWT	Endangered Wildlife Trust
FFG	Functional Feeding Guild
FI	Functional Integrity
GIS	Geographic Information Systems
ha	hectares
IBA	Important Bird and Biodiversity Area
KBA	Key Biodiversity Area
km	kilometres
kV	kilo Volt
LC	Least Concern
m	metres
m^2	square metres
MTS	Main Transmission Substation
MW	Mega Watt
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem priority Areas
NPAES	National Protected Areas Expansion Strategy
NT	Near Threatened
ONA	Other Natural Areas
PAOI	Project Area of Influence
PV	Photo Voltaic
REDZ	Renewable Energy Development Zones
REEA	Renewable Energy EIA Application
RR	Receptor Resilience
SABAP2	South African Bird Atlas Project 2
SACAD	South African Conservation Areas Database
SAIIAE	South African Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute

SAPAD	South African Protected Areas Database
SCC	Species of Conservation Concern
SEI	Site ecological Importance
TBC	The Biodiversity Company
V	Volt
VU	Vulnerable

1 Introduction

1.1 Background

The Biodiversity Company was appointed to undertake an Avifauna Site Sensitivity Verification (SSV) for the proposed Boshoek Solar 1 Photovoltaic (PV) Facility. The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW. The development area is situated approximately 33 km north west of Rustenburg within the Kgetlengrivier and Rustenburg Local Municipality and the Bojanala District Municipality, in the North West Province (Figure 1-1 and Figure 1-2).

The National Web-based Environmental Screening Tool (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended) indicated that the Animal Species Theme Sensitivity was rated as 'medium' due to the possible presence of Species of Conservation Concern (see section 2.2 of this report for the definition), including avifauna species. Accordingly, The Biodiversity Company was sub-contracted to undertake an Avifauna Impact Assessment to inform on the impact of the proposed PV to the avifauna community within the receiving environment. The approach was informed by the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices 320 (20 March 2020 amended 28 July 2023) in terms of NEMA, dated 20 March, 30 October 2020 and 28 July 2023: "*Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation*" (Reporting Criteria). Based on the size of the photovoltaic (PV) project and the associated risks, a Regime 2 assessment was undertaken.

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision-making, as to the ecological viability of the proposed project.

1.2 Project Information

Boshoek Solar 1 (Pty) Ltd proposes the propose the establishment and operation of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province. The future planned Eskom collector switching station will facilitate the connection of the facility substation to the Ngwedi Main Transmission Substation (MTS) 400/132kV via a single or double circuit 132 kV overhead powerline. Other associated infrastructure will also be required for the grid connection solution, including access tracks/roads, an area of up to 1 ha will be occupied by buildings which will include (but not limited to) a 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre and a BESS area up to 5ha.

The project is planned as part of a larger cluster, which includes two additional PV facilities (Boshoek Solar 2 and Boshoek Solar 3) up to 150 MW and 50 MW, respectively.

An assessment area of approximately 290 ha is being assessed as part of this authroisation process and the infrastructure associated with the 150 MW facility includes:

- PV modules (mono- or bifacial) and mounting structures;
- Inverters and transformers;
- Battery Energy Storage System (BESS);
- Site access road;
- Internal access roads;

- Auxiliary buildings (switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Temporary and permanent laydown area; and
- Grid connection infrastructure, including:
  - Underground medium-voltage cabling between the project components and the facility substation;
  - Up to 132 kV facility substation;
  - Switching station;
  - A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.

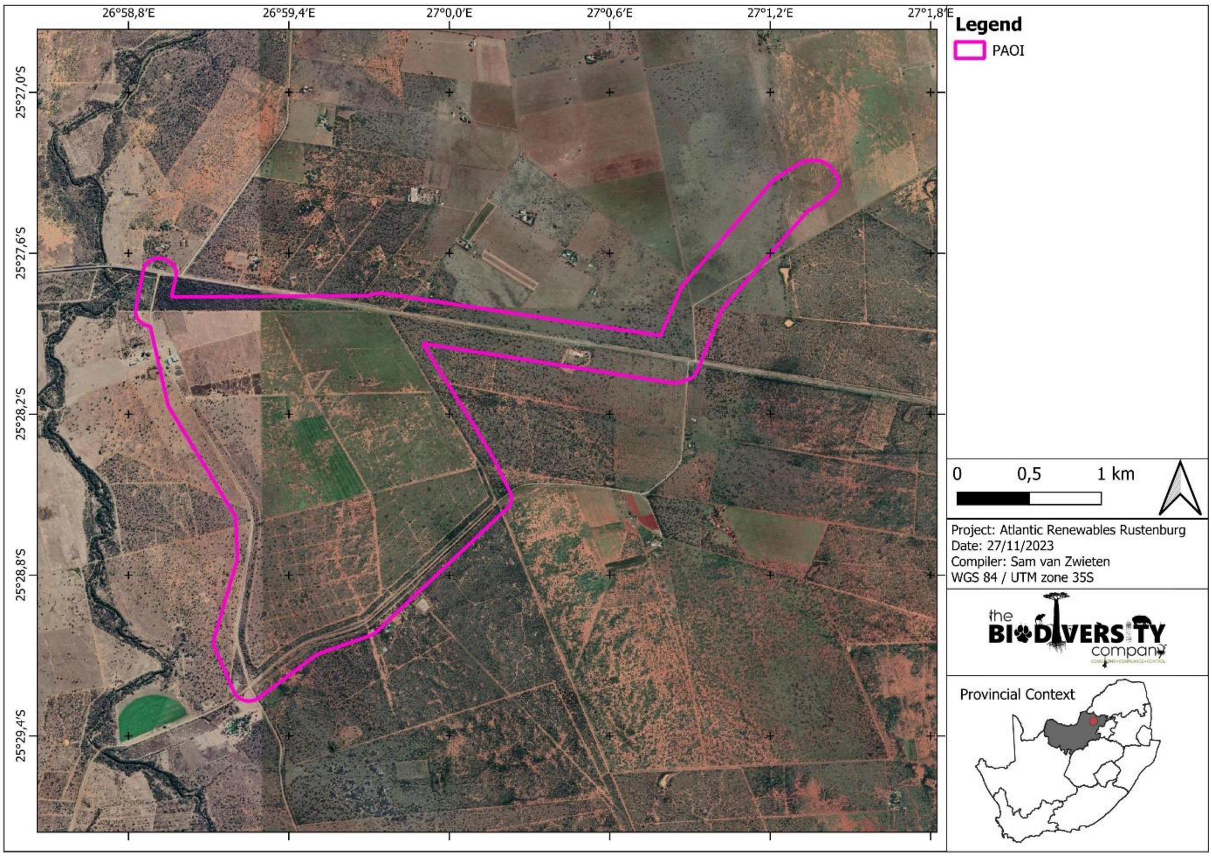


Figure 1-1 Proposed Boshoek 1 Solar PV project

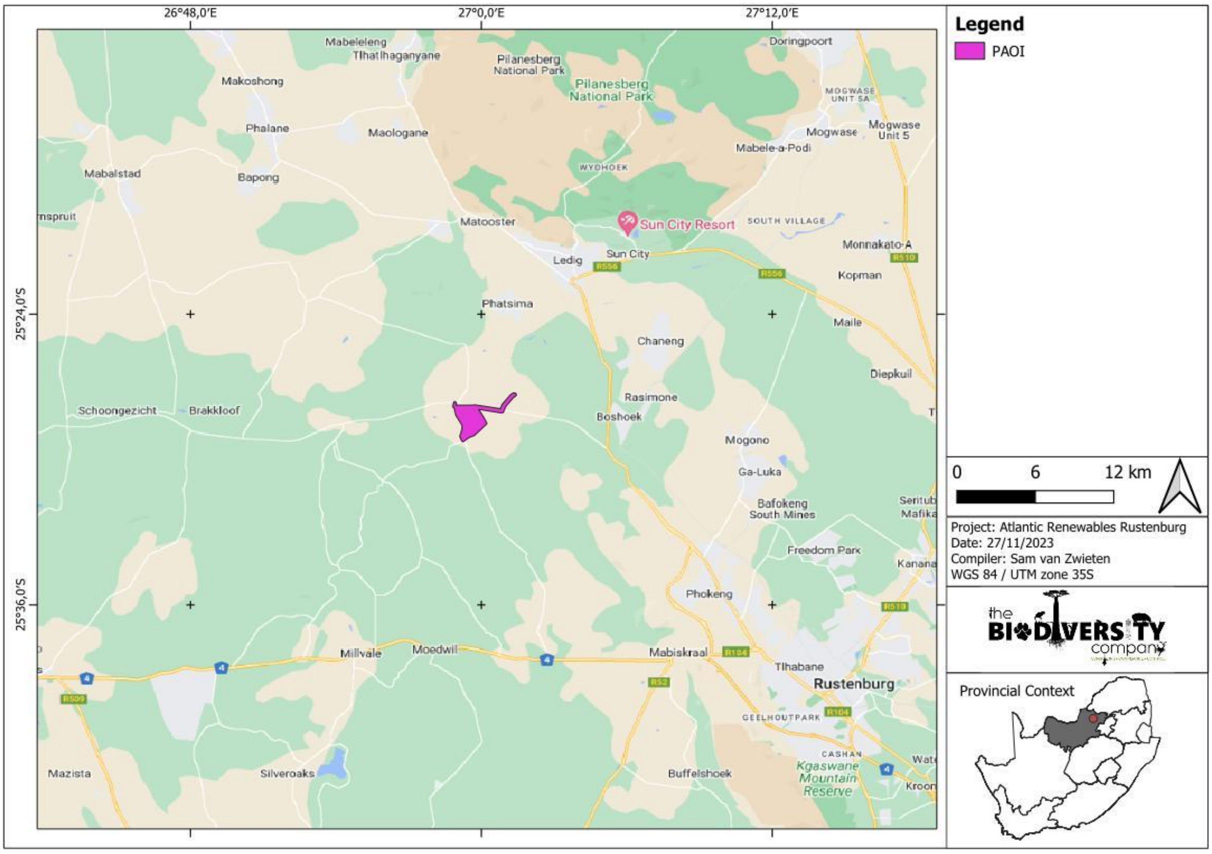


Figure 1-2 Map illustrating the location of the proposed PV Project

1.3 Terms of Reference

The assessment was achieved under the Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes in terms of Section 24(5) (a) and (h) and 44 of NEMA ("the Protocols") promulgated in GN No. 320 of 20 March 2020. Where no specific environmental theme protocol has been prescribed, the level of assessment must be based on the findings of the site verification. It must comply with Appendix 6 of the EIA Regulations of 2014 (as amended), and the best-practice guidelines and principles for Avifaunal Impact Assessments within the context of PVs as outlined by BirdLife South Africa (2017).

The scope of the Avifaunal Impact Assessment included the following:

- Desktop assessment to identify the relevant ecologically important geographical features within the Project Area of Influence (PAOI) and surrounding landscape;
- Desktop assessment to compile an expected species list and possible avifauna Species of Conservation Concern (SCC) that potentially occur within the PAOI;
- Description of the baseline avifauna species and Functional Feeding Guild (FFG) composition assemblage within the PAOI;
- Delineate site sensitivity or sensitivities i.e., the Site Ecological Importance (SEI) within the context of the avifauna species assemblage of the PAOI;
- Identify the manner that the proposed development impacts the avifauna community and evaluate the level of risk of these potential impacts; and

- Additional data outside the PAOI was added to obtain a more comprehensive understanding of the avifauna community within the area.

1.4 Assumptions and Limitations

The following assumptions and limitations should be noted for the assessment:

- The proposed project area, and this was delineated to provide the Project Area of influence (PAOI). See section 2.1 of this report for additional details. Any alterations to the area and/or missing Geographic Information Systems (GIS) information pertaining to the assessment area would have affected the area surveyed and hence the results of this assessment;

- Two site visits were conducted for this regime 2 assessment in winter over the 9-11th of June 2023 and in spring over the 16-17th of September. These site visits are considered sufficient from a seasonal perspective and require no additional season assessment. However, the data was compared to the following dataset listed in section 4.3 and no differences were observed, further suggesting that sufficient data sampling was conducted to better our understanding of the bird community in the area;

- Whilst every effort was made to cover as much of the PAOI as possible, it is possible that some species that are present within the PAOI were not recorded during the field investigations due to their secretive behaviour; and

- The GPS used in the assessment has an accuracy of 5 m, and consequently, any spatial features delineated may be offset by up to 5 m.

1.5 Key Legislative Requirements

The legislation, policies and guidelines listed below in Table 1-1 are applicable to the proposed project. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

Table 1-1 A list of key legislative requirements relevant to biodiversity and conservation in the North West Province

Region	Legislation and Guidelines
International	Convention on Biological Diversity (CBD, 1993)
	The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1973)
	The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)
National	Constitution of the Republic of South Africa (Act No. 108 of 1996)
	Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, GNR 320 of Government Gazette 43310 (March 2020)
	Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, GNR 1150 of Government Gazette 43855 (October 2020)
	The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management: :Biodiversity Act (Act No. 10 of 2004) (NEMBA), Threatened or Protected Species Regulations
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
	The Environment Conservation Act (Act No. 73 of 1989)
	National Protected Areas Expansion Strategy (NPAES)
	Natural Scientific Professions Act (Act No. 27 of 2003)

	National Biodiversity Framework (NBF, 2009)
	National Spatial Biodiversity Assessment (NSBA)
	National Heritage Resources Act, 1999 (Act 25 of 1999)
	Alien and Invasive Species Regulations and Alien and Invasive Species List 2020, published under NEMBA
	South Africa's National Biodiversity Strategy and Action Plan (NBSAP)
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
	White Paper on Biodiversity
	South African National Biodiversity Institute (SANBI). 2020. *Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa*. South African National Biodiversity Institute, Pretoria. Version 1.2020.
	Best practice guidelines for avifaunal impact studies at solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al*., 2017)
Provincial	North-West Biodiversity Sector Plan of 2015 (READ,2015).

2 Definitions

2.1 Project Area of Influence (PAOI)

The Project Area of Influence (PAOI) encompasses the geographical extent of the potential impacts of the proposed development on the receiving environment. Essentially, the PAOI is defined according to the important ecosystem processes and functions that may be plausibly affected by the proposed development and its associated activities.

2.2 Species of Conservation Concern (SCC)

According to the National Red List of South African Plants website, managed and maintained by the South African National Biodiversity Institute (SANBI), a Species of Conservation Concern (SCC) is a species with high conservation importance in terms of preserving South Africa's rich biodiversity. This classification covers a range of conservation status categories, as illustrated in Figure 2-1.

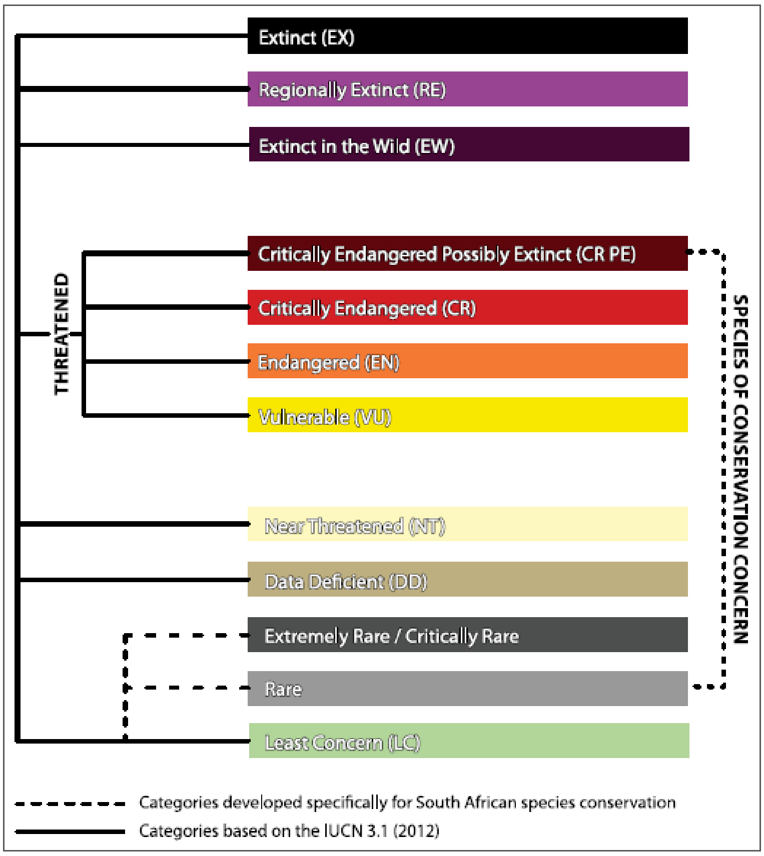


Figure 2-1 The different Species of Conservation Concern categories were modified from the IUCN's extinction risk categories. Source: SANBI (2020)

South Africa uses the internationally endorsed International Union for Conservation of Nature (IUCN) Red List Categories and Criteria (IUCN, 2021). This scientific system is designed to measure species' risk of extinction, and its purpose is to highlight those species that are in need of critical conservation action. As this system has been adopted from the IUCN, the definition of an SCC as described and categorised above is extended to all red list classifications relevant to fauna and the IUCN categories for this report.

2.3 Risk Species

Priority species are susceptible to impacts from energy developments (Ralston Paton *et al.* 2017). These species are typically susceptible to collisions. This list was initially developed for use with Wind Energy Facilities (Ralston Paton et al. 2017); however, the collision, electrocution and habitat loss risks are considered appropriate for renewable energy developments and re-utilised here. Also utilised here is the Eskom and Endangered Wildlife Trust (EWT) poster: Birds and Powerlines (Eskom & EWT, no date), identifying birds most prone to collision and electrocution from powerlines. Some birds are not included in these lists but are considered by the TBC avifauna specialists as risk species for collisions, electrocutions and habitat loss as a result of Solar PV infrastructure. All species are referred to collectively in this report as "Risk Species".

3 Methods

3.1 Desktop Assessment

The desktop assessment was principally undertaken using GIS to access the latest available spatial datasets to develop digital cartographs and species lists. These datasets and their date of publishing are provided below.

3.1.1 Ecologically Important Landscape Features

Existing ecologically relevant data layers were incorporated into GIS to establish how the proposed development might interact with any ecologically important entities. Emphasis was placed around the following spatial datasets:

- South Africa Protected Areas Database (SAPAD) (DFFE, 2023) – The South African Protected Areas Database (SAPAD) contains spatial data for the conservation of South Africa. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. SAPAD is updated on a continuous basis and forms the basis for the Register of Protected Areas which is a legislative requirement under the National Environmental Management: Protected Areas Act, Act 57 of 2003;

- National Protected Areas Expansion Strategy (NPAES) (DFFE, 2021) – The National Protected Area Expansion Strategy (NPAES) provides spatial information on areas that are suitable for terrestrial ecosystem protection. These focus areas are large, intact and unfragmented and are therefore, of high importance for biodiversity, climate resilience and freshwater protection;

- Important Bird and Biodiversity Areas (BirdLife South Africa, 2022) – Important Bird and Biodiversity Areas (IBAs) constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria;

- The North-West Department of Rural, Environment, and Agricultural Development (READ), as custodian of the environment in the North West, is the primary implementing agent of the Biodiversity Sector Plan. The spatial component of the Biodiversity Sector Plan is based on systematic biodiversity planning undertaken by READ. The purpose of a Biodiversity Sector Plan is to inform land use planning, environmental assessments, land and water use authorisations, as well as natural resource management, undertaken by a range of sectors whose policies and decisions impact on biodiversity. This is done by providing a map of biodiversity priority areas, referred to as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), with accompanying land use planning and decision-making guidelines (READ, 2015);

- South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Van Deventer *et al.,* 2018) – A South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was established during the National Biodiversity Assessment of 2018. It is a collection of data layers that represent the extent of river and inland wetland ecosystem types as well as pressures on these systems;

- Strategic Water Source Areas (SWSAs) (Le Maitre *et al,* 2021) – SWSAs are defined as areas of land that supply a quantity of mean annual surface water runoff in relation to their size and therefore, contribute considerably to the overall water supply of the country. These are key ecological infrastructure assets and the effective protection of surface water SWSAs areas is vital for national security because a lack of water security will compromise national security and human wellbeing; and

- National Freshwater Ecosystem Priority Area (NFEPA) (Nel *et al.,* 2011) – The NFEPA database provides strategic spatial priorities for conserving the country’s freshwater ecosystems and associated biodiversity as well as supporting sustainable use of water resources.

3.1.2 Expected Avifauna Species

The following resources were considered during the desktop assessment and for the compilation of the expected species list:

- South African Bird Atlas Project 2 (SABAP2). Full protocol data from 16 relevant pentads (2515_2655, 2515_2700, 2515_2705, 2520_2655, 2520_2700, 2520_2705, 2525_2655, 2525_2700, 2525_2705, 2525_2710, 2530_2655, 2530_2700, 2530_2705, 2530_2710, 2535_2705, 2535_2710) were used to compile the expected species list;

- Coordinated Water Bird Counts (CWAC) – The Animal Demography Unit (ADU) launched the Coordinated Waterbird Counts (CWAC) project in 1992 as part of South Africa's commitment to international waterbird conservation. The primary aim of CWAC is to act as an effective long-term waterbird monitoring tool. This is done through a programme of regular mid-summer and mid-winter censuses at several wetlands. The database is located at https://cwac.birdmap.africa/index.php;

- Coordinated Avifaunal Roadcounts (CAR) – The Coordinated Avifaunal Roadcounts (CAR) were pioneered in July 1993 in a joint Cape Bird Club/ADU project to monitor the populations of two threatened species: *Anthropoides paradiseus* (Blue Crane) and *Neotis denhamii* (Denham's Bustard). Presently it monitors 36 species of large terrestrial birds along 350 fixed routes covering over 19 000 km using a standardised method;

- Important Bird and Biodiversity Areas (BirdLife South Africa, 2022) – Important Bird and Biodiversity Areas (IBAs) constitute a global network of over 13 500 sites, of which 112 are found in South Africa. IBAs are sites of global significance for bird conservation, identified through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria;

- Hockey *et al*. (2005), Roberts Birds of Southern Africa (7th edition). The primary source for species identification, geographic range, and life history information;

- Sinclair and Ryan (2010), Birds of Africa South of the Sahara. Secondary source for identification; and

- Taylor *et al*. (2015), Eskom Red Data Book of Birds of South Africa, Lesotho, and Swaziland. Used for conservation status, nomenclature, and taxonomical ordering.

3.2 Field Survey

Two site visits were conducted for this regime 2 assessment in winter over the 9-11th of June 2023 and in spring over the 16-17th of September. These site visits are considered sufficient from a seasonal perspective and require no additional season assessment. However, the data was compared to the following dataset listed in section 4.3 and no differences were observed, further suggesting that sufficient data sampling was conducted to better our understanding of the bird community in the area.

Sampling consisted of Standardised Point Counts as well as random diurnal incidental surveys. Standardised Point Counts (Buckland et al., 1993) were conducted to gather data on the species composition and relative abundance of species within the broad habitat types identified. The Standardized Point Count technique was utilised as it was demonstrated to outperform line routes (Cumming & Henry, 2019). Each point count was run over 10 minutes. The horizontal detection limit was set at 150 m. At each point, the observer would document the date, start time, and end time, habitat, numbers of each species, detection method (seen or heard), behaviour (perched or flying) and general notes on habitat and nesting suitability for conservation important species. Diurnal and nocturnal incidental searches were conducted to supplement the species inventory with cryptic and elusive species that may not be detected during the rigid point count protocol. This involved opportunistic species sampling between point count periods, random meandering and road cruising. An effort was made to cover all the different habitat types within the limits of time and access (

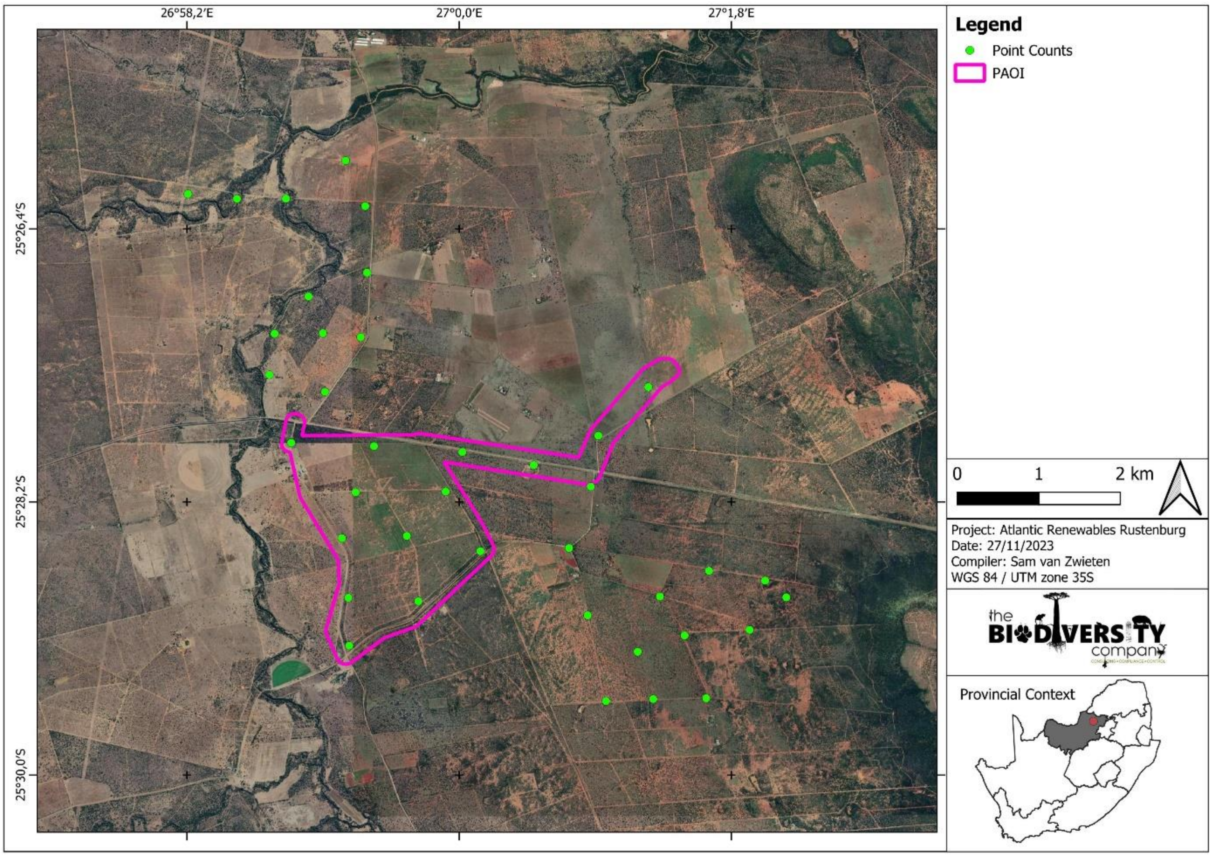


Figure 3-1).

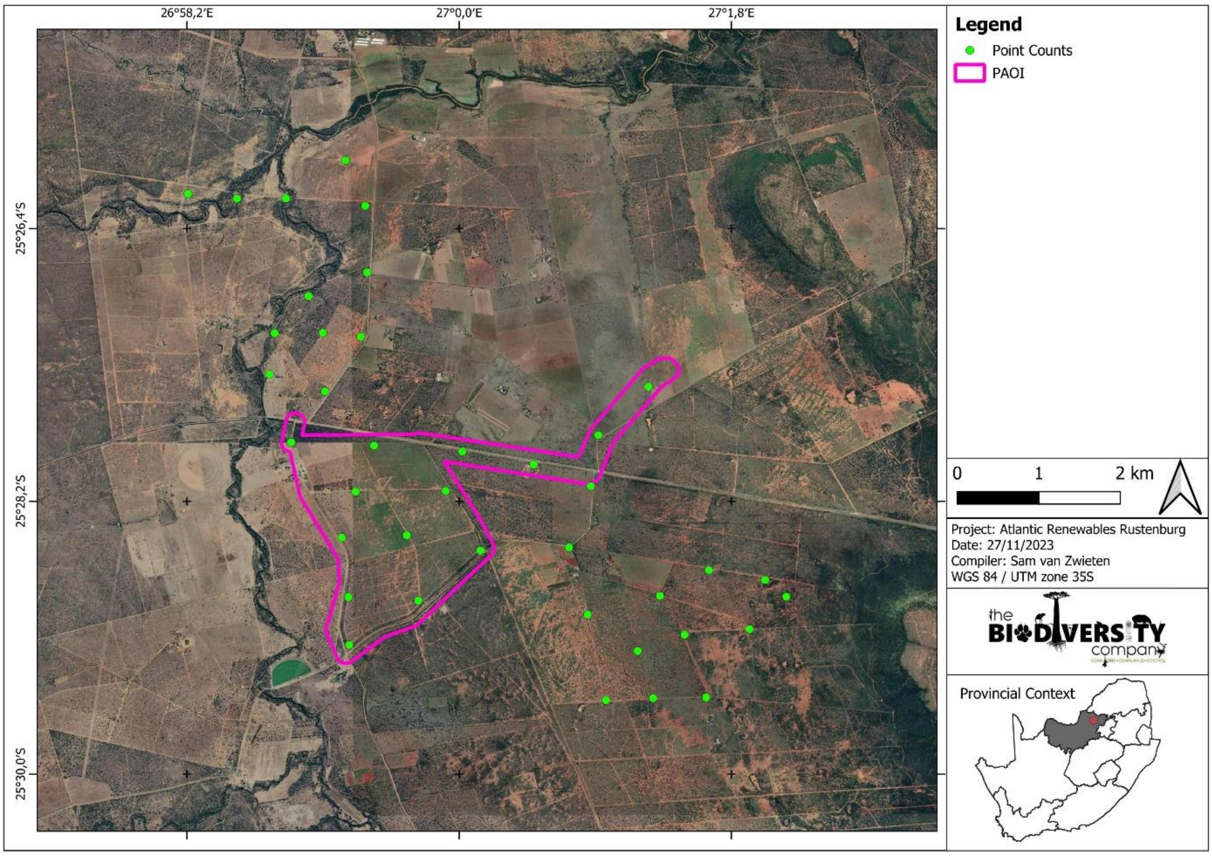


Figure 3-1 Map illustrating the field survey area and locations of Standardised Point Counts used for the analysis in this report

3.3 Data Analysis

The analyses described below only used the data collected from the Standardised Point Counts for this proposed project. However, if there are any distinct differences between the report, it will be highlighted. Raw count data were converted to relative abundance values and used to establish dominant species and calculate the diversity of each habitat. Present and potentially occurring species were assigned to 13 major trophic guilds loosely based on the classification system developed by González-Salazar *et al.* (2014). Species were first classified by their dominant diet (carnivore, herbivore, granivore, frugivore, nectarivore, omnivore), then by the medium upon/within which they most frequently forage (ground, water, foliage, air) and lastly by their activity period (nocturnal or diurnal).

3.4 Site Ecological Importance (SEI)

The habitat types within the project area were delineated and identified based on observations during the field assessment and available satellite imagery. These habitat types were assigned Ecological Importance (EI) categories based on their ecological integrity, conservation value, the presence of species of conservation concern and their ecosystem processes.

Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the receptor (e.g., SCC, the vegetation/fauna community or habitat type present on the site) and Receptor Resilience (RR) (its resilience to impacts) as follows.

BI is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows. The criteria for the CI and FI ratings are provided in Table 3-1 and Table 3-2, respectively.

Table 3-1 Summary of Conservation Importance (CI) criteria

Conservation Importance	Fulfilling Criteria
Very High	Confirmed or highly likely occurrence of Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Extremely Rare or CR species that have a global extent of occurrence (EOO) of < 10 km^2. Any area of natural habitat of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent) of natural habitat of an EN ecosystem type. Globally significant populations of congregatory species (> 10% of global population).
High	Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type. Presence of Rare species. Globally significant populations of congregatory species (> 1% but < 10% of global population).
Medium	Confirmed or highly likely occurrence of populations of Near Threatened (NT) species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals. Any area of natural habitat of threatened ecosystem type with status of VU. Presence of range-restricted species. > 50% of receptor contains natural habitat with potential to support SCC.
Low	No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species. < 50% of receptor contains natural habitat with limited potential to support SCC.
Very Low	No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.

Table 3-2 Summary of Functional Integrity (FI) criteria

Functional Integrity	Fulfilling Criteria
Very High	Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. No or minimal current negative ecological impacts, with no signs of major past disturbance.
High	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Good habitat connectivity, with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Only minor current negative ecological impacts, with no signs of major past disturbance and good rehabilitation potential.
Medium	Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts, with some major impacts and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	Small (> 1 ha but < 5 ha) area. Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. Several minor and major current negative ecological impacts.
Very Low	Very small (< 1 ha) area. No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts.

BI can be derived from a simple matrix of CI and FI as provided in Table 3-3.

Table 3-3 Matrix used to derive Biodiversity Importance (BI) from Functional Integrity (FI) and Conservation Importance (CI)

Biodiversity Importance (BI)		Conservation Importance (CI)				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Functional Integrity (FI)	**Very High**	Very High	Very High	High	Medium	Low
	High	Very High	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very Low
	Low	Medium	Medium	Low	Low	Very Low
	Very Low	Medium	Low	Very Low	Very Low	Very Low

The fulfilling criteria to evaluate RR are based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor, as summarised in Table 3-4.

Table 3-4 Summary of Receptor Resilience (RR) criteria

Resilience	Fulfilling Criteria
Very High	Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.

Resilience	Fulfilling Criteria
Medium	Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
Very Low	Habitat that is unable to recover from major impacts, or species that are unlikely to: (i) remain at a site even when a disturbance or impact is occurring, or (ii) return to a site once the disturbance or impact has been removed.

Subsequent to the determination of the BI and RR, the SEI can be ascertained using the matrix as provided in Table 3-5.

Table 3-5 Matrix used to derive Site Ecological Importance from Receptor Resilience (RR) and Biodiversity Importance (BI)

Site Ecological Importance		**Biodiversity Importance (BI)**				
		Very high	**High**	**Medium**	**Low**	**Very low**
Receptor Resilience (RR)	Very Low	Very high	Very high	High	Medium	Low
	Low	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	High	High	Medium	Low	Very low	Very low
	Very High	Medium	Low	Very low	Very low	Very low

Interpretation of the SEI in the context of the proposed project is provided in Table 3-6.

Table 3-6 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

The SEI evaluated for each taxon can be combined into a single multi-taxon evaluation of SEI for the assessment area. Either a combination of the maximum SEI for each receptor should be applied, or the SEI may be evaluated only once per receptor but for all necessary taxa simultaneously. For the latter, justification of the SEI for each receptor is based on the criteria that conforms to the highest CI and FI, and the lowest RR across all taxa. For the purposes of this assessment, only avifauna were considered.

3.5 Environmental Impact Assessment

The environmental assessment aims to identify the various possible environmental impacts that could result from the proposed activity. Different impacts need to be evaluated in terms of its significance and in doing so highlight the most critical issues to be addressed.

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e., site, local, national or global whereas intensity is defined by the severity of the impact e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Error! Reference source not found.**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

3.5.1 Impact Rating System

The hacking method was used as per the request from the client. Details can be provided on request.

4 Results & Discussion

4.1 Desktop Assessment

4.1.1 Ecologically Important Landscape Features

The following features describe the general area and habitat. This assessment is based on spatial data from various sources, such as the provincial environmental authority and SANBI. The desktop analysis and its relevance to this project are listed in Table 4-1.

Table 4-1 Summary of the relevance of the proposed development to ecologically important landscape features

Desktop Information Considered	Relevant/Irrelevant	Section
Biodiversity Spatial Plan	Relevant - The PAOI overlaps with CBA2, Ecological Support Area (ESA) 1 and Ecological Support Area (ESA) 2	4.1.1.1
Ecosystem Threat Status	Relevant - The proposed PAOI overlaps with a LC ecosystem	4.1.1.2
Ecosystem Protection Level	Relevant - The proposed PAOI project overlaps with a PP ecosystem	4.1.1.3
Protected Areas	Relevant - the proposed developments do not overlap with any protected areas but is approximately 10 km away from the Pilanesberg National Park	4.1.1.4
National Protected Areas Expansion Strategy	Relevant - The PAOI does overlap with priority focus and protected areas developments	4.1.1.5
Important Bird and Biodiversity Areas	Irrelevant - The PAOI does not overlap with an IBA but is in close proximity but is approximately 10 km away from the Pilanesberg National Park	4.1.1.6
Coordinated Avifaunal Road Count	Irrelevant - The PAOI does not overlap with any Coordinated Avifaunal Roadcount Routes	4.1.1.7
Coordinated Waterbird Count	Relevant - The PAOI is more than 18 km away from the nearest Coordinated Waterbird Count site (Rockwall Dam).	4.1.1.8
Strategic Water Source Areas	Irrelevant - The PAOI does not fall within any Strategic Water Source Areas	4.1.1.9
South African Inventory of Inland Aquatic Ecosystems	Irrelevant - The PAOI is in close within 500 m of CR wetlands and rivers.	4.1.1.9
National Freshwater Priority Area	Irrelevant - The proposed project area layout does not overlap with FEPA wetlands and rivers but border them.	4.1.1.9
Powerline Corridor	Irrelevant - The PAOI does not overlap with the central EGI corridor.	4.1.1.10
Renewable Energy Development Zone (REDZ)	Irrelevant - The PAOI does not overlap with any REDZ	4.1.1.11
Renewable Energy EIA Application Database (REEA)	Irrelevant - The PAOI is not in close proximity to already approved REEA project.	4.1.1.12

4.1.1.1 North-West Province Conservation Plan

The North-West Department of Rural, Environment, and Agricultural Development (READ), as custodian of the environment in the North West, is the primary implementing agent of the Biodiversity Sector Plan. The spatial component of the Biodiversity Sector Plan is based on systematic biodiversity planning undertaken by READ. The purpose of a Biodiversity Sector Plan is to inform land use planning, environmental assessments, land and water use authorisations, as well as natural resource management, undertaken by a range of sectors whose policies and decisions impact on biodiversity. This is done by providing a map of biodiversity priority areas, referred to as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), with accompanying land use planning and decision-making guidelines (READ, 2015). A North West Conservation Plan map was produced as part of this plan and sites were assigned to the following CBA categories, based on their biodiversity characteristics, spatial configuration and requirement for meeting targets for both biodiversity pattern and ecological processes. Relevant - The PAOI overlaps with CBA2, Ecological Support Area (ESA) 1 and Ecological Support Area (ESA) 2 (Figure 4-1).

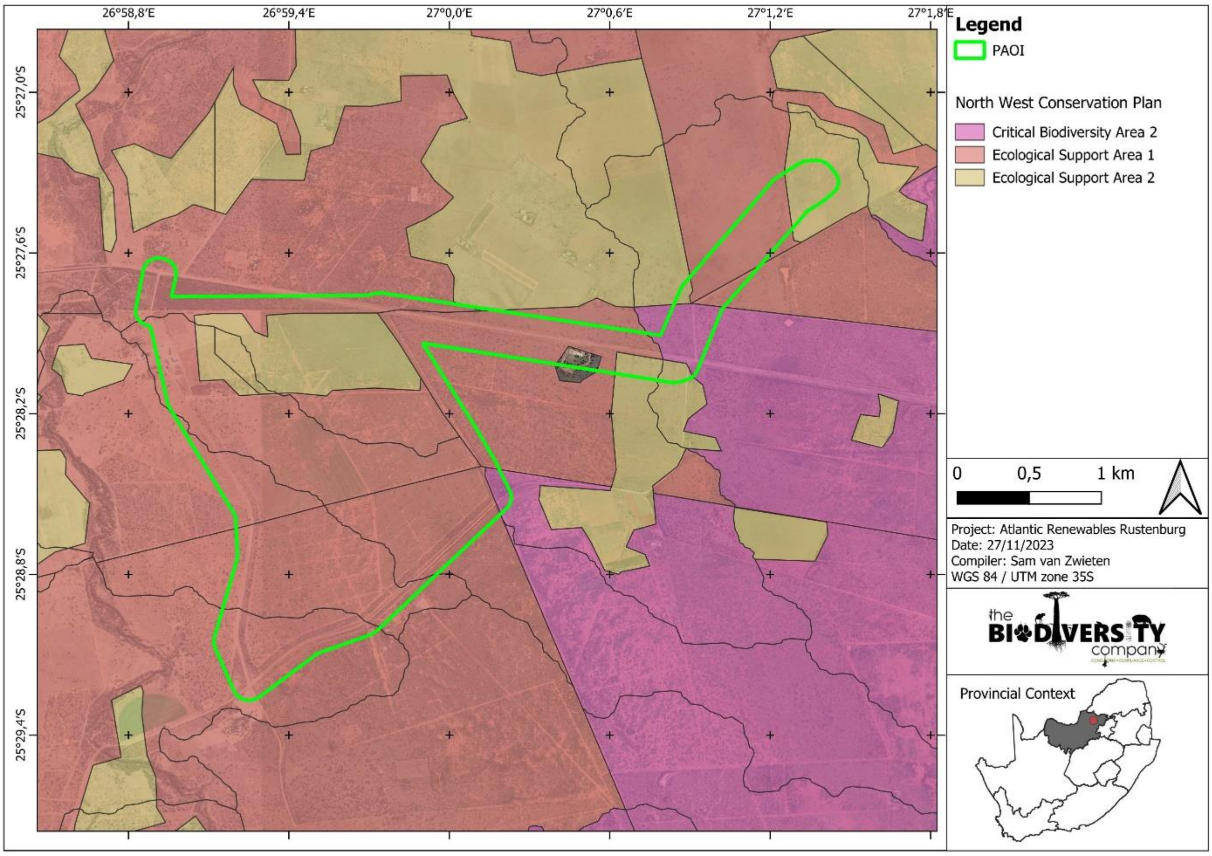


Figure 4-1 ***Map illustrating the location of Critical Biodiversity and Ecological Support Areas proximal to the Project Area of Influence***

4.1.1.2 Ecosystem Threat Status

The Ecosystem Threat Status is an indicator of an ecosystem's well-being based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition. Relevant - The proposed PAOI overlaps with an LC ecosystem (Figure 4-2).

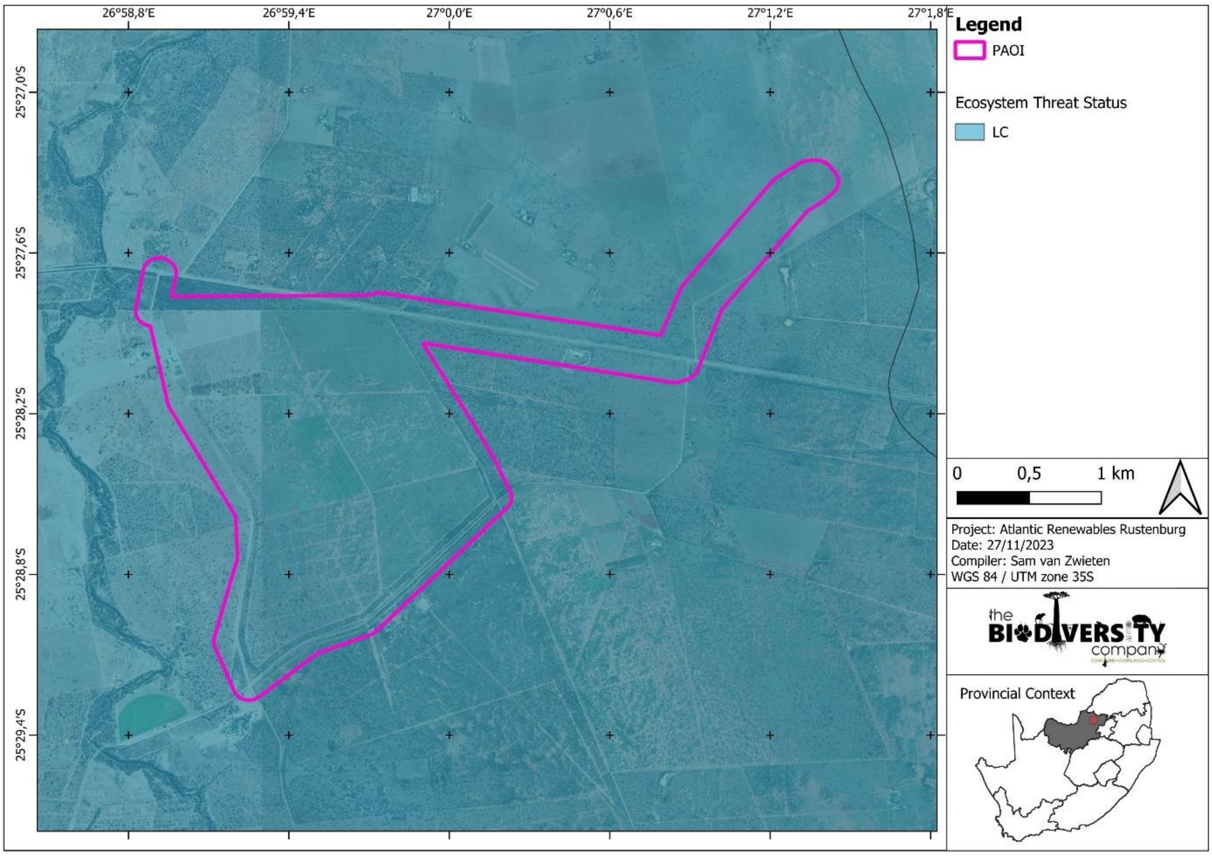


Figure 4-2 Map illustrating the ecosystem threat status associated with the PAOI

4.1.1.3 Ecosystem Protection Level

This is an indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. NP, PP or MP ecosystem types are collectively referred to as under-protected ecosystems. Relevant - The proposed PAOI project overlaps with a PP ecosystem and bordered by MP (Figure 4-3).

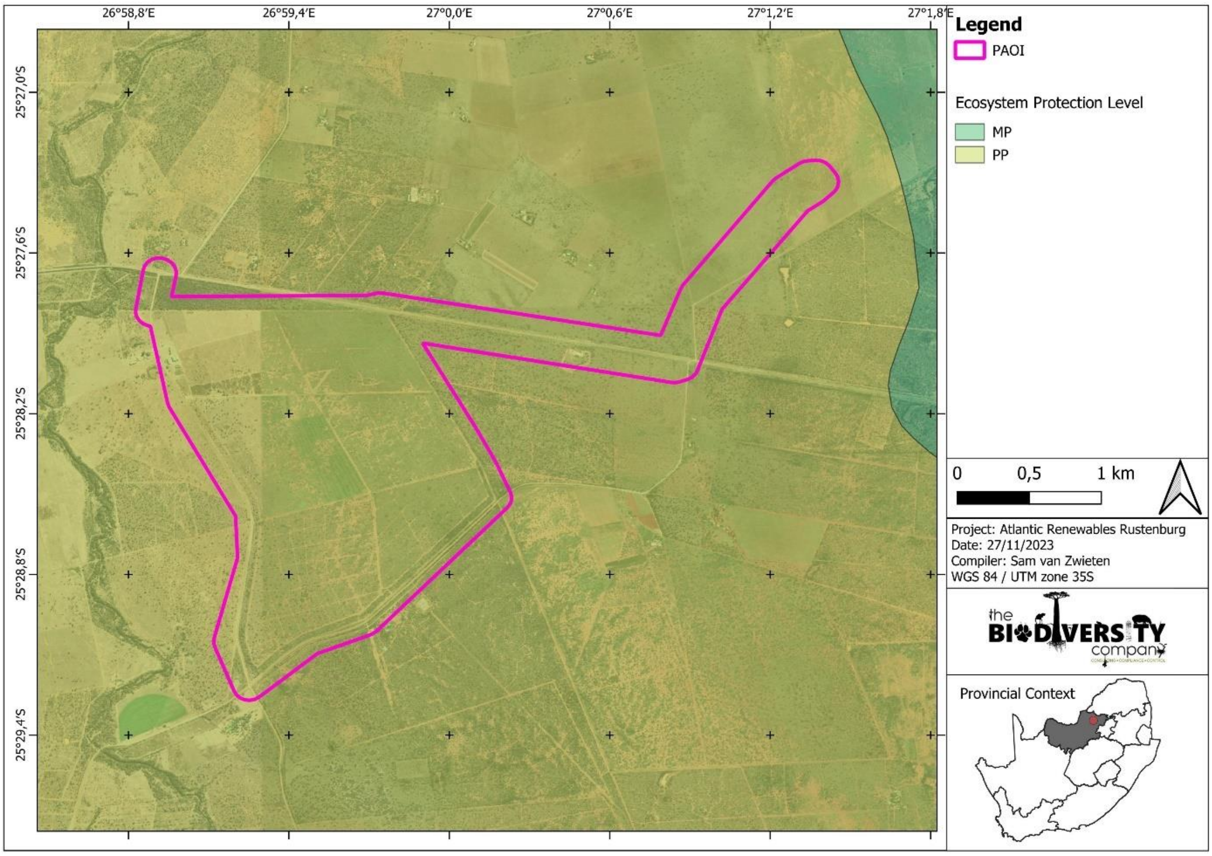


Figure 4-3 Map illustrating the ecosystem protection level associated with the PAOI

4.1.1.4 Protected Areas

According to the protected area spatial datasets from SAPAD (DFFE, 2022) and SACAD (DFFE, 2022). The Department of Environmental Affairs maintains a spatial database on Protected Areas and Conservation Areas. Protected Areas and Conservation Areas (PACA) Database scheme that used for classifying protected areas (South Africa Protected Areas Database-SAPAD) and conservation areas (South Africa Conservation Areas Database-SACAD) into types and sub-types in South Africa.

Relevant - the proposed developments do not overlap with any protected areas. However, it is in close proximity to Pilanesberg National Park (~10km away) and other private reserves Reserve (Figure 4-4).

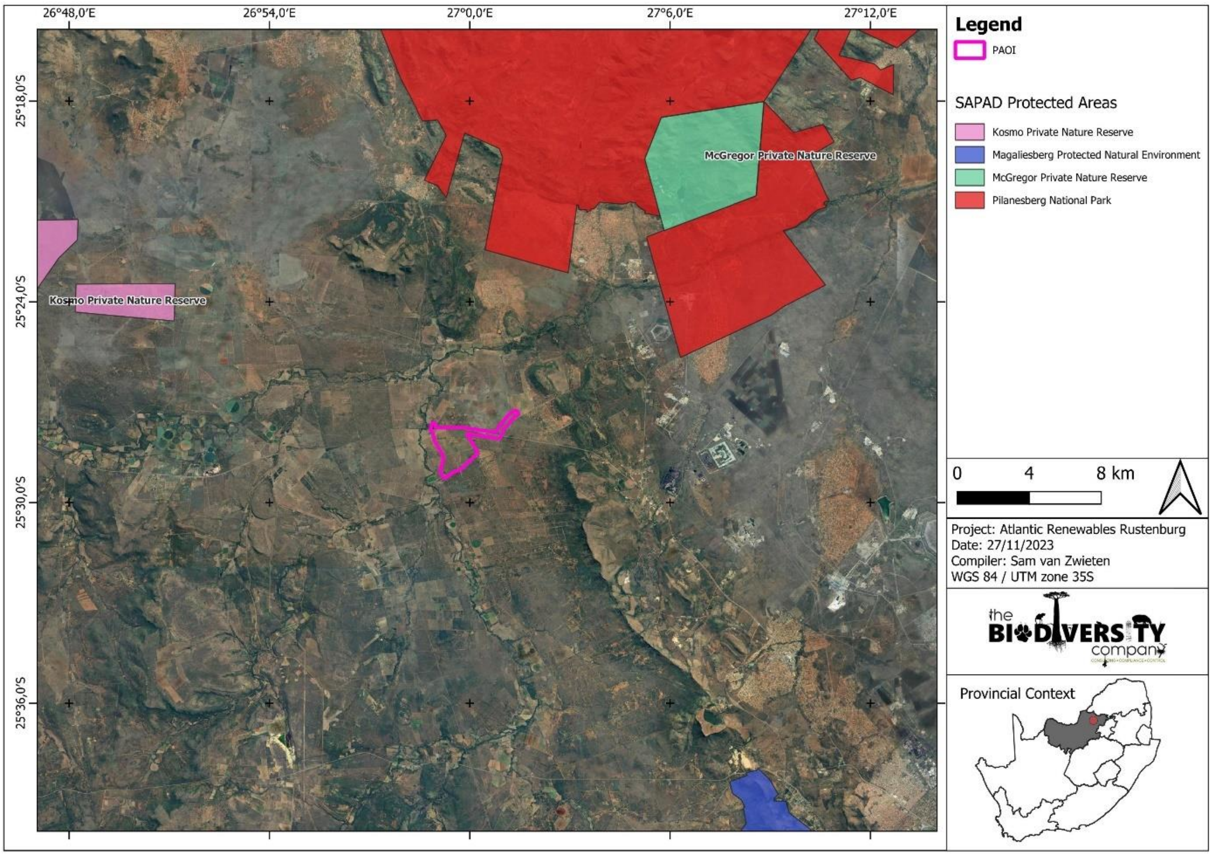


Figure 4-4 ***Map illustrating the Project Area of Influence (PAOI) in relation to Conservation and Protected Areas***

4.1.1.5 National Protected Area Expansion Strategy

National Protected Area Expansion Strategy (NPAES) areas were identified through a systematic biodiversity planning process. They presented the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with a strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases, only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine-scale planning, which may identify different priority sites based on local requirements, constraints and opportunities (DFFE, 2021). Relevant - The PAOI does overlap with priority focus and protected areas developments (Figure 4-5).

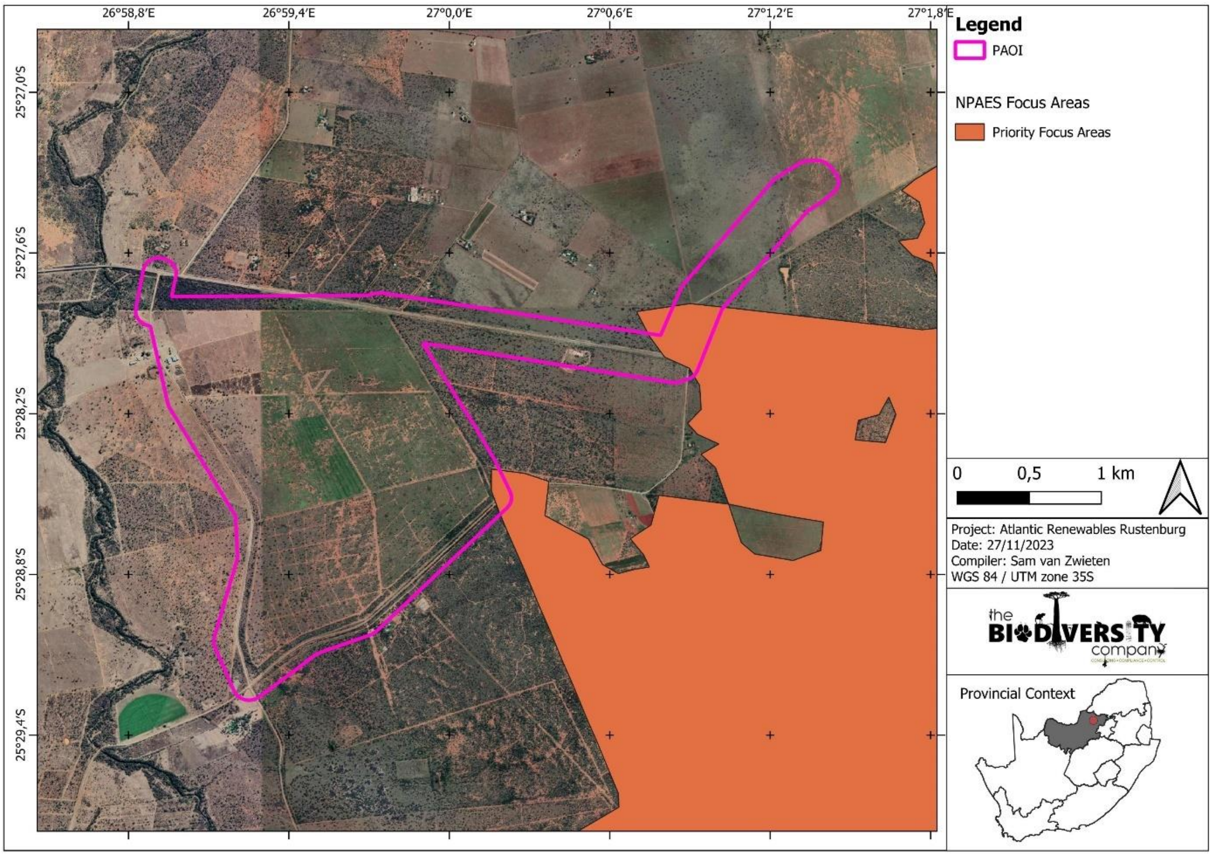


Figure 4-5 ***Map illustrating the Project Area of Influence (PAOI) in relation to NPAES Focus Areas***

4.1.1.6 Important Bird and Biodiversity Area

Important Bird & Biodiversity Areas (IBAs) are the sites of international significance for the conservation of the world's birds and other conservation significant species as identified by BirdLife International. These sites are also all Key Biodiversity Areas; sites that contribute significantly to the global persistence of biodiversity (BirdLife South Africa, 2017).

According to Birdlife South Africa (2017), selecting IBAs is achieved by applying quantitative ornithological criteria grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations and provide a common currency that all IBAs adhere to, thus creating consistency among and enabling comparability between sites at national, continental and global levels. Irrelevant - The PAOI does not overlap with an IBA but is in close proximity (~10km) to the Pilanesberg National Park.

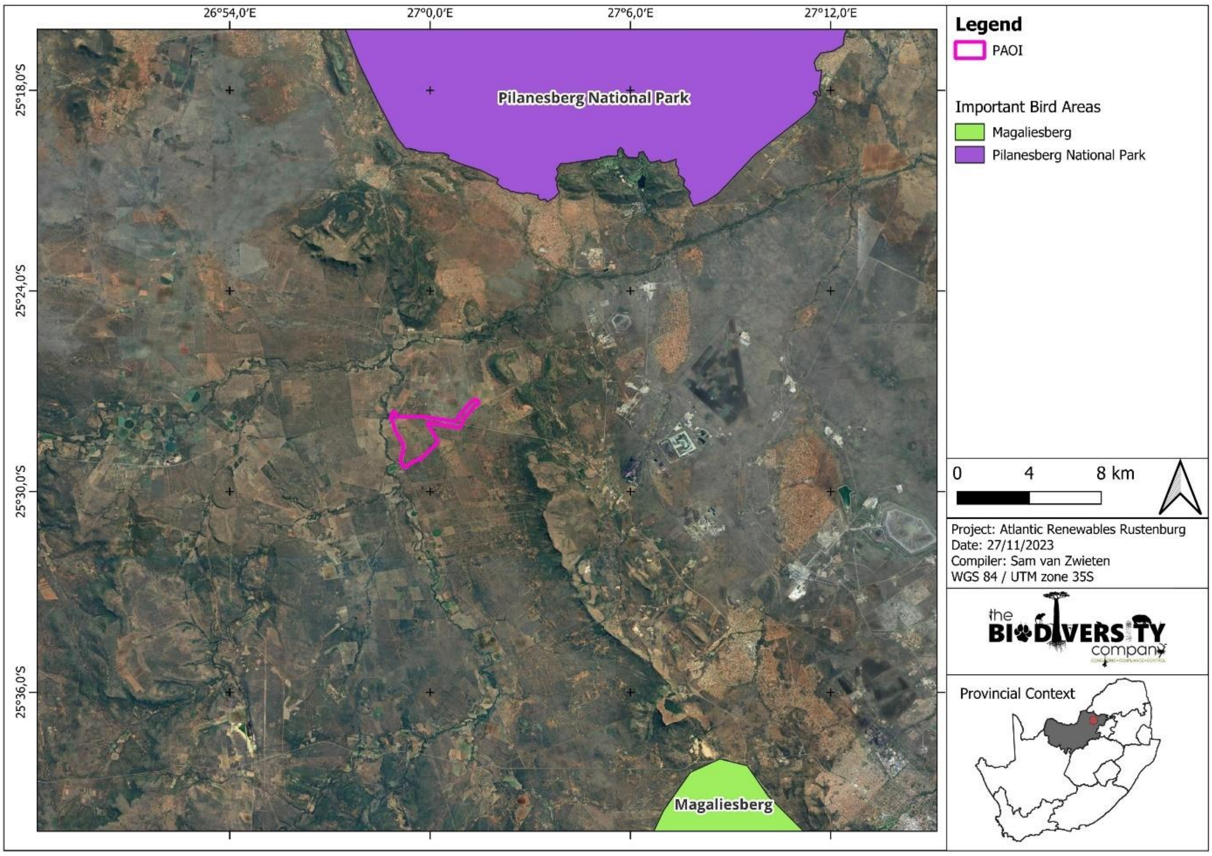


Figure 4-6 Map illustrating the Project Area of Influence (PAOI) in relation to IBA's

4.1.1.7 Coordinated Avifaunal Roadcount (CAR)

The Animal Demographic Unit (ADU)/Cape bird club pioneered the avifaunal road counts of larger birds in 1993 in South Africa. Originally it was started to monitor the Blue Crane (*Anthropoides paradiseus*) and Denham's/Stanley's Bustard (*Neotis Denham*). Today it has been expanded to monitor 36 species of large terrestrial birds (cranes, bustards, korhaans and storks) along 350 fixed routes covering over 19 000 km. Road counts are carried out twice yearly in midsummer (the last Saturday in January) and midwinter (the last Saturday in July) using this standardised method. These counts are essential for conserving these larger species that are under threat due to habitat loss through land use changes, increases in crop agriculture and human population densities, poisoning, and man-made structures like powerlines. With the prospect of increasing wind and solar farms, using renewable energy sources and monitoring these species is most important (CAR, 2020). Irrelevant - The PAOI does not overlap with any Coordinated Avifaunal Roadcount Routes, with the nearest over 60km away.

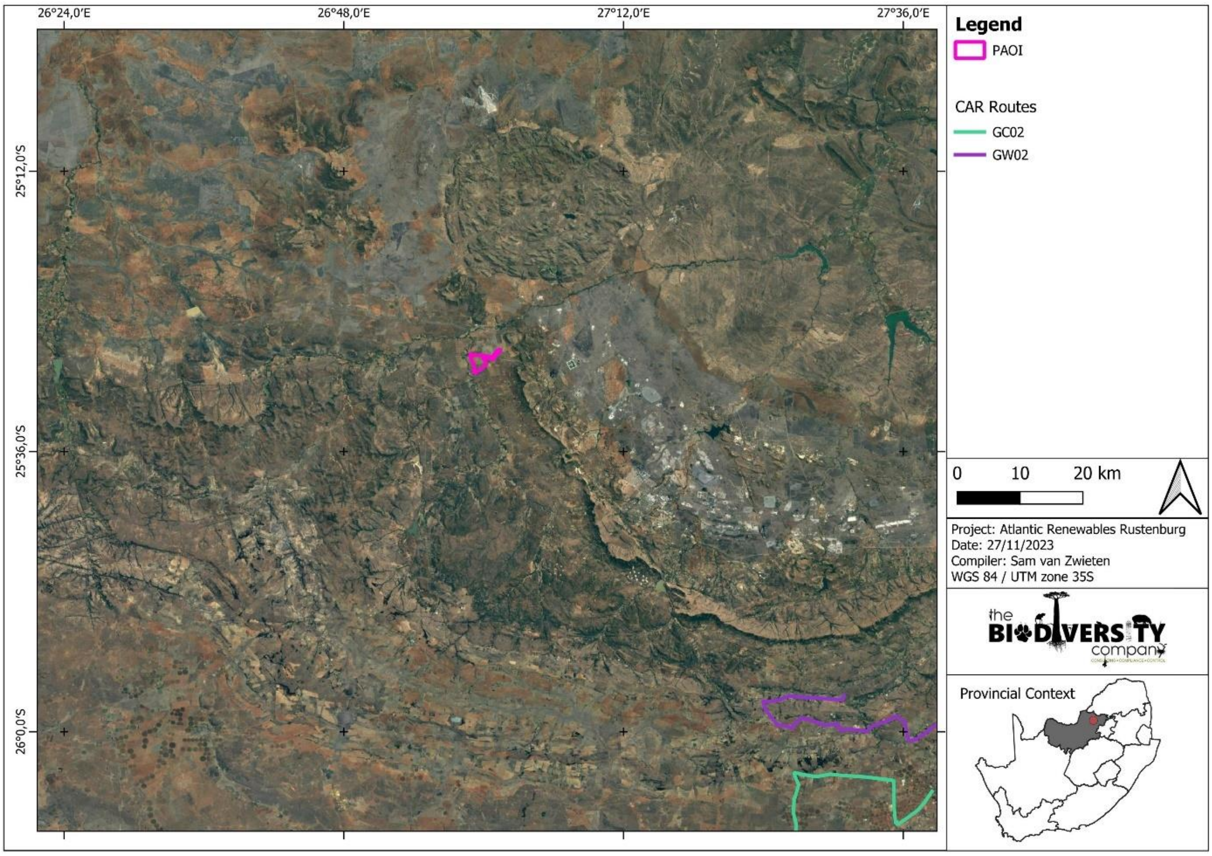


Figure 4-7 Map illustrating the Project Area of Influence (PAOI) in relation to CAR routes.

4.1.1.8 Coordinated Waterbird Count

The ADU launched the Coordinated Waterbird Counts (CWAC) project in 1992 as part of South Africa's commitment to international waterbird conservation. Regular mid-summer and mid-winter censuses are done to determine the various features of water birds, including population size, how waterbirds utilise water sources and determining the health of wetlands. For a full description of CWAC, please refer to http://cwac.birdmap.africa/about.php. Relevant - The PAOI is more than 18 km away from the nearest Coordinated Waterbird Count site (Rockwall Dam).

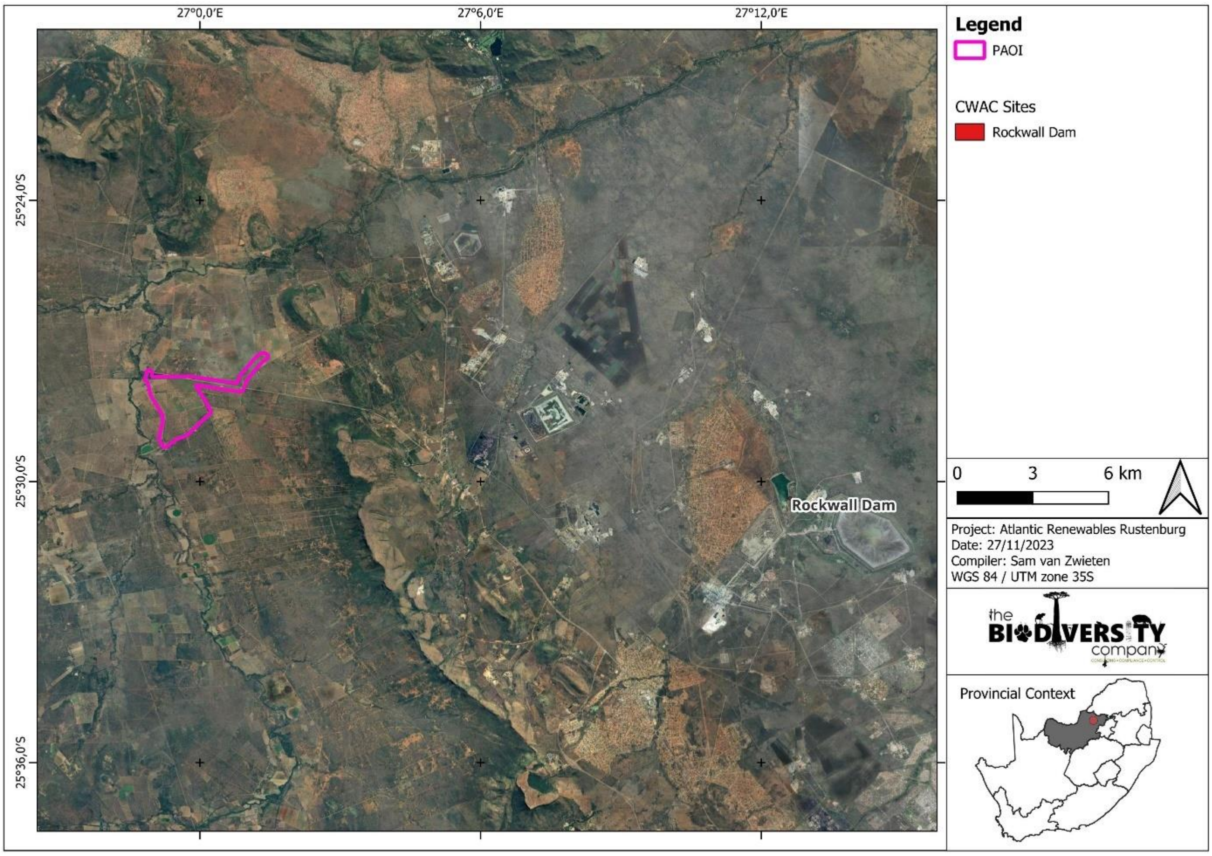


Figure 4-8 Map illustrating the Project Area of Influence (PAOI) in relation to CWAC sites.

4.1.1.9 Freshwater Ecology

Irrelevant - The PAOI does not fall within any Strategic Water Source Areas (SWSA).

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was released with the NBA 2018. The ecosystem threat status (ETS) of the river and wetland ecosystem types is based on the extent to which each river ecosystem type has been altered from its natural condition. Ecosystem types are categorised as CR, EN, VU or LT, with CR, EN and VU ecosystem types collectively referred to as 'threatened' (Van Deventer et al., 2019; Skowno et al., 2019). Relevant - The PAOI is within 500 m of CR wetlands and river (Figure 4-9 and Figure 4-10).

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver et al., 2011). The FEPAs are intended to be conservation support tools and are envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEMBA) biodiversity goals (Nel et al., 2011). Relevant - The proposed project area layout borders FEPA wetlands and rivers (Figure 4-11).

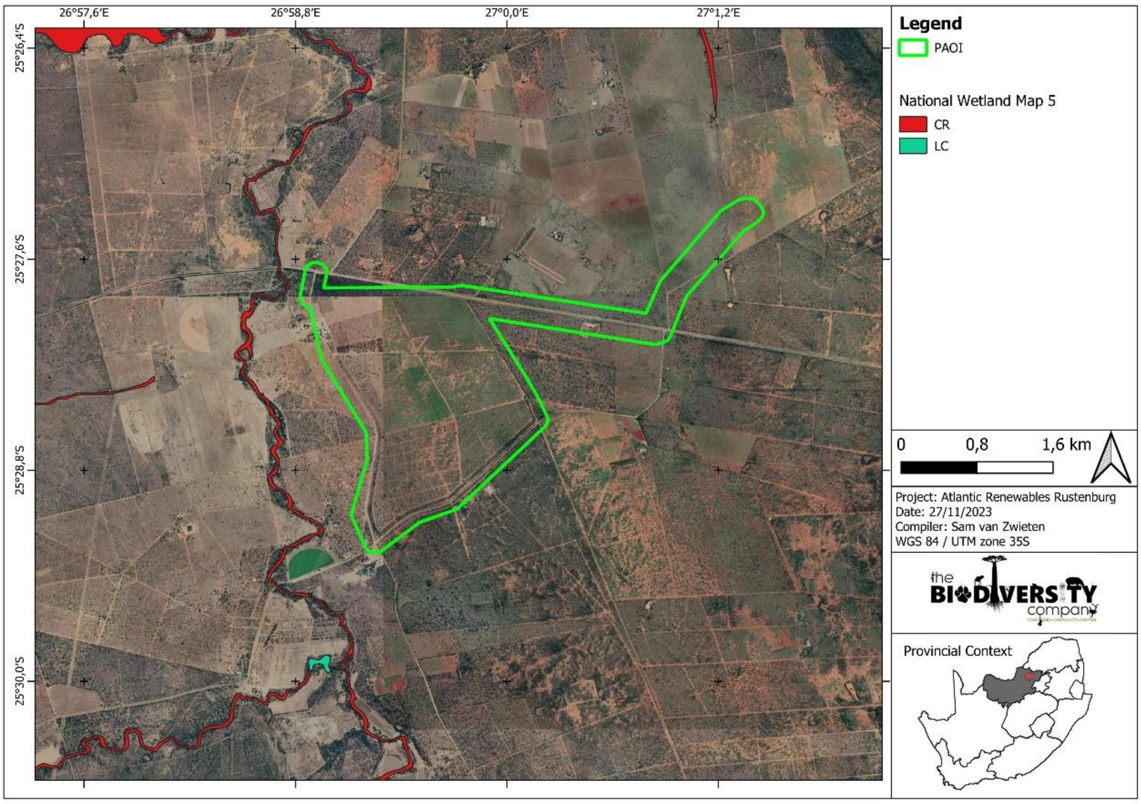


Figure 4-9 ***Map illustrating the Project Area of Influence (PAOI) in relation to South African Inventory of Inland Aquatic Ecosystems (SAIIAE) features***

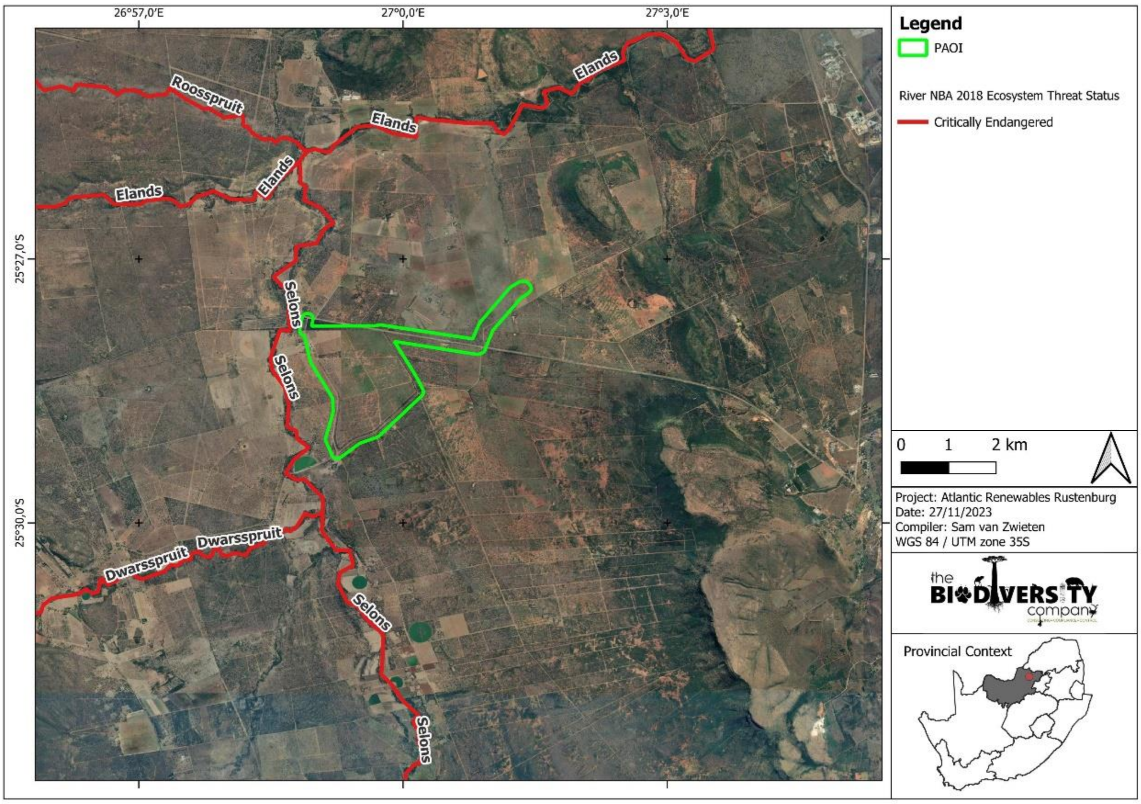


Figure 4-10 ***Map illustrating the Project Area of Influence (PAOI) in relation to NBA, 2018***

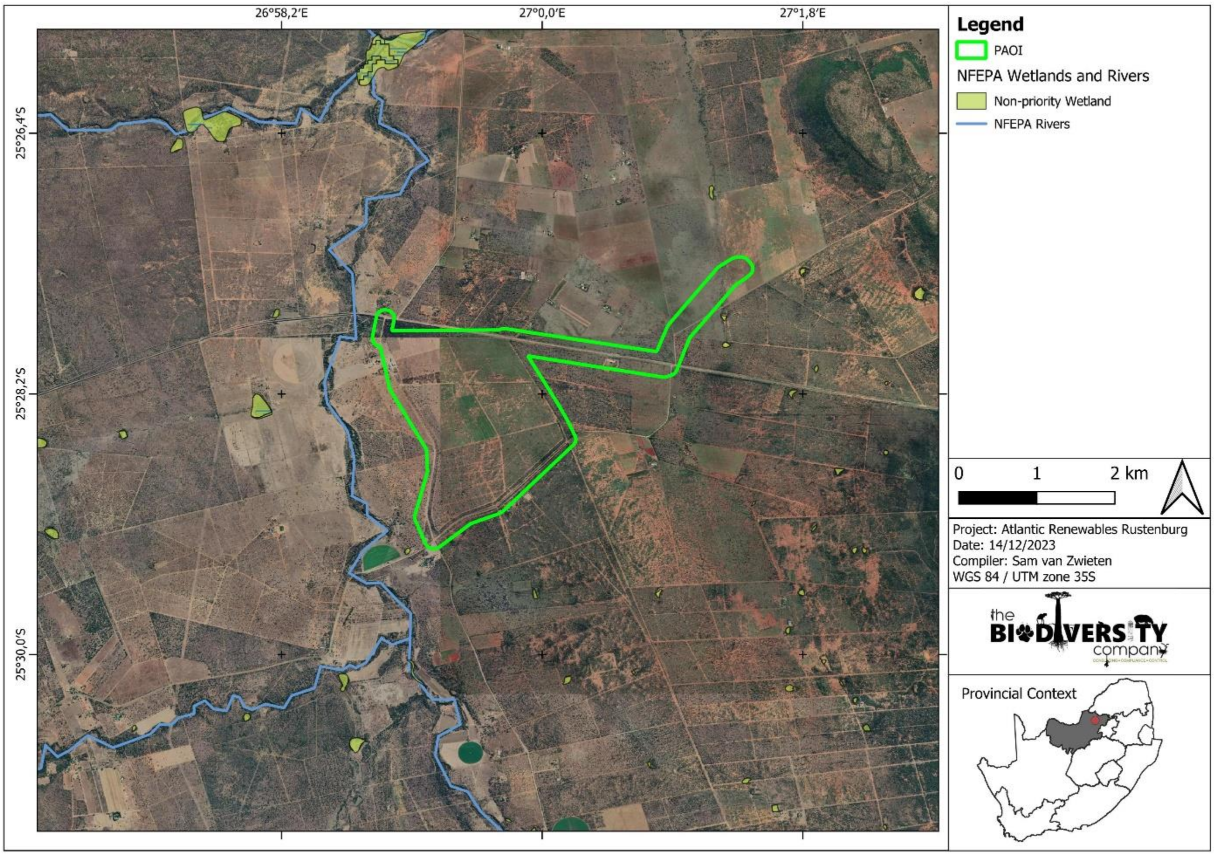


Figure 4-11 Map illustrating the Project Area of Influence (PAOI) in relation to the National Freshwater Ecosystem Priority Areas

4.1.1.10 Strategic Transmission Corridors (EGI)

On the 16 February 2018, Minister Edna Molewa published Government Notice No. 113 in Government Gazette No. 41445, which identified 5 strategic transmission corridors important for the planning of electricity transmission and distribution infrastructure as well as the procedure to be followed when applying for environmental authorisation for electricity transmission and distribution expansion when occurring in these corridors.

On 29 April 2021, Minister Barbara Dallas Creecy published Government Notice No. 383 in Government Gazette No. 44504, which expanded the eastern and western transmission corridors and gave notice of the applicability of the application procedures identified in Government Notice No. 113, to these expanded corridors. More information on this can be obtained from https://egis.environment.gov.za/egi. Irrelevant - The PAOI does not overlap with the central EGI corridor.

4.1.1.11 Renewable Energy Development Zones (REDZ)

In 2018 the Government Notice No. 114 in Government Gazette No. 41445 was published where 8 renewable energy development zones important for the development of large-scale wind and solar photovoltaic facilities were identified. In 2021 an additional 3 sites were included. The REDZs were identified through the undertaking of 2 Strategic Environmental Assessments. Irrelevant - The PAOI does not overlap with any REDZ.

4.1.1.12 Renewable Energy EIA Application Database

The Renewable Energy Database (http://egis.environment.gov.za/), shows that there are not any other projects in the near vicinity. This increases the overall impact on the habitats in the area. Irrelevant - The PAOI is not in close proximity to already approved REEA project.

4.2 Expected Species of Conservation Concern

SABAP2 data indicate that 278 avifauna species are expected for the PAOI and surrounding landscape (Appendix A). Of these, 22 are considered SCC and include those listed in Table 4-2. These species are described below.

Table 4-2 Expected avifauna Species of Conservation Concern that are expected to occur within the PAOI. CR = Critically Endangered, EN = Endangered, LC = Least Concern, NT = Near Threatened and VU = Vulnerable

Common Name	Scientific Name	Regional	Global	Likelihood of Occurrence
Lanner Falcon	*Falco biarmicus*	VU	LC	High
Greater Flamingo	*Phoenicopterus roseus*	NT	LC	Moderate
African Marsh Harrier	*Circus ranivorus*	EN	LC	Low
Marabou Stork	*Leptoptilos crumenifer*	NT	LC	High
Cape Vulture	*Gyps coprotheres*	EN	VU	Moderate
Abdim's Stork	*Ciconia abdimii*	NT	LC	Low
African Finfoot	*Podica senegalensis*	VU	LC	Low
African Grass Owl	*Tyto capensis*	VU	LC	Low
Bateleur	*Terathopius ecaudatus*	EN	EN	Low
Black Stork	*Ciconia nigra*	VU	LC	Moderate
Blue Crane	*Anthropoides paradiseus*	NT	VU	Low
Caspian Tern	*Hydropogne caspia*	VU	LC	Moderate
Curlew Sandpiper	*Calidris ferruginea*	LC	NT	Low
European Roller	*Coracias garrulus*	NT	LC	Moderate
Greater Painted-snipe	*Rostratula benghalensis*	NT	LC	Low
Half-collared Kingfisher	*Alcedo semitorquata*	NT	LC	Low
Kori Bustard	*Ardeotis kori*	NT	NT	High
Lappet-faced Vulture	*Torgos tracheliotos*	EN	EN	Low
Lesser Flamingo	*Phoeniconaias minor*	NT	NT	Moderate
Martial Eagle	*Polemaetus bellicosus*	EN	EN	Low
Pallid Harrier	*Circus macrourus*	NT	NT	Low
Pink-backed Pelican	*Pelecanus rufescens*	VU	LC	Low

Falco biarmicus (Lanner Falcon) is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). They may occur in groups up to 20 individuals, but have also been observed solitary. Their diet is mainly composed of small birds such as pigeons and francolins.

Phoenicopterus roseus (Greater Flamingo) is listed as NT on a regional scale only. This species breed on large undisturbed alkaline and saline lakes, salt pans or coastal lagoons, usually far out from the shore after seasonal rains have provided the flooding necessary to isolate remote breeding sites from terrestrial predators and the soft muddy material for nest building (IUCN, 2017). Due to the absence of its preferred habitat within the Project area but that it is in close proximity, the likelihood of occurrence is rated as moderate.

Leptoptilos crumenifer (Marabou Stork) is a sedentary or locally nomadic species that disperse based on water availability, prey abundance and breeding (BirdLife International 2023). This species breeds in colonies of up to several thousand birds and may nest with other species. When not breeding, this species tend to feed in groups and roost in large groups of up to 1000 birds. Habitat for this species is open dry savanna, grassland, swampy areas, the banks of rivers, and shores of lakes and dams. Diet includes prey such as fish, termites, locusts, frogs lizards, snakes, rats, mice and birds, as well as carrion. This species has a very large range and is very large in size globally (BirdLife International 2023). Likelihood of occurrence is high.

Ciconia nigra (Black Stork) is native to South Africa, and inhabits old, undisturbed, open forests. They are known to forage in shallow streams, pools, marshes swampy patches, damp meadows, flood-plains, pools in dry riverbeds and occasionally grasslands, especially where there are stands of reeds or long grass (IUCN, 2017). It is unlikely that this species would breed in the project area due to the lack of forested areas, however some suitable foraging habitat remains in the form of the open grasslands and wetland areas, and as such the likelihood of occurrence is rated as moderate.

Gyps coprotheres (Cape Vulture) is listed as Endangered (EN) on both a regional and global scale. Cape Vultures are long-lived carrion-feeders specialising on large carcasses, they fly long distances over open country, although they are usually found near steep terrain, where they breed and roost on cliffs (IUCN, 2017). Individuals may be seen foraging within the area but are unlikely to be resident. Likelihood of occurrence is rated as moderate.

Sterna caspia (Caspian Tern) is native to South Africa and are known to occur in inland freshwater systems such as large rivers, creeks, floodlands, reservoirs and sewage ponds. Surrounding habitat is suitable and thus the likelihood of occurrence is moderate.

Coracias garrulous (European Roller) is a winter migrant from most of South-central Europe and Asia occurring throughout sub-Saharan Africa (IUCN, 2017). The European Roller has a preference for bushy plains and dry savannah areas (IUCN, 2017). There is a moderate chance of this species occurring in the project area as they prefer to forage in open/disturbed agricultural areas.

Ardeotis kori (Kori Bustard) is listed as NT both on a regional and global scale. It occurs in flat, arid, mostly open country such as grassland, karoo, bushveld, thornveld, scrubland and savanna but also including modified habitats such as wheat fields and firebreaks. Collisions with high voltage power lines are a major threat to this species in the Karoo of South Africa (IUCN, 2007). The habitat at the project site is typical to the habitat of this species and therefore it's likelihood of occurrence is rated as high.

Phoeniconaias minor (Lesser Flamingo) is listed as NT on a global and regional scale whereas *Phoenicopterus roseus* (Greater Flamingo) is listed as NT on a regional scale only. Both species have similar habitat requirements and the species breed on large undisturbed alkaline and saline lakes, salt pans or coastal lagoons, usually far out from the shore after seasonal rains have provided the flooding necessary to isolate remote breeding sites from terrestrial predators and the soft muddy material for nest building (IUCN, 2017). Due to the absence of its preferred habitat within the project area, but around the project around, the likelihood of occurrence is moderate.

4.3 Field Assessment

4.3.1 Species List of the Field Survey

Two site visits were conducted for this regime 2 assessment in winter over the 9-11th of June 2023 and in spring over the 16-17th of September. These site visits are considered sufficient from a seasonal perspective and require no additional season assessment. However, the data was compared to the following dataset listed in section 4.3 and no differences were observed, further suggesting that sufficient data sampling was conducted to better our understanding of the bird community in the area.

The total number of 97 individual species accounts for approximately 34.89% of the total number of expected species. Only one SCC were recorded during this visit, *Sagittarius serpentarius* (Secretarybird).

4.3.1.1 Risk Species

As aforementioned, Priority Species are considered threatened, rare or prone to impacts from energy development (Ralston Paton *et al*, 2017), which is indicated by ”X”. TBC has defined Risk Species as those species that are listed in Ralston Paton *et al* (2017) as Priority Species, as well as those listed in the Eskom poster of Birds and Power Lines (Eskom and EWT, no date), which together include all species, common or red-listed that may be at risk of collision, electrocution or habitat loss as a result of the proposed activity, which is indicated by “O”. However, of the 97 species recorded at the PAOI, eleven were priority species, namely *Haliaeetus vocifer* (African Fish Eagle), *Accipiter malanoleucus* (Black Sparrowhawk), *Ardea maloncephala* (Black-headed Heron), *Elanus caeruleus* (Black-winged kite), *Melierax canorus* (Pale chanting goshawk), *Afrotis afraoides* (Northern Black Korhaan), *Lophotis rufirista* (Red-crested Korhaan), *Hieraaetus wahlbergi* (Wahlberg’s Eagle), *Aquila spilogaster* (African Hawk Eagle) and *Micronisus gabar (*Gabar Goshawk).

Table 4-3 Summary of Priority Species recorded within and around the proposed development

Common Name	Scientific Name	Sources	Collision	Electrocution	Disturbance/Habitat Loss
African Fish Eagle	*Haliaeetus vocifer*	X	X	X	X
Black Sparrowhawk	*Accipiter melanoleucus*	X	X		
Black-winged Kite	*Elanus caeruleus*	X	X		
Pale Chanting Goshawk	*Melierax canorus*	X	X	X	X
Secretarybird	*Sagittarius serpentarius*	X	X		X
Northern Black Korhaan	*Afrotis afraoides*	X	X		
Red-crested Korhaan	*Lophotis ruficrista*	O	X		
Gabar Goshawk	*Micronisus gabar*	O	X		X
Marsh Owl	*Asio capensis*	X	X		X
Wahlberg's Eagle	*Hieraaetus wahlbergi*	X	X	X	X
African Hawk Eagle	*Aquila spilogaster*	X	X	X	X

4.3.1.2 Dominant Species

Table 4-4 provides the relative abundance of the dominant species as well as the frequency with which each species appeared in the point count samples. The most abundant species was the *Numida meleagris* (Helmeted Guineafowl) with a relative abundance of 0.090 and a frequency of occurrence of 17.65 % (Table 4-4). Other species with high levels of abundance include *Pycnonotus tricolor* (Dark-capped Bulbul), *Corythaixoides concolor* (Grey Go-Away Bird) and *Streptopelia capicola* (Ring-necked dove).

Table 4-4 Relative abundance and frequency of occurrence of dominant avifauna species recorded during the standardised point counts within and around the proposed development during the field survey.

Common Name	Scientific Name	Relative abundance	Frequency (%)
Helmeted Guineafowl	*Numida meleagris*	0.090	17.65

Ring-necked Dove	*Streptopelia capicola*	0.063	60.78
Dark-capped Bulbul	*Pycnonotus tricolor*	0.056	54.90
Grey Go-away-bird	*Corythaixoides concolor*	0.055	62.75
Chestnut-vented Warbler	*Curruca subcoerulea*	0.043	60.78
Arrow-marked Babbler	*Turdoides jardineii*	0.040	23.53
African Grey Hornbill	*Lophoceros nasutus*	0.039	21.57
Rattling Cisticola	*Cisticola chiniana*	0.032	43.14
Red-faced Mousebird	*Urocolius indicus*	0.030	23.53
Crowned Lapwing	*Vanellus coronatus*	0.023	19.61
White-browed Scrub Robin	*Cercotrichas leucophrys*	0.021	31.37
Acacia Pied Barbet	*Tricholaema leucomelas*	0.018	31.37
Fork-tailed Drongo	*Dicrurus adsimilis*	0.016	19.61
Crimson-breasted Shrike	*Laniarius atrococcineus*	0.015	25.49
Long-billed Crombec	*Sylvietta rufescens*	0.015	19.61
Pied Crow	*Corvus albus*	0.013	21.57
Crested Francolin	*Dendroperdix sephaena*	0.013	15.69
Northern Black Korhaan	*Afrotis afraoides*	0.010	15.69

4.3.1.3 Trophic Guilds

Trophic guilds are defined as a group of species that exploit the same class of environmental resources in a similar way (González-Salazar *et al,* 2014). The guild classification used in this assessment is as per González-Salazar *et al* (2014); they divided avifauna into 13 major groups based on their diet, habitat, and main area of activity. Although species to tend to exhibit varied diet with invertivores consuming fruit and frugivores consuming insects for example, the dominant composition of the diet was considered.

The analysis of the major avifaunal guilds reveals that the species composition during the survey was dominated by invertivores birds that feed on the ground during the day (IGD) followed by omnivorous birds (OMD) (Figure 4-6). The species composition is spread throughout the various groups. The species composition is spread throughout the various groups (Figure 4-7).

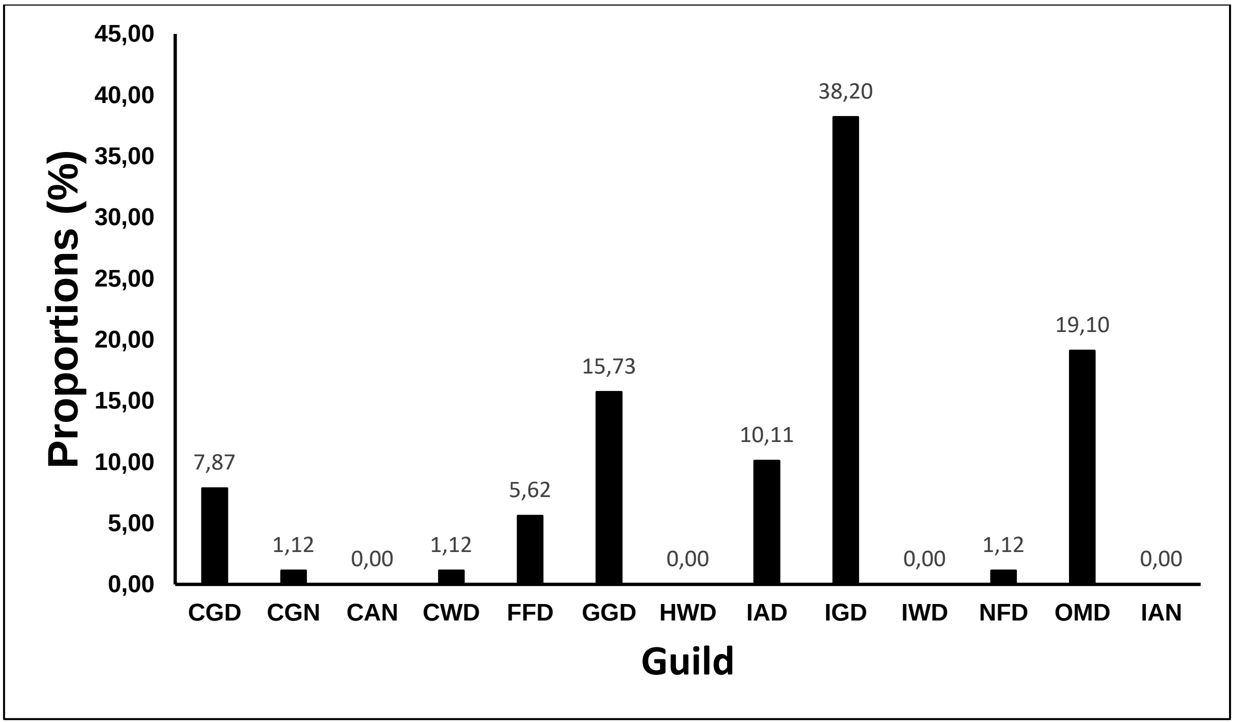


Figure 4-6 ***Column plot illustrating the proportion of each Functional Feeding Guild to the total abundance. Avifaunal trophic guilds – CGD, Carnivore Ground Diurnal; CGN, Carnivore Ground Nocturnal, CAN, Carnivore Air Nocturnal, CWD, Carnivore Water Diurnal; FFD, Frugivore Foliage Diurnal; GGD, Granivore Ground Diurnal; HWD, Herbivore Water Diurnal; IAD, Invertivore Air Diurnal; IGD, Insectivore Ground Diurnal; IWD, Invertivore Water Diurnal; NFD, Nectivore Foliage Diurnal; OMD, Omnivore Multiple Diurnal; IAN, Invertivore Air Nocturnal.***

Figure 4-7 ***Bird species with PAOI – A. Green-winged Pytilia (Pytilia melba), B. Pale Chanting Goshawk (Melierax canorus), C. Red-crested Korhaan (Lophotis ruficrista) and D. Black-headed Heron (Ardea melanocephala)***

4.3.1.4 Flight and Nest Analysis

Observing and monitoring flight paths and nesting sites of SCC and/or priority species are important in ascertaining habitat sensitivity and evaluating the impact risk significance of any proposed development. Flight analysis is also important for species that exhibit diel movement between roosting and foraging sites to prevent the risk of collision with infrastructure. A very condensed version of flight path analysis was done, the aim of this was to determine if there is a general direction of most birds on site. This section needs to be interpreted cautiously based on the limited time spent on this component.

No specific flight paths were noted.

4.4 Fine-Scale Habitat Use

Three (3) primary habitat types were delineated within PV cluster, specifically water resources, thorny bushveld and modified habitat (roads/agriculture) and is discussed in Table 4-5 and Table 5-1, whereas a photo illustration can be seen in Figure 4-9, Figure 4-10 and Figure 4-11.

Based on the criteria provided in Section 3.4 of this report, all habitats within the assessment area of the proposed project were allocated a sensitivity category. The sensitivities of the habitat types delineated are illustrated in Figure 5-3.

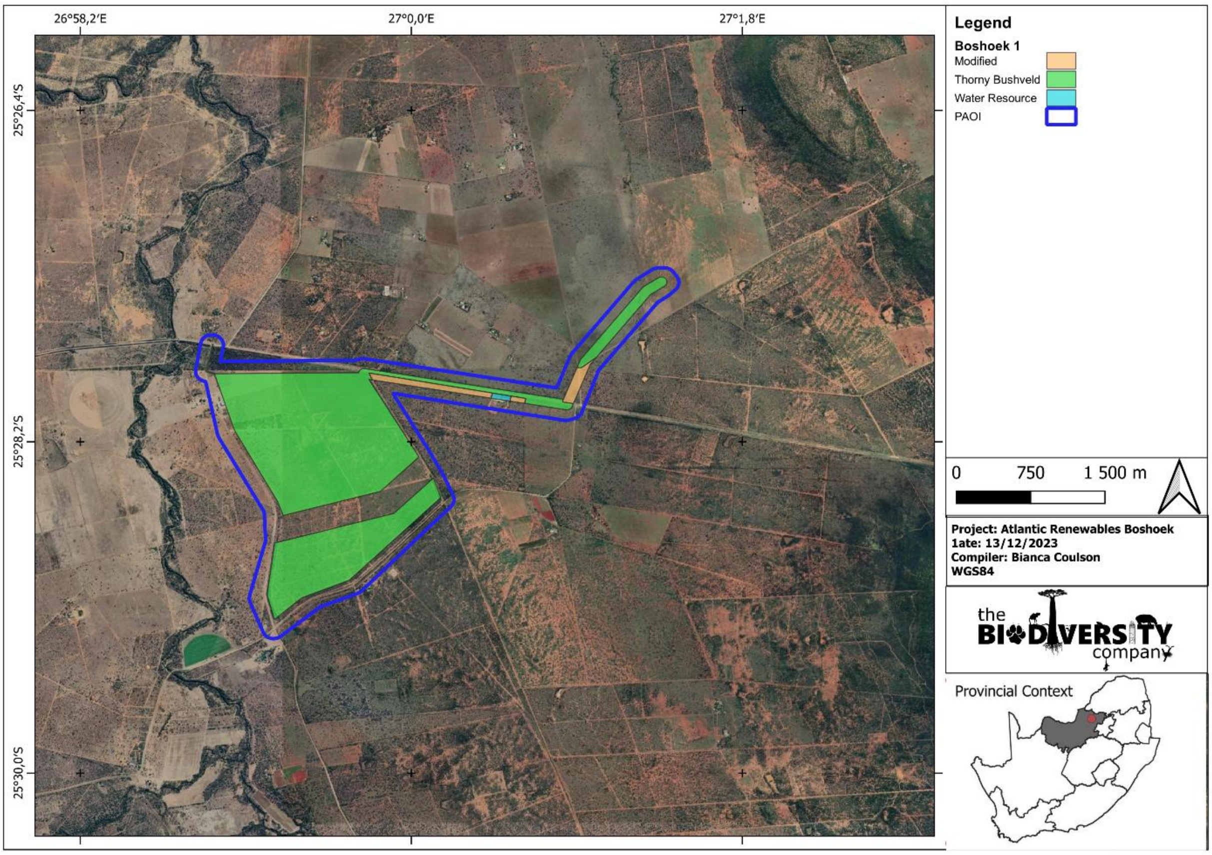


Figure 4-8 Map illustrating the habitats identified in the PAOI

Figure 4-9 Photos illustrating the condition of the Thornveld habitat within the PV area.

Figure 4-10 Photos illustrating the Modified habitats within the PV area.

Figure 4-11 Photos illustrating the Water Resource habitats within the PV area.

Table 4-5 Summary of habitat types delineated within field assessment area of the PV Cluster

Habitat	Description and condition	Ecosystem Processes and Services
Thornveld	This habitat unit is found within the proposed PV plant area. This habitat is regarded as semi – natural, due to it being disturbed as a result of livestock grazing (overgrazing), the presence of roads, waste dumping and wood harvesting. Human infringement is high within this habitat unit as it is surrounded by rural communities and public roads.	The current ecological condition of this habitat regarding the main driving forces has been altered, which is evident in the lower diversity of avifaunal species. The habitat maintains some level of functionality due to the presence of indigenous vegetation and the presence of SCC's. The condition difference within this habitat depends on the extent of the disturbance, being more severe in some areas, usually related to one being more overgrazed and exposed to current anthropogenic activities.
Water Resources	Impacted permanently to seasonally wet portions of land as delineated by the wetland specialist. Even though somewhat disturbed, the ecological integrity, importance and functioning of these areas play a crucial role as a water resource system locally and regionally and an important habitat for various avifauna, including the SCC that were not recorded.	Provides surface water resources within the landscape. Aids in trapping sediment and nutrients carried by surface runoff. Corridor for avifauna dispersion within the landscape and important foraging and nesting habitat.
Modified	The modified areas have little to no remaining natural vegetation due to land transformation by historic and current mining, agriculture and mismanagement. These habitats exist in a constant disturbed state as it cannot recover to a more natural state due to ongoing disturbances and impacts it receives.	The ecological services provided by this habitat are limited due to the extensive cover of impermeable surfaces and the large amount of bare land. Locally common bird species will forage and nest in the larger trees, and parts of the area may be considered a movement corridor.

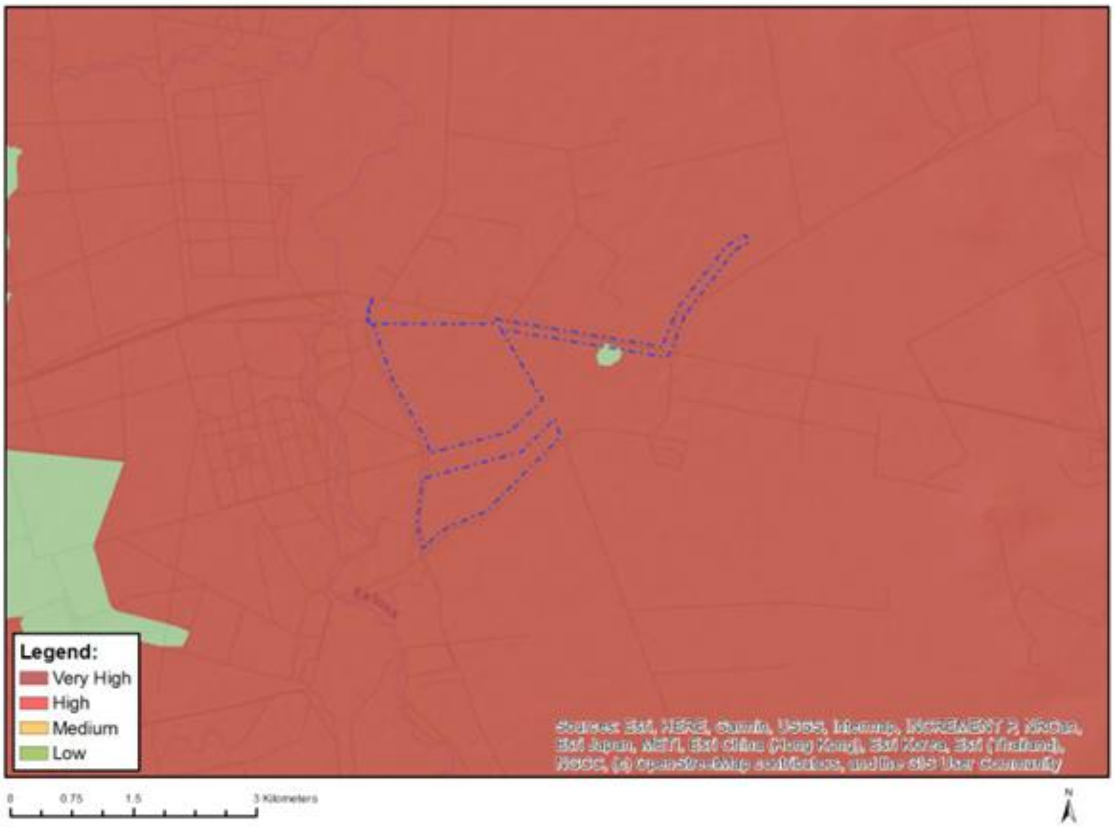
5 Site Ecological Importance (SEI)

5.1 Environmental Screening Tool

The following is deduced from the National Web-based Environmental Screening Tool Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended):

- Terrestrial Biodiversity Theme sensitivity is 'Very High' for the project area due to the presence of an Ecological Support Area 1 and 2, Critical Biodiversity Area 2 and a Protected Areas Expansion Strategy (Figure 5-1); and
- Animal Species Theme sensitivity is 'High' for the project area, with the possibility of high and medium sensitivity species being present (Figure 5-2).

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY



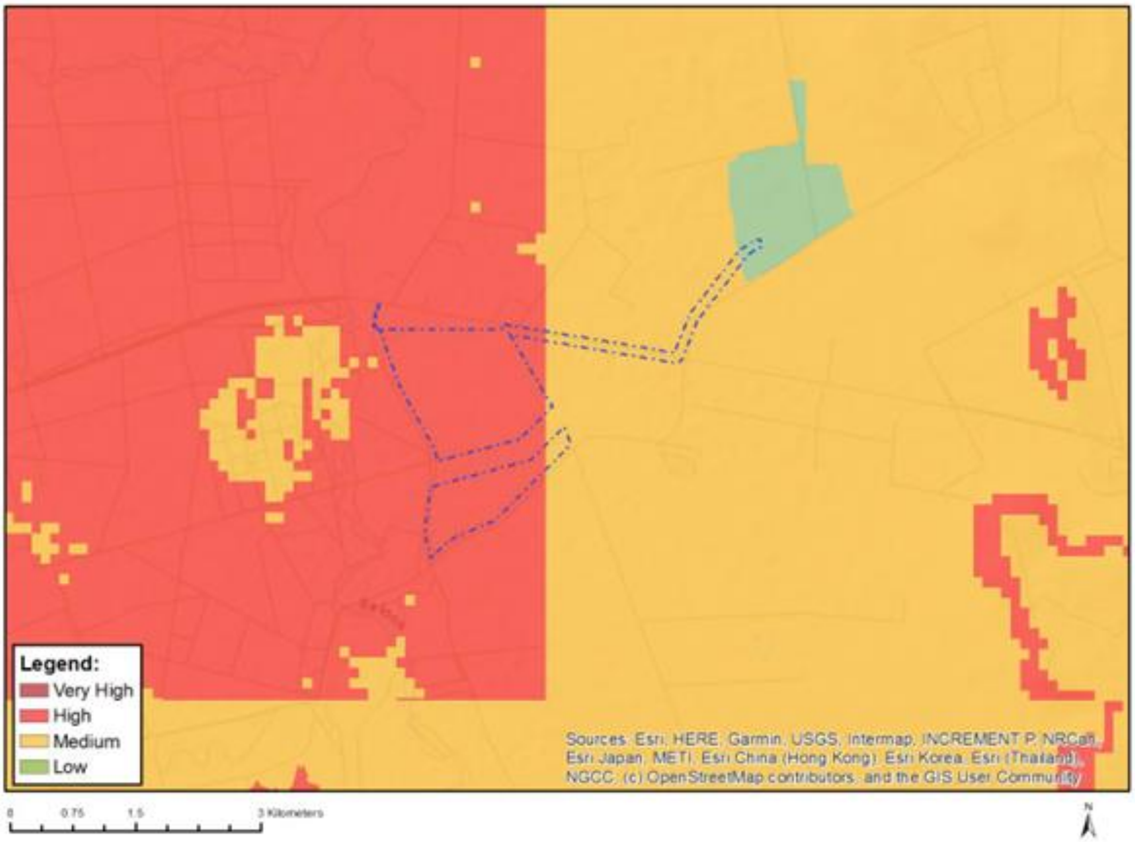
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Very High	CBA 2
Very High	ESA 1
Very High	ESA 2
Very High	National Protected Area Expansion Strategy (NPAES)

Figure 5-1 ***Map of Relative Terrestrial Biodiversity Theme Sensitivity for the proposed Solar Power Plant (SPP) Project Area generated by the Environmental Screening Tool***

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Torgos tracheliotos
Low	Subject to confirmation
Medium	Aves-Aquila rapax
Medium	Sensitive species 5
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Lycaon pictus
Medium	Reptilia-Kinixys lobatsiana

Figure 5-2 Map of Relative Animal Biodiversity Theme Sensitivity for the proposed Solar Power Plant (SPP) Project Area generated by the Environmental Screening Tool

Based on the criteria provided in section 3.4 of this report, the five delineated habitat types have each been allocated a sensitivity category, or SEI, and this breakdown is presented in Table 5-1 below. In

Figure 5-3 order to identify and spatially present sensitive features in terms of the relevant specialist discipline, the sensitivities of each of the habitat types delineated within the PAOI are mapped in below.

It is important to note that this map does not replace any local, provincial, or national government legislation relating to these areas or the land use capabilities or sensitivities of these environments.

Table 5-1 SEI Summary of habitat types delineated within field assessment area of project area

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance	Site Ecological Importance (SEI) Guidelines for interpreting SEI in the context of the proposed development activities
Water Resources	High Confirmed or highly likely occurrence of populations of Near Threatened (NT) species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals.	Medium Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches.	**Medium**	Medium Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.	**Medium**	**Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities**
Thorny Bushveld	High Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A.	Medium Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches.	**Medium**	Medium Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.	**Medium**	**Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities**
Modified Habitat	High Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A.	Low Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road	**Medium**	Very High Habitat that can recover rapidly	**Low**	**Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate**

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance	Site Ecological Importance (SEI) Guidelines for interpreting SEI in the context of the proposed development activities
		network surrounds the area.				**restoration activities.**

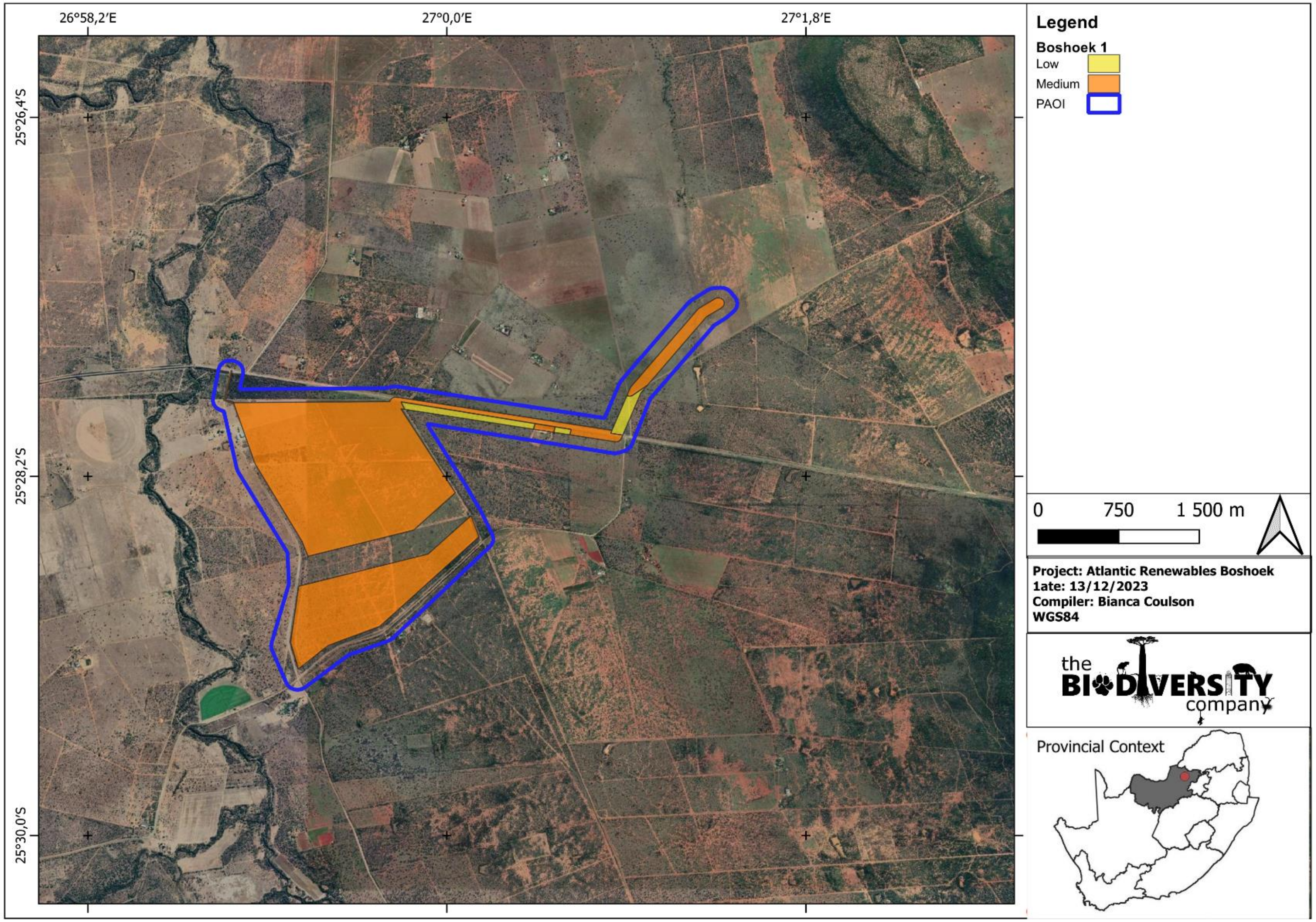


Figure 5-3 ***Map illustrating the Site Ecological Importance of the proposed development within an avifauna context***

5.2 Screening Tool Comparison

Table 5-2 provides a comparison between the Environmental Screening Tool and the specialist determined Site Ecological Importance (SEI). The specialist-assigned sensitivity ratings are based largely on the SEI process followed in the previous section, and consideration is given to any observed or likely presence of SCC. Due to the different distinctive habitats present within the Project Area, these were compared separately.

Table 5-2 Summary of the Screening Tool Sensitivity versus the Specialist assigned Site Ecological Importance (SEI) for the proposed Solar Power Plant (SPP) Project Area

Screening Tool Theme	Screening Tool	Habitat	Specialist	Tool Validated or Disputed by Specialist - Reasoning
Animal Theme	High	Water Resources	Medium	Disputed - Habitat has been altered with limited potential to support SCC.
		Thorny Bushveld	Medium	Disputed - Habitat has been altered with limited potential to support SCC.
		Modified Habitat	Low	Disputed - Habitat is altered with limited capacity to support SCC.

6 Impact Assessment

Potential impacts were evaluated against the data captured during the fieldwork and from a desktop perspective to identify relevance to the project site, specifically the proposed development footprint area. The assessment of the significance of direct, indirect and cumulative impacts was undertaken. Bennun *et al* (2021) describes three broad types of impacts associated with solar energy development:

- Direct impacts – Impacts that result from project activities or operational decisions that can be predicted based on planned activities and knowledge of local biodiversity, such as habitat loss under the project footprint, habitat fragmentation as a result of project infrastructure and species disturbance or mortality as a result of project operations.
- Indirect impacts – Impacts induced by, or ‘by-products’ of, project activities within a project’s area of influence.
- Cumulative impacts – Impacts that result from the successive, incremental and/or combined effects of existing, planned and/or reasonably anticipated future human activities in combination with project development impacts.

The assessment of impact significance considers pre-mitigation as well as implemented post-mitigation scenarios. Three phases were considered for the impact assessment:

- Construction Phase;
- Operational Phase; and
- Decommission/Closure/Rehabilitation Phase.

6.1 Present Impacts to Avifauna

In consideration that there are anthropogenic activities and influences are present within the landscape, there are several negative impacts to biodiversity, including avifauna (Figure 6-1). These include:

- Fences; and
- Powerlines.

Figure 6-1 Impacts observed during the assessment included existing fences and powerlines.

6.2 Anticipated Impacts

The impacts anticipated for the proposed activities are considered in order to predict and quantify these impacts and assess & evaluate the magnitude on the identified avifauna (Table 6-1).

Table 6-1 Anticipated impacts for the proposed activities on avifauna

Main Impact	Project activities that can cause loss/impacts to habitat (especially with regard to the proposed infrastructure areas):	Secondary impacts anticipated
1. Destruction, fragmentation and degradation of habitats and ecosystems	Physical removal of vegetation, including protected species.	Displacement/loss of avifauna (including possible SCC)
	Access roads and servitudes	Increased potential for soil erosion
	Soil dust precipitation	Habitat fragmentation
	Dumping of waste products	Increased potential for establishment of alien & invasive vegetation
	Random events such as fire (cooking fires or cigarettes)	Erosion
Main Impact	**Project activities that can cause the spread and/or establishment of alien and/or invasive species**	**Secondary impacts anticipated**
2. Spread and/or establishment of alien and/or invasive species	Vegetation removal	Habitat loss for native avifauna (including SCC)
	Vehicles potentially spreading seed	Spreading of potentially dangerous diseases due to invasive and pest species
	Unsanitary conditions surrounding infrastructure promoting the establishment of alien and/or invasive rodents	Alteration of fauna assemblages due to habitat modification
	Creation of infrastructure suitable for breeding activities of alien and/or invasive birds	

Main Impact	Project activities that can cause direct mortality of avifauna	Secondary impacts anticipated
3. Direct mortality of avifauna	Clearing of vegetation	Loss of habitat Loss of ecosystem services
	Roadkill due to vehicle collision	Increase in rodent populations and associated disease risk
	Pollution of water resources due to dust effects, chemical spills, etc.	
	Intentional killing of avifauna for food (hunting)	
Main Impact	**Project activities that can cause reduced dispersal/migration of avifauna**	**Secondary impacts anticipated**
4. Reduced dispersal/migration of avifauna	Loss of landscape used as corridor	Reduced dispersal/migration of avifauna Loss of ecosystem services
	Compacted roads	Reduced plant seed dispersal
	Removal of vegetation	
Main Impact	**Project activities that can cause pollution in watercourses and the surrounding environment**	**Secondary impacts anticipated**
5. Environmental pollution due to water runoff, spills from vehicles and erosion	Chemical (organic/inorganic) spills	Pollution in watercourses and the surrounding environment
	Erosion	avifauna mortality (direct and indirectly) Groundwater pollution Loss of ecosystem services
Main Impact	**Project activities that can cause disruption/alteration of ecological life cycles due to sensory disturbance.**	**Secondary impacts anticipated**
6.Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise, dust and light pollution.	Operation of machinery (Large earth moving machinery, vehicles)	Disruption/alteration of ecological life cycles due to noise Loss of ecosystem services
	Project activities that can cause disruption/alteration of ecological life cycles due to dust	Secondary impacts associated with disruption/alteration of ecological life cycles due to dust
	Vehicles	Loss of ecosystem services
Main Impact	**Project activities that can cause staff to interact directly with potentially dangerous avifauna**	**Secondary impacts anticipated**
7. Staff and others interacting directly with avifauna (potentially dangerous) or poaching of animals	All unregulated/supervised activities outdoors	Loss of SCCs
Main Impact	**Project activities that can cause staff to interact directly with potentially dangerous avifauna**	**Secondary impacts anticipated**
8. Collision and electrocution with	Collisions are thought to arise when birds (particularly waterbirds) mistake the panels for waterbodies, known as the “lake effect” (Lovich & Ennen, 2011).	Loss of avifauna species and SCCs

any infrastructure (PV panel, power lines, fencing)	Migrating or dispersing birds become disorientated by the polarised light reflected by the panels. Visser *et al* (2019) performed a study at a utility-scale PV SEF in the Northern Cape and found that most of the species affected by the facility were passerine species. This is due to collisions with solar panels from underneath. During a predator attack while foraging under the panels, individuals may alight and then collide with the panel Fencing of the PV site can influence birds in six ways (BirdLife South Africa, 2015): • Snagging – occurs when a body part is impaled on one or more barbs or razor points of a fence; • Snaring – when a bird's foot/leg becomes trapped between two overlapping wires; • Impact injuries – birds flying into a fence, the impact may kill or injure the bird; • Snarling – when birds try and push through a mesh or wire stands, ultimately becoming trapped (uncommon); • Electrocution – electrified fence can kill or severely injure birds; and • Barrier effect – fences may limit flightless birds including moulting waterfowl from resources.	

6.3 Alternatives considered

The DEAT 2006 guidelines on 'assessment of alternatives and impacts' proposes the consideration of four types of alternatives namely, the no-go, location, activity, and design alternatives. It is, however, important to note that the regulation and guidelines specifically state that only 'feasible' and 'reasonable' alternatives should be explored. As such, no alternatives were considered for this proposed development.

6.4 Loss of Irreplaceable Resources

The proposed activities will be conducted over the several habitats. These areas encompass indigenous vegetation that may be considered largely functional in nature and as such any irresponsible and/or medium to high impact activities will likely result in the loss of the following resources:

- CBA 1;
- ESA 1 and 2 and
- LC ecosystem.

6.5 Assessment of Impact Significance

The assessment of impact significance considers pre-mitigation as well as implemented of post-mitigation scenarios. Although different species and groups will react differently to the development, the risk assessment was undertaken bearing in mind the potential impacts to the important species that may be found within the PAOI.

6.5.1.1 Construction Phase

The following potential main impacts on the avifauna (based on the framework above) were considered for the construction phase of the proposed development. This phase refers to the period during construction when the proposed features are constructed; and is considered to have the largest direct impact on biodiversity. The following potential impacts to avifauna were considered:

- Destruction, further loss and fragmentation of the of habitats, ecosystems and vegetation community, foraging and potential breeding habitats for SCC;
- Introduction of alien species, especially plants, altering natural vegetation for avifauna;

- Displacement of the indigenous avifauna communities (including SCC) due to habitat loss, direct mortalities, and disturbance (road collisions, noise, dust, light, vibration, and poaching); and

- Direct mortality from persecution or poaching of avifauna species and collection of eggs.

As the avifauna species in the area is dependent on the habitat and the preservation of the habitat, the impacts of the possible degradation of the habitat condition such as the infestation of the area with alien vegetation and erosion were also considered.

All likely impacts are rated as Medium-High negative significance pre-mitigation but may be reduced to Low-Medium significance through the proper implementation of effective mitigation measures. The most important mitigation measures for this phase are as follows:

- Ensure that the site footprint is as small as possible and responsibly positioned, the development area must be properly fenced off during construction;

- Land clearing must be done over at least three days and conducted linearly and successively from the south to the north; and

- No trapping, killing, or poisoning of any wildlife is to be allowed and signs must be put up to enforce this. Monitoring must take place in this regard.

6.5.1.2 Operational Phase

The operational phase of the impact of daily activities is anticipated to spread further the IAP, as well as the deterioration of the habitats due to the increase of dust and edge effect impacts. Moving maintenance vehicles do not only cause sensory disturbances to avifauna, affecting their life cycles and movement, but will lead to direct mortalities due to collisions.

The following potential impacts were considered:

- Continued fragmentation and degradation of natural habitats and ecosystems;

- Continuing spread of IAP and weed species; and

- Ongoing displacement and direct mortalities of the avifauna communities (including SCC) due to continued disturbance (road collisions, noise, light, dust, vibration, poaching, etc.).

- Heat Radiation from the BESS and Solar Panels.

All potential impacts may be reduced from a significance rating of High to Low with the proper implementation of ongoing mitigation measures. The most important mitigation measures to implement during this phase include:

- The continual usage of the same roadways, parking areas and walkways, and the following of speed limits;

- The responsible management of all waste;

- An IAP management and habitat rehabilitation plan must be implemented and updated annually by specialist;

- Ongoing post-construction monitoring should be conducted to determine the impact of PV facilities as required by the Jenkins et al. (2017).

6.5.2 Construction Phase

Table 6-2 Assessment of significance of impacts on the avifauna associated with the proposed activity.

Impact Phase: Construction							
Potential impact description: Destruction, further loss and fragmentation of the habitats, ecosystems and vegetation community, including protected species. **Vegetation clearing and construction of PV Facility**							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	H	M
With Mitigation	M	M	M	Negative	M	M	M
Can the impact be reversed?			Yes, but only partially as vegetation will still be lost				
Will impact cause irreplaceable loss or resources?			Yes, but habitat will still be lost				
Can impact be avoided, managed or mitigated?			Yes, but only partially. Vegetation will still be lost				

Mitigation measures to reduce residual risk or enhance opportunities:

- The areas to be developed must be specifically demarcated to prevent movement into surrounding environments.
- Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, must under no circumstances be fragmented or disturbed further.
- If possible solar panels must be mounted on pile driven or screw foundations, such as post support spikes, rather than heavy foundations, such as trench-fill or mass concrete foundations, to reduce the negative effects on natural soil functioning, such as its filtering and buffering characteristics, while maintaining habitats for both below and above-ground biodiversity.
- Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion. This will also reduce the likelihood of encroachment by alien invasive plant species. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are indigenous to this vegetation type.
- A hydrocarbon spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use. No servicing of equipment on site unless necessary. All contaminated soil / yard stone shall be treated in situ or removed and be placed in containers. Appropriately contain any generator diesel storage tanks, machinery spills (e.g., accidental spills of hydrocarbons oils, diesel etc.) in such a way as to prevent them leaking and entering the environment.
- Cement must be mixed in a designated area on a liner away from water sources and buffers and that successful rehabilitation of the construction areas can take place
- Leaking equipment and vehicles must be repaired immediately or be removed from PAOI to facilitate repair.
- A fire management plan needs to be complied to restrict the impact of fire.
- Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site. A location specific waste management plan must be put in place to limit the presence of rodents and pests and waste must not be allowed to enter surrounding areas.
- A pest control plan must be put in place and implemented; it is imperative that poisons not be used to control pests due to the likely occasional presence of SCC.
- Litter, spills, fuels, chemical and human waste in and around the project area must be minimised and controlled according to the waste management plan.
- A minimum of one toilet must be provided per 10 persons. Portable toilets must be pumped dry to ensure the system does not degrade over time and spill into the surrounding area.
- The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility within every 10 days at least.
- Where a registered disposal facility is not available close to the project area, the Contractor shall provide a method statement with regards to waste management. Under no circumstances may domestic waste be burned on site or buried on open pits.

• Discussions are required on sensitive environmental receptors within the PAOI to inform contractors and site staff of the presence of protected species and sensitive habitat, their identification, conservation status and importance, biology, habitat requirements and management requirements in line with the Environmental Authorisation and within the EMPr. • Refuse bins will be responsibly emptied and secured. Temporary storage of domestic waste shall be in covered and secured waste skips. Maximum domestic waste storage period will be 10 days. •	
Residual impact	*Yes, but acceptable negative impact*

Impact Phase: Construction							
Potential impact description: Spread and/or establishment of alien and/or invasive species **Vegetation clearing and construction of PV Facility**							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	L
Can the impact be reversed?			Yes, alien invasive management plan can control it				
Will impact cause irreplaceable loss or resources?			No, should the alien management plan be implemented				
Can impact be avoided, managed or mitigated?			Yes, should the alien management plan be implemented				
Mitigation measures to reduce residual risk or enhance opportunities: • An Invasive Alien Plant Management Plan must be compiled and implemented. This should regularly be updated to reflect the annual changes in IAP composition. • The footprint area of the construction should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas. Footprints of the roads must be kept to prescribed widths.							
Residual impact	*Yes, but acceptable negative impact*						

Impact Phase: Construction							
Potential impact description: Displacement of avifaunal community due to habitat loss, direct mortalities and disturbance (road and powerline collisions, noise, dust, vibration, fencing and poaching)							
Vegetation clearing and construction of PV Facility							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	H	M
With Mitigation	M	M	M	Negative	M	M	M
Can the impact be reversed?			Yes, but only partially as avifauna will still be disturbed and displaced. Territories will also be disrupted				
Will impact cause irreplaceable loss or resources?			Yes, but avifauna will still be disturbed and displaced.				
Can impact be avoided, managed or mitigated?			Yes, but avifauna will still be disturbed and displaced.				

Mitigation measures to reduce residual risk or enhance opportunities:

- The areas to be developed must be specifically demarcated to prevent movement into surrounding environments.
- All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting terrestrial species, and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.
- The duration of the construction must be kept to a minimum to avoid disturbing avifauna
- Outside lighting must be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (red/green) lights should be used wherever possible.
- All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (40 km/h), to respect all forms of wildlife. Speed limits must be enforced to ensure that road killings and erosion is limited.
- All project activities must be undertaken with appropriate noise mitigation measures to avoid disturbance to avifauna population in the region
- All areas to be developed must be walked through prior to any activity to ensure no SCC nests or avifauna species are found in the area. Should any Species of Conservation Concern be found and not move out of the area, or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.
- Infrastructure must be consolidated where possible in order to minimise the amount of ground and air space used.
- **Fencing mitigations:**
  - **Top 2 strands must be smooth wire;**
  - **Routinely retention loose wires;**
  - **Minimum 300 mm between wires; and**
  - Place markers on fences.
- If feasible the internal medium voltage powerlines should be thoroughly insulated and preferably buried.
- Any exposed parts must be covered (insulated) to reduce electrocution risk
- The BESS must be enclosed in a structure with a non-reflective surface

- Post-construction monitoring should follow the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017). If monitoring results indicate excessive bird fatalities, then adaptive mitigations should be implemented. Before implementation, these should be discussed with the avifaunal specialist and ECO and could include the retrofitting/incorporation of additional visual cues/diverters to existing PV panels/infrastructure.
- Overhead cables/lines must be fitted with bird diverters or flappers.
- All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution
- Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes the wetting of exposed soft soil surfaces.
- No non-environmentally friendly suppressants may be used as this could result in the pollution of water sources.
- Speed limits must be put in place to reduce erosion. Soil surfaces must be wetted as necessary to reduce the dust generated by the project activities. Speed bumps and signs must be erected to enforce slow speeds.
- A stormwater management plan must be compiled and implemented.

Residual impact	*Yes, but acceptable negative impact*

Impact Phase: Construction							
Potential impact description: Dust generation from construction activities Vegetation clearing and construction of PV Facility							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	L	M	M	Negative	L	L	M
With Mitigation	L	L	L	Negative	L	L	L
Can the impact be reversed?			Yes, dust can be reduced				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed or mitigated?			Yes, with appropriate mitigations, dust can be reduced				
Mitigation measures to reduce residual risk or enhance opportunities: • Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events etc. • Speed limits must be put in place to reduce erosion. Soil surfaces must be wetted as necessary to reduce the dust generated by the project activities. Speed bumps and signs must be erected to enforce slow speeds. • Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes the wetting of exposed soft soil surfaces. • No non-environmentally friendly suppressants may be used as this could result in the pollution of water sources.							
Residual impact	*Yes, but acceptable negative impact*						

6.5.3 Operational Phase

Table 6-3 Assessment of significance of impacts on the avifauna associated with the proposed activity.

Impact Phase: Operational							
Potential impact description: Continued fragmentation and degradation of habitats and ecosystems							
Operation of PV Facility							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	H	M
With Mitigation	M	M	M	Negative	M	M	M
Can the impact be reversed?			Yes, but only partially as vegetation will still be lost				
Will impact cause irreplaceable loss or resources?			Yes, but habitat will still be lost				
Can impact be avoided, managed or mitigated?			Yes, but only partially. Vegetation will still be lost				

Mitigation measures to reduce residual risk or enhance opportunities:

- Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion. This will also reduce the likelihood of encroachment by alien invasive plant species. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are indigenous to this vegetation type.
- A hydrocarbon spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use. No servicing of equipment on site unless necessary. All contaminated soil / yard stone shall be treated in situ or removed and be placed in containers. Appropriately contain any generator diesel storage tanks, machinery spills (e.g., accidental spills of hydrocarbons oils, diesel etc.) in such a way as to prevent them leaking and entering the environment.
- Cement must be mixed in a designated area on a liner away from water sources and buffers and that successful rehabilitation of the construction areas can take place
- Leaking equipment and vehicles must be repaired immediately or be removed from PAOI to facilitate repair.
- A fire management plan needs to be complied to restrict the impact of fire.
- Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site. A location specific waste management plan must be put in place to limit the presence of rodents and pests and waste must not be allowed to enter surrounding areas.
- A pest control plan must be put in place and implemented; it is imperative that poisons not be used to control pests due to the likely occasional presence of SCC.
- Litter, spills, fuels, chemical and human waste in and around the project area must be minimised and controlled according to the waste management plan.
- A minimum of one toilet must be provided per 10 persons. Portable toilets must be pumped dry to ensure the system does not degrade over time and spill into the surrounding area.
- The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility within every 10 days at least.
- Where a registered disposal facility is not available close to the project area, the Contractor shall provide a method statement with regards to waste management. Under no circumstances may domestic waste be burned on site or buried on open pits.
- Discussions are required on sensitive environmental receptors within the PAOI to inform contractors and site staff of the presence of protected species and sensitive habitat, their identification, conservation status and importance, biology, habitat requirements and management requirements in line with the Environmental Authorisation and within the EMPr.

- Refuse bins will be responsibly emptied and secured. Temporary storage of domestic waste shall be in covered and secured waste skips. Maximum domestic waste storage period will be 10 days.

Residual impact	*Yes, but acceptable negative impact*

Impact Phase: Operational							
Potential impact description: Spread of alien and/or invasive species **Operation of PV Facility**							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	L	L	L	Negative	L	L	L
Can the impact be reversed?			Yes, alien invasive management plan can control it				
Will impact cause irreplaceable loss or resources?			No, should the alien management plan be implemented				
Can impact be avoided, managed or mitigated?			Yes, should the alien management plan be implemented				

Mitigation measures to reduce residual risk or enhance opportunities:

- An Invasive Alien Plant Management Plan must be compiled and implemented. This should regularly be updated to reflect the annual changes in IAP composition.
- The footprint area of the construction should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas. Footprints of the roads must be kept to prescribed widths.

Residual impact	*Yes, but acceptable negative impact*

Impact Phase: Operational							
Potential impact description: Ongoing displacement and direct mortalities of faunal community (including SCC) due to disturbance (road and powerline collisions, noise, light, dust, vibration)							
Operation of PV Facility							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	H	M	M	Negative	M	H	M
With Mitigation	M	M	M	Negative	M	M	M
Can the impact be reversed?			Yes, but only partially as avifauna will still be disturbed and displaced. Territories will also be disrupted				
Will impact cause irreplaceable loss or resources?			Yes, but avifauna will still be disturbed and displaced.				
Can impact be avoided, managed or mitigated?			Yes, but avifauna will still be disturbed and displaced.				

Mitigation measures to reduce residual risk or enhance opportunities:

- All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting terrestrial species, and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.
- Outside lighting must be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (red/green) lights should be used wherever possible.
- All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (40 km/h), to respect all forms of wildlife. Speed limits must be enforced to ensure that road killings and erosion is limited.
- Fencing mitigations:
  - Top 2 strands must be smooth wire;
  - Routinely retention loose wires;
  - Minimum 300 mm between wires; and
  - Place markers on fences.
- Any exposed parts must be covered (insulated) to reduce electrocution risk
- Post-construction monitoring should follow the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017). If monitoring results indicate excessive bird fatalities, then adaptive mitigations should be implemented. Before implementation, these should be discussed with the avifaunal specialist and ECO and could include the retrofitting/incorporation of additional visual cues/diverters to existing PV panels/infrastructure.
- Overhead cables/lines must be fitted with bird diverters or flappers, this must be maintained for the extent of the project.
- All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution
- No non-environmentally friendly suppressants may be used as this could result in the pollution of water sources.
- Speed limits must be put in place to reduce erosion. Soil surfaces must be wetted as necessary to reduce the dust generated by the project activities. Speed bumps and signs must be erected to enforce slow speeds.
- A stormwater management plan must be compiled and implemented.

Residual impact	*Yes, but acceptable negative impact*

6.6 Unplanned Events

The planned activities will have anticipated impacts as discussed above; however, unplanned events may occur on any project, leading to potential impacts that will require appropriate management.

Table 6-4 is a summary of the findings of an unplanned event assessment conducted from an avifauna perspective. Note that not all potential unplanned events may be captured herein, and this process must therefore be managed throughout all phases and according to events that take place or have a high likelihood of taking place.

Table 6-4 Summary of unplanned events, potential impacts and mitigations

Unplanned Event	Potential Impact	Mitigation
Spills into the surrounding environment	Contamination of habitat as well as water resources associated with a spillage.	A spill response kit must be available at all times. The incident must be reported on, and if necessary, a biodiversity specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Fire	Uncontrolled/unmanaged fire that spreads to the surrounding natural savannah.	An appropriate fire management plan needs to be compiled and implemented.
Erosion caused by water runoff from the surface	Erosion on the side of the roads and cleared areas.	A storm water management plan must be compiled and implemented.

6.7 Cumulative Impacts

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts pre-existing in an area or region, it is appropriate to consider the cumulative effects of development or disturbance activities. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a specific point in time may actually represent a significant change from the original state of the system. This section describes the potential cumulative impacts of the project on local fauna and flora specifically.

Cumulative impacts are assessed within the context of the extent of the proposed PAOI, other similar developments and activities in the area (existing and in-process), and general habitat loss and transformation resulting from any other activities in the area. Localised cumulative impacts include those from operations that are close enough (within 30 km) to potentially cause additive effects on the local environment or any sensitive receptors (relevant operations include nearby large road networks, other solar PV facilities, agricultural activities, dense urban development, and power infrastructure). Relevant impacts include the overall reduction of foraging and nesting habitat, dust deposition, noise and vibration, disruption of functional corridors of habitat important for movement and migration, disruption of waterways, groundwater drawdown, and groundwater and surface water quality depletion.

Long-term cumulative impacts associated with the site development activities can lead to the loss of endemic and threatened species, including natural habitat and vegetation types, and these impacts can even lead to the degradation of conserved areas such as regional game parks and reserves.

In order to spatially quantify the cumulative effects of the proposed development, the PAOI is compared with the overall effects of surrounding development (including total transformation, and transformation as a result of new and proposed developments of a similar type, i.e., solar). Note that this spatial assessment is only conducted for the proposed solar development footprint area, the powerline area is omitted.

The total area within the 30 km buffer around the PV development area amounts to 344742 ha, but when considering the transformation (84838 ha) that has taken place within this radius, 259904 ha of intact habitat remains according to the 2021 National Biodiversity Assessment. Therefore, the area within 30 km of the project has experienced approximately 24.61% loss in natural habitat. No similar projects exist within the 30 km region (as per the latest South African Renewable Energy EIA Application Database). The total amount of remaining habitat lost as a result of the solar project amounts to 0.352% (PV developments as a percentage of the total remaining habitat).

Table 6-5 Loss of natural habitat within a 30 km radius

	Total Habitat (ha)	Tot. Remaining Habitat (ha)	Total Historical Loss	PV development (ha)	Cumulative Habitat Lost
Project cumulative effects (Spatial)	344742	259904	**24.61%**	299 (Boshoek 1), 310 (Boshoek 2) and 307 (Boshoek 3) = **916 ha**	**0.352%**

Refer to Figure 6-2 for a map illustrating the amount of remaining natural habitat within a 30 km radius of the proposed project.

The expected cumulative impact of PV development as a whole is expected to be of a 'Low' significance, since the proposed development will result in a further 0.352% loss of the current remnant habitat.

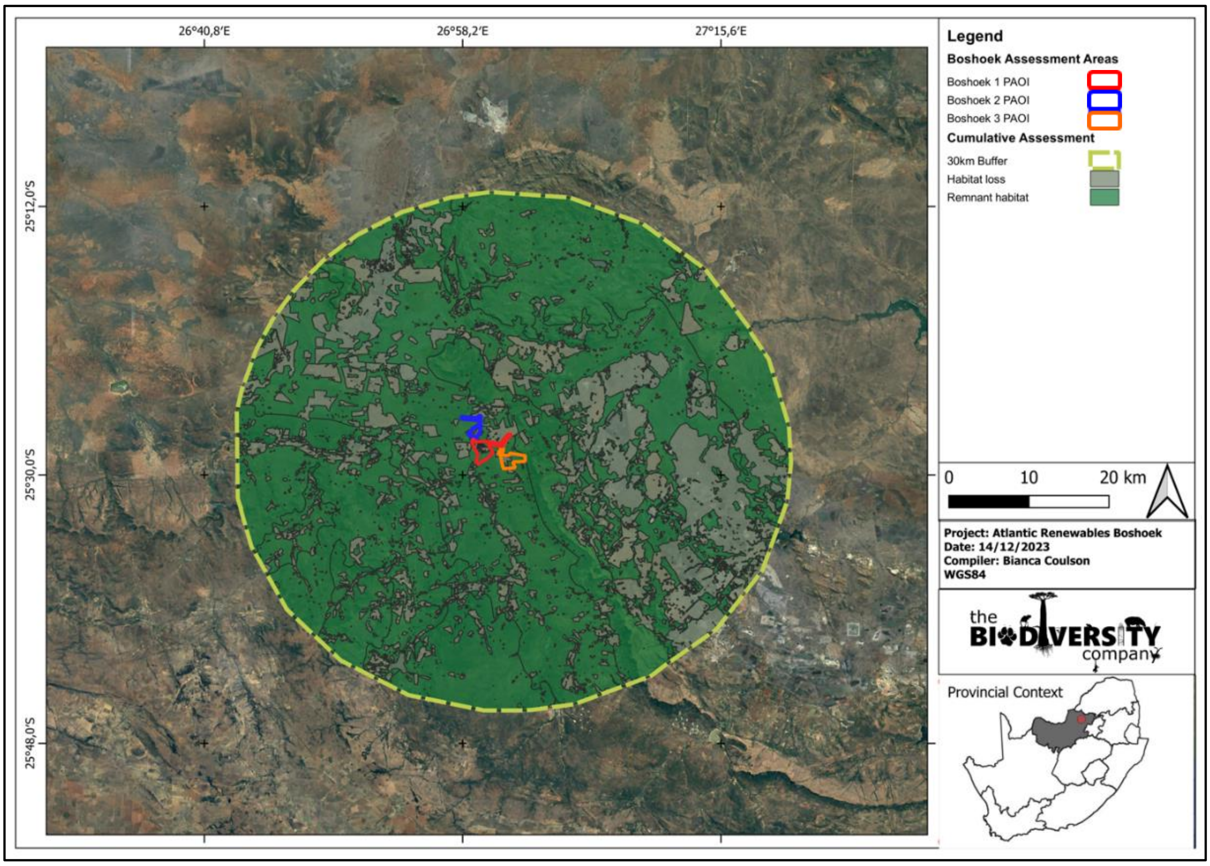


Figure 6-2 Map of the remaining natural vegetation and approved PV projects within the PAOI region.

Table 6-6 Cumulative impact rating

Impact Phase: Cumulative							
Potential impact description: PV cluster development, leading to habitat loss, collisions and electrocutions							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	M	Negative	M	M	M
With Mitigation	M	M	M	Negative	M	M	M
Can the impact be reversed?			Yes, but only partially as habitat will be lost and likely collisions and electrocutions would still persist.				
Will impact cause irreplaceable loss or resources?			Yes, but only partially as habitat will be lost and likely collisions and electrocutions would still persist.				
Can impact be avoided, managed or mitigated?			Yes, with appropriate mitigations, dust can be reduced				
Mitigation measures to reduce residual risk or enhance opportunities: • Diverters must be placed along the whole route; • All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution • The areas to be developed must be specifically demarcated to prevent movement into surrounding environments. • Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, must under no circumstances be fragmented or disturbed further.							
Residual impact	*Yes, but acceptable negative impact*						

6.8 No-Go Scenario

The current land use is predominantly agriculture and livestock grazing and the associated impacts caused by this, to the AVIFAUNA ecology is considered to be medium. If the land use is well managed, then the long-term impacts to the local ecology will continue to be low - this will require that grazing areas are rotated, grazing capacities are sustained, and stocking densities are controlled. Under the current circumstances, the 'no-go' alternative is considered to represent a low-medium long-term negative impact on the environment. However, it is noted that if the current land uses are left unmanaged for the foreseeable future, it is probable that the ecological integrity and functioning of the area will deteriorate.

7 Environmental Management Programme (EMPr)

The aim of the management outcomes is to present the mitigations in such a way that the can be incorporated into the Environmental Management Programme (EMPr), allowing for more successful implementation and auditing of the mitigations and monitoring guidelines. Table 7-1 presents the recommended mitigation measures and the respective timeframes, targets and performance indicators for the avifauna study.

The focus of mitigation measures is to reduce the significance of potential impacts associated with the development and thereby to:

- Prevent the further loss and fragmentation of vegetation communities and the CBA areas in the vicinity of the project area;
- As far as possible, reduce the negative fragmentation effects of the development and enable safe movement of avifaunal species;
- Prevent the direct and indirect loss and disturbance of avifaunal species and community (including potentially occurring species of conservation concern); and
- Follow the guidelines for interpreting Site Ecological Importance (SEI).

Table 7-1 presents the recommended mitigation measures and the respective timeframes, targets, and performance indicators pertaining to the avifaunal component.

Table 7-1 Summary of management outcomes pertaining to impacts to avifauna and their habitats

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Management outcome: Habitats				
The areas to be developed must be specifically demarcated to prevent movement into surrounding environments.	Life of operation	Project Manager Environmental Officer	Development footprint	Ongoing
Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, must under no circumstances be fragmented or disturbed further.	Life of operation	Project Manager Environmental Officer	Areas of indigenous vegetation	Ongoing
If possible solar panels must be mounted on pile driven or screw foundations, such as post support spikes, rather than heavy foundations, such as trench-fill or mass concrete foundations, to reduce the negative effects on natural soil functioning, such as its filtering and buffering characteristics, while maintaining habitats for both below and above-ground biodiversity.	Life of operation	Project Manager	Solar panels must be mounted on pile driven or screw foundations, such as post support spikes, rather than heavy foundations, such as trench-fill or mass concrete foundations, to reduce the negative effects on natural soil functioning, such as its filtering and buffering characteristics, while maintaining habitats for both below and above-ground biodiversity	Life of operation

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion. This will also reduce the likelihood of encroachment by alien invasive plant species. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are indigenous to this vegetation type.	Decommissioning /Rehabilitation	Project Manager	Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion. This will also reduce the likelihood of encroachment by alien invasive plant species. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are indigenous to this vegetation type.	Decommissioning /Rehabilitation
A hydrocarbon spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use. No servicing of equipment on site unless necessary. All contaminated soil / yard stone shall be treated in situ or removed and be placed in containers. Appropriately contain any generator diesel storage tanks, machinery spills (e.g., accidental spills of hydrocarbons oils, diesel etc.) in such a way as to prevent them leaking and entering the environment.	Life of operation	Environmental Officer Contractor	Spill events, Vehicles dripping.	Ongoing
Cement must be mixed in a designated area on a liner away from water sources and buffers and that successful rehabilitation of the construction areas can take place	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Water pollution and restricted rehabilitation	During phase
Leaking equipment and vehicles must be repaired immediately or be removed from PAOI to facilitate repair.	Life of operation	Environmental Officer Contractor	Leaks and spills	Ongoing
A fire management plan needs to be complied to restrict the impact of fire.	Life of operation	Environmental Officer Contractor	Fire Management	During Phase

Management outcome: Avifauna

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting avifauna species, and owls,	Life of operation	Environmental Officer	Evidence of trapping etc	Ongoing

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
which are often persecuted out of superstition. Signs must be put up to enforce this.				
The duration of the construction must be kept to a minimum to avoid disturbing avifauna.	Construction/Operational Phase	Project Manager Environmental Officer	Construction/Closure Phase	Ongoing
Outside lighting must be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (red/green) lights should be used wherever possible.	Construction/Operational Phase	Project Manager Environmental Officer Design Engineer	Light pollution and period of light.	Ongoing
All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (40 km/h), to respect all forms of wildlife. Speed limits must be enforced to ensure that road killings and erosion is limited.	Life of Operation	Health and Safety Officer	Compliance to the training.	Ongoing
All project activities must be undertaken with appropriate noise mitigation measures to avoid disturbance to avifauna population in the region	Construction/Operational Phase	Project Manager Environmental Officer	Noise	Ongoing
All areas to be developed must be walked through prior to any activity to ensure no SCC nests or avifauna species are found in the area. Should any Species of Conservation Concern be found and not move out of the area, or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.	Construction	Environmental Officer	Presence of avifauna species and nests	During Phase
Infrastructure must be consolidated where possible in order to minimise the amount of ground and air space used.	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Presence of bird collisions	During phase
All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution	Planning and Construction	Environmental Officer Contractor Engineer	Presence of electrocuted birds	During phase
Use environmentally friendly cleaning and dust suppressant products	Construction and Operation	Environmental Officer Contractor Engineer	Chemicals used	During phase
Fencing mitigations: • Top 2 strands must be smooth wire; • Routinely retention loose wires; • Minimum 300 mm between wires; and • Place markers on fences.	Life of Operation	Project Manager Environmental Officer Contractor Design Engineer	Presence of birds stuck /dead in fences Monitor fences for slack wires	During phase

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
•If feasible the internal medium voltage powerlines should be thoroughly insulated and preferably buried.	Construction and Operation	Project Manager Environmental Officer Design Engineer	Exposed cables	During phase
Any exposed parts must be covered (insulated) to reduce electrocution risk	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase
The BESS must be enclosed in a structure with a non-reflective surface	Construction and Operation	Project Manager Environmental Officer Design Engineer	Reflective surfaces on BESS	During phase
Post-construction monitoring should follow the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017). If monitoring results indicate excessive bird fatalities, then adaptive mitigations should be implemented. Before implementation, these should be discussed with the avifaunal specialist and ECO and could include the retrofitting/incorporation of additional visual cues/diverters to existing PV panels/infrastructure.	Operational	Project Manager Environmental Officer Design Engineer	Presence of dead birds in the project site. Monitoring must be undertaken in accordance with the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017). The precise location of any dead birds found should be recorded and mapped (using GPS). All carcasses should be photographed as found then placed in a plastic bag, labelled as to the location and date, and preserved (refrigerated or frozen) until identified. Feather spots (e.g., a group of feathers attached to skin) and body parts should also be collected.	During phase. The monitoring frequency is based on the collision rate.
Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Presence of bird collisions	During phase
All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution	Planning and Construction	Environmental Officer Contractor Engineer	Presence of electrocuted birds	During phase

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Any exposed parts must be covered (insulated) to reduce electrocution risk	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase
Overhead cables/lines must be fitted with bird diverters or flappers.	Operational	Project Manager Environmental Officer Design Engineer	Collisions. Monitoring must be undertaken in accordance with the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017).	During phase. The monitoring frequency is based on the collision rate.
All infrastructure including powerlines must be removed if the facility is decommissioned	Closure/Rehabilitation	Project Manager Environmental Officer	Infrastructure removal	During Process

Management outcome: Alien species

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
An Invasive Alien Plant Management Plan must be compiled and implemented. This should regularly be updated to reflect the annual changes in IAP composition.	Life of operation	Project manager, Environmental Officer & Contractor	Manage and assess presence and encroachment of alien vegetation	Twice a year
The footprint area of the construction should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas. Footprints of the roads must be kept to prescribed widths.	Construction/Operational Phase	Project manager, Environmental Officer & Contractor	Footprint Area	Life of operation
Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site. A location specific waste management plan must be put in place to limit the presence of rodents and pests and waste must not be allowed to enter surrounding areas.	Life of operation	Environmental Officer & Health and Safety Officer	Presence of waste	Life of operation
A pest control plan must be put in place and implemented; it is imperative that poisons not be used to control pests due to the likely occasional presence of SCC.	Life of operation	Environmental Officer & Health and Safety Officer	Evidence or presence of pests	Life of operation

Management outcome: Dust

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Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes the wetting of exposed soft soil surfaces. No non-environmentally friendly suppressants may be used as this could result in the pollution of water sources.	Construction phase	Contractor	Dustfall	Dust monitoring program.

Management outcome: Waste management

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Waste management must be a priority and all waste must be collected and stored effectively and responsibly according to a site-specific waste management plan. Dangerous waste such as metal wires and glass must only be stored in fully sealed and secure containers, before being moved off site as soon as possible.	Life of operation	Environmental Officer & Contractor	Waste Removal	Weekly
Litter, spills, fuels, chemical and human waste in and around the project area must be minimised and controlled according to the waste management plan.	Construction/Closure Phase	Environmental Officer & Health and Safety Officer	Presence of Waste	Daily
Cement mixing may not be performed on the ground. It is recommended that only closed side drum or pan type concrete mixers be utilised. Any spills must be immediately contained and isolated from the natural environment, before being removed from site.	Construction Phase	Environmental Officer & Contractor	Cement mixing and spills	Every occurrence
A minimum of one toilet must be provided per 10 persons. Portable toilets must be pumped dry to ensure the system does not degrade over time and spill into the surrounding area.	Life of operation	Environmental Officer & Health and Safety Officer	Number of toilets per staff member. Waste levels	Daily
The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility within every 10 days at least.	Life of operation	Environmental Officer & Health and Safety Officer	Availability of bins and the collection of the waste	Ongoing
Where a registered disposal facility is not available close to the project area, the Contractor shall provide a method statement with regards to waste management. Under no circumstances may domestic waste be burned on site or buried on open pits.	Life of operation	Environmental Officer, Contractor & Health and Safety Officer	Collection/handling of the waste	Ongoing

Refuse bins will be responsibly emptied and secured. Temporary storage of domestic waste shall be in covered and secured waste skips. Maximum domestic waste storage period will be 10 days.	Life of operation	Environmental Officer, Contractor & Health and Safety Officer	Management of bins and collection of waste	Ongoing, every 10 days

Management outcome: Environmental awareness training				
Impact Management Actions	**Implementation**		**Monitoring**	
	Phase	Responsible Party	Aspect	Frequency
All personnel and contractors are to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof. Discussions are required on sensitive environmental receptors within the PAOI to inform contractors and site staff of the presence of protected species and sensitive habitat, their identification, conservation status and importance, biology, habitat requirements and management requirements in line with the Environmental Authorisation and within the EMPr. Contractors and employees must all undergo the induction and must be made aware of any sensitive areas to be avoided.	Pre-construction phase	Health and Safety Officer, Environmental Officer	Compliance to the training	Ongoing

Management outcome: Erosion				
Impact Management Actions	**Implementation**		**Monitoring**	
	Phase	Responsible Party	Aspect	Frequency
Speed limits must be put in place to reduce erosion. Soil surfaces must be wetted as necessary to reduce the dust generated by the project activities. Speed bumps and signs must be erected to enforce slow speeds.	Life of operation	Project manager, Environmental Officer	Water Runoff from road surfaces	Ongoing
Only existing access routes and walking paths may be made use of.	Life of operation	Project manager, Environmental Officer	Routes used within the area	Ongoing
Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events etc.	Life of operation	Project manager, Environmental Officer	Re-establishment of indigenous vegetation	Progressively
A stormwater management plan must be compiled and implemented.	Life of operation	Project manager, Environmental Officer	Management plan	Before construction phase: Ongoing

8 Conclusion and Impact Statement

8.1 Conclusion

This Avifauna Impact Assessment aimed to provide information to guide the risk of the proposed Solar PV project and the associated infrastructure to the Avifauna community likely affected by its development. Two site visits were conducted for this regime 2 assessment in winter over the 9-11th of June 2023 and in spring over the 16-17th of September. These site visits are considered sufficient from a seasonal perspective and require no additional season assessment. However, the data was compared to the SABAP dataset (listed in section 4.3) and no differences were observed, further suggesting that sufficient data sampling was conducted to better our understanding of the bird community in the area.

Sampling consisted of Standardised Point Counts as well as random diurnal incidental surveys. The total number of individual species accounts for approximately 35% of the total number of expected species. Only one SCC was recorded in the field investigation (Secretarybird) and eleven priority species.

The SEI of the proposed PAOI was found to be low to medium but predominantly medium. However, the sensitivity can be assumed to be low. Impacts were identified as being High to Medium in the Construction Phase, most of which could be reduced to Medium or Low with mitigation measures described in the report. Impacts in the operational phase are expected to be Medium and can be reduced to Medium or Low with mitigation measures described in the report. Decommissioning phase impacts are expected to be Medium and can be reduced to Low with mitigation measures. Cumulative impacts are Low for the project in isolation and Medium in consideration with other similar projects.

Management measures include ensuring the construction footprint is kept small and industry-standard mitigations are put into place for solar panels, fencing and electrical infrastructure, among other measures. All project aspects can be effectively mitigated to an acceptable residual impact in support of the renewable development project.

8.2 Impact Statement

The main expected impacts of the proposed infrastructure will include the following:

- Habitat loss and fragmentation;
- Degradation of surrounding habitat;
- Disturbance and displacement caused during the construction and maintenance phases; and
- Direct mortality during the construction phase.

Mitigation measures, as described in this report, can be implemented to reduce the significance of the risk to an acceptable residual risk level. The cumulative impact of the project, taking into account the transformation of surrounding land, is rated as 'Low'. However, the cumulative impact of the total cluster project, also considering the transformation of surrounding land, is rated as 'Medium' – largely due to the more significant loss of important corridors of remaining habitat. Considering the above-mentioned information, it is the opinion of the specialist that the project may be favourably considered, on condition that all the mitigation measures and recommendations provided in this report and other specialist reports are implemented. The proposed PV development already avoids sensitive areas. However, it is recommended that a final walkthrough be done, and the purpose of the walkthrough would be for any additional mitigation measures, which does not constitute post-environmental authorisation studies.

8.3 Final Layout

The layout was adjusted based on the provided sensitivities (Figure 8-1). As can be seen in Figure 8-2, the new layout avoids sensitive areas. From an avifauna perspective this layout is acceptable.

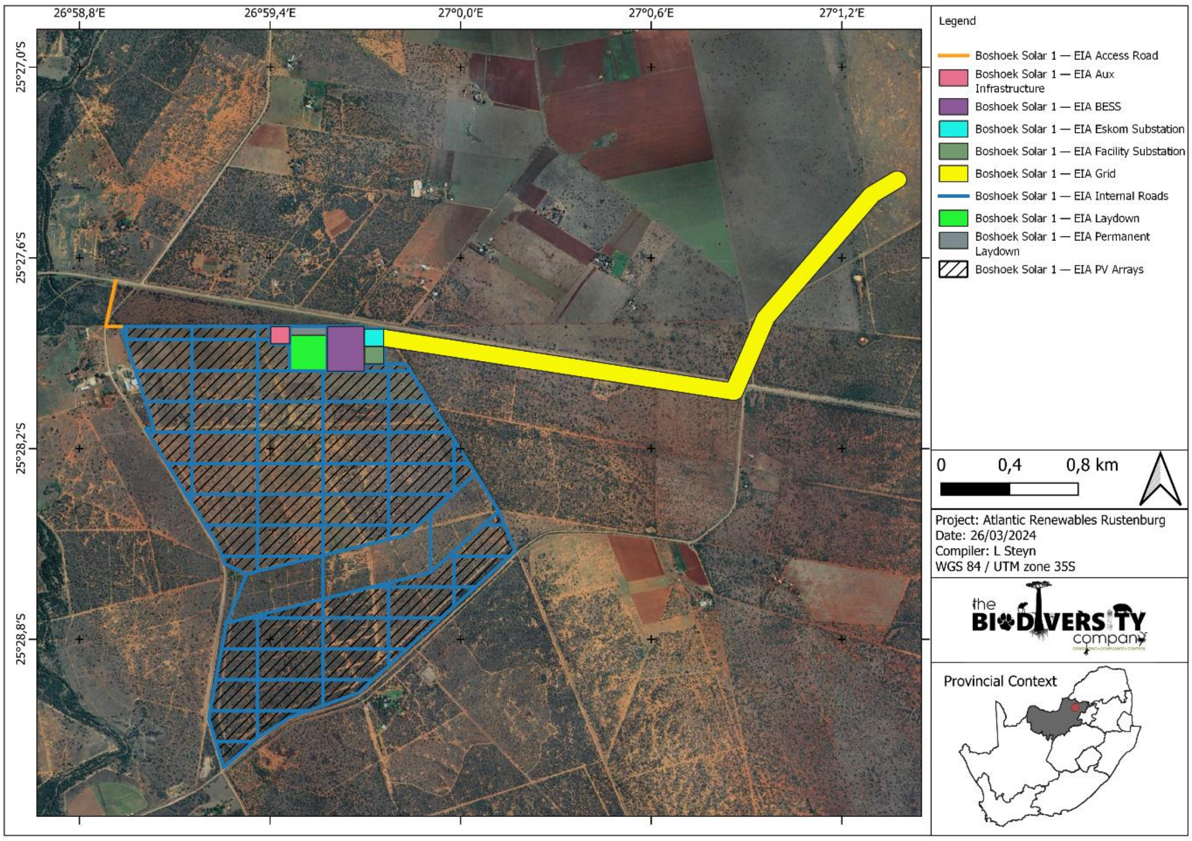

Figure 8-1 Final Layout of Boshoek 1

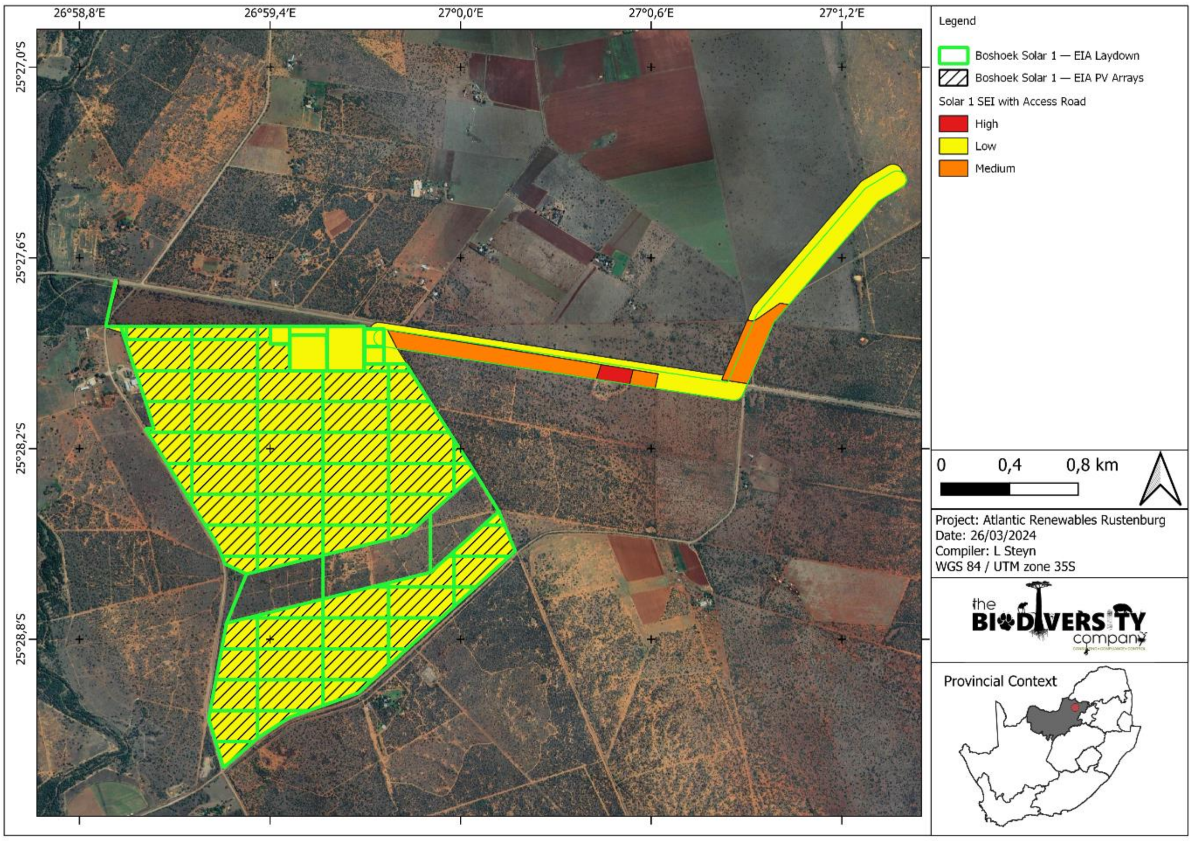

Figure 8-2 Final Layout superimposed on the SEI of the PAOI

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10 Appendix Items

10.1 Appendix A: Expected species

Scientific Name	Common Name	Family Name	Regional	Global (IUCN)
Ciconia abdimii	*Abdim's Stork*	*Ciconiidae*	NT	LC
Tricholaema leucomelas	*Acacia Pied Barbet*	*Lybiidae*	Unlisted	Unlisted
Crecopsis egregia	*African Crake*	*Rallidae*	Unlisted	Unlisted
Cuculus gularis	*African Cuckoo*	*Cuculidae*	Unlisted	Unlisted
Aviceda cuculoides	*African Cuckoo Hawk*	*Accipitridae*	Unlisted	Unlisted
Anhinga rufa	*African Darter*	*Anhingidae*	Unlisted	Unlisted
Podica senegalensis	*African Finfoot*	*Heliornithidae*	VU	LC
Lagonosticta rubricata	*African Firefinch*	*Estrididae*	Unlisted	Unlisted
Polyboroides typus	*African Harrier-Hawk*	*Accipitridae*	Unlisted	Unlisted
Aquila spilogaster	*African Hawk Eagle*	*Accipitridae*	Unlisted	Unlisted
Upupa africana	*African Hoopoe*	*Upupidae*	Unlisted	Unlisted
Actophilornis africanus	*African Jacana*	*Jacanidae*	Unlisted	Unlisted
Anastomus lamelligerus	*African Openbill*	*Ciconiidae*	Unlisted	Unlisted
Anthus cinnamomeus	*African Pipit*	*Motacillidae*	Unlisted	Unlisted
Gallinago nigripennis	*African Snipe*	*Scolopacidae*	Unlisted	Unlisted
Platalea alba	*African Spoonbill*	*Threskiornithidae*	Unlisted	Unlisted
Saxicola torquatus	*African Stonechat*	*Muscicapidae*	Unlisted	Unlisted
Porphyrio madagascariensis	*African Swamphen*	*Rallidae*	Unlisted	Unlisted
Anas sparsa	*African Black Duck*	*Anatidae*	Unlisted	Unlisted
Apus barbatus	*African Black Swift*	*Apodidae*	Unlisted	Unlisted
Haliaeetus vocifer	*African Fish Eagle*	*Accipitridae*	Unlisted	Unlisted
Tyto capensis	*African Grass Owl*	*Strigidae*	VU	LC
Treron calvus	*African Green Pigeon*	*Columbidae*	Unlisted	Unlisted
Lophoceros nasutus	*African Grey Hornbill*	*Bucerotidae*	Unlisted	Unlisted
Circus ranivorus	*African Marsh Harrier*	*Accipitridae*	EN	LC
Columba arquatrix	*African Olive Pigeon*	*Columbidae*	Unlisted	Unlisted
Cypsiurus parvus	*African Palm Swift*	*Apodidae*	Unlisted	Unlisted
Terpsiphone viridis	*African Paradise Flycatcher*	*Monarchidae*	Unlisted	Unlisted
Motacilla aguimp	*African Pied Wagtail*	*Motacillidae*	Unlisted	Unlisted

Ispidina picta	*African Pygmy Kingfisher*	*Alcedinidae*	Unlisted	Unlisted
Pycnonotus nigricans	*African Red-eyed Bulbul*	*Pycnonotidae*	Unlisted	Unlisted
Threskiornis aethiopicus	*African Sacred Ibis*	*Threskiornithidae*	Unlisted	Unlisted
Otus senegalensis	*African Scops Owl*	*Strigidae*	Unlisted	Unlisted
Vanellus senegallus	*African Wattled Lapwing*	*Charadriidae*	Unlisted	Unlisted
Tachymarptis melba	*Alpine Swift*	*Apodidae*	Unlisted	Unlisted
Chalcomitra amethystina	*Amethyst Sunbird*	*Nectariniidae*	Unlisted	Unlisted
Falco amurensis	*Amur Falcon*	*Falconidae*	Unlisted	Unlisted
Myrmecocichla formicivora	*Ant-eating Chat*	*Muscicapidae*	Unlisted	Unlisted
Turdoides jardineii	*Arrow-marked Babbler*	*Leiothrichidae*	Unlisted	Unlisted
Melaniparus cinerascens	*Ashy Tit*	*Paridae*	Unlisted	Unlisted
Riparia cincta	*Banded Martin*	*Hirundinidae*	Unlisted	Unlisted
Hirundo rustica	*Barn Swallow*	*Hirundinidae*	Unlisted	Unlisted
Calamonastes fasciolatus	*Barred Wren-Warbler*	*Cisticolidae*	Unlisted	Unlisted
Apalis thoracica	*Bar-throated Apalis*	*Cisticolidae*	Unlisted	Unlisted
Terathopius ecaudatus	*Bateleur*	*Accipitridae*	EN	EN
Chloropicus namaquus	*Bearded Woodpecker*	*Picidae*	Unlisted	Unlisted
Campethera bennettii	*Bennett's Woodpecker*	*Picidae*	Unlisted	Unlisted
Zapornia flavirostra	*Black Crake*	*Rallidae*	Unlisted	Unlisted
Cuculus clamosus	*Black Cuckoo*	*Cuculidae*	Unlisted	Unlisted
Campephaga flava	*Black Cuckooshrike*	*Campephagidae*	Unlisted	Unlisted
Egretta ardesiaca	*Black Heron*	*Ardeidae*	Unlisted	Unlisted
Milvus migrans	*Black Kite*	*Accipitridae*	Unlisted	Unlisted
Accipiter melanoleucus	*Black Sparrowhawk*	*Accipitridae*	Unlisted	Unlisted
Ciconia nigra	*Black Stork*	*Ciconiidae*	VU	LC
Dryoscopus cubla	*Black-backed Puffback*	*Malaconotidae*	Unlisted	Unlisted
Prinia flavicans	*Black-chested Prinia*	*Cisticolidae*	Unlisted	Unlisted
Circaetus pectoralis	*Black-chested Snake Eagle*	*Accipitridae*	Unlisted	Unlisted
Lybius torquatus	*Black-collared Barbet*	*Lybiidae*	Unlisted	Unlisted
Tchagra senegalus	*Black-crowned Tchagra*	*Malaconotidae*	Unlisted	Unlisted
Nycticorax nycticorax	*Black-crowned Night Heron*	*Ardeidae*	Unlisted	Unlisted
Brunhilda erythronotos	*Black-faced Waxbill*	*Estrildidae*	Unlisted	Unlisted

Ardea melanocephala	*Black-headed Heron*	*Ardeidae*	Unlisted	Unlisted
Oriolus larvatus	*Black-headed Oriole*	*Oriolidae*	Unlisted	Unlisted
Podiceps nigricollis	*Black-necked Grebe*	*Podicipedidae*	Unlisted	Unlisted
Vanellus armatus	*Blacksmith Lapwing*	*Charadriidae*	Unlisted	Unlisted
Crithagra atrogularis	*Black-throated Canary*	*Fringillidae*	Unlisted	Unlisted
Elanus caeruleus	*Black-winged Kite*	*Accipitridae*	Unlisted	Unlisted
Himantopus himantopus	*Black-winged Stilt*	*Recurvirostridae*	Unlisted	Unlisted
Anthropoides paradiseus	*Blue Crane*	*Gruidae*	NT	VU
Uraeginthus angolensis	*Blue Waxbill*	*Estrildidae*	Unlisted	Unlisted
Spatula hottentota	*Blue-billed Teal*	*Anatidae*	Unlisted	Unlisted
Merops persicus	*Blue-cheeked Bee-eater*	*Meropidae*	Unlisted	Unlisted
Telophorus zeylonus	*Bokmakierie*	*Malaconotidae*	Unlisted	Unlisted
Hieraaetus pennatus	*Booted Eagle*	*Accipitridae*	Unlisted	Unlisted
Spermestes cucullata	*Bronze Mannikin*	*Estrildidae*	Unlisted	Unlisted
Circaetus cinereus	*Brown Snake Eagle*	*Accipitridae*	Unlisted	Unlisted
Prodotiscus regulus	*Brown-backed Honeybird*	*Indicatoridae*	Unlisted	Unlisted
Tchagra australis	*Brown-crowned Tchagra*	*Malaconotidae*	Unlisted	Unlisted
Halcyon albiventris	*Brown-hooded Kingfisher*	*Alcedinidae*	Unlisted	Unlisted
Riparia paludicola	*Brown-throated Martin*	*Hirundinidae*	Unlisted	Unlisted
Nilaus afer	*Brubru*	*Malaconotidae*	Unlisted	Unlisted
Sarothrura elegans	*Buff-spotted Flufftail*	*Sarothruridae*	Unlisted	Unlisted
Anthus vaalensis	*Buffy Pipit*	*Motacillidae*	Unlisted	Unlisted
Centropus burchellii	*Burchell's Coucal*	*Cuculidae*	Unlisted	Unlisted
Lamprotornis australis	*Burchell's Starling*	*Sturnidae*	Unlisted	Unlisted
Eremomela usticollis	*Burnt-necked Eremomela*	*Cisticolidae*	Unlisted	Unlisted
Anthus caffer	*Bushveld Pipit*	*Motacillidae*	Unlisted	Unlisted
Emberiza capensis	*Cape Bunting*	*Emberizidae*	Unlisted	Unlisted
Corvus capensis	*Cape Crow*	*Corvidae*	Unlisted	Unlisted
Sphenoeacus afer	*Cape Grassbird*	*Macrosphenidae*	Unlisted	Unlisted
Macronyx capensis	*Cape Longclaw*	*Motacillidae*	Unlisted	Unlisted
Cossypha caffra	*Cape Robin-Chat*	*Muscicapidae*	Unlisted	Unlisted
Spatula smithii	*Cape Shoveler*	*Anatidae*	Unlisted	Unlisted

Passer melanurus	*Cape Sparrow*	*Passeridae*	Unlisted	Unlisted
Lamprotornis nitens	*Cape Starling*	*Sturnidae*	Unlisted	Unlisted
Anas capensis	*Cape Teal*	*Anatidae*	Unlisted	Unlisted
Gyps coprotheres	*Cape Vulture*	*Accipitridae*	EN	VU
Motacilla capensis	*Cape Wagtail*	*Motacillidae*	Unlisted	Unlisted
Ploceus capensis	*Cape Weaver*	*Ploceidae*	Unlisted	Unlisted
Zosterops virens	*Cape White-eye*	*Zosteropidae*	Unlisted	Unlisted
Anthoscopus minutus	*Cape Penduline Tit*	*Remizidae*	Unlisted	Unlisted
Monticola rupestris	*Cape Rock Thrush*	*Muscicapidae*	Unlisted	Unlisted
Oenanthe pileata	*Capped Wheatear*	*Muscicapidae*	Unlisted	Unlisted
Dendropicos fuscescens	*Cardinal Woodpecker*	*Picidae*	Unlisted	Unlisted
Hydropogne caspia	*Caspian Tern*	*Laridae*	VU	LC
Melaenornis infuscatus	*Chat Flycatcher*	*Muscicapidae*	Unlisted	Unlisted
Eremopterix leucotis	*Chestnut-backed Sparrow-Lark*	*Alaudidae*	Unlisted	Unlisted
Curruca subcoerulea	*Chestnut-vented Warbler*	*Sylviidae*	Unlisted	Unlisted
Batis molitor	*Chinspot Batis*	*Platysteiridae*	Unlisted	Unlisted
Emberiza tahapisi	*Cinnamon-breasted Bunting*	*Emberizidae*	Unlisted	Unlisted
Cisticola textrix	*Cloud Cisticola*	*Cisticolidae*	Unlisted	Unlisted
Buteo buteo	*Common Buzzard*	*Accipitridae*	Unlisted	Unlisted
Tringa nebularia	*Common Greenshank*	*Pycnonotidae*	Unlisted	Unlisted
Gallinula chloropus	*Common Moorhen*	*Rallidae*	Unlisted	Unlisted
Acridotheres tristis	*Common Myna*	*Sturnidae*	Unlisted	Unlisted
Struthio camelus	*Common Ostrich*	*Struthionidae*	Unlisted	Unlisted
Coturnix coturnix	*Common Quail*	*Phasianidae*	Unlisted	Unlisted
Actitis hypoleucos	*Common Sandpiper*	*Scolopacidae*	Unlisted	Unlisted
Rhinopomastus cyanomelas	*Common Scimitarbill*	*Phoeniculidae*	Unlisted	Unlisted
Apus apus	*Common Swift*	*Apodidae*	Unlisted	Unlisted
Estrilda astrild	*Common Waxbill*	*Estrildidae*	Unlisted	Unlisted
Curruca communis	*Common Whitethroat*	*Sylviidae*	Unlisted	Unlisted
Delichon urbicum	*Common House Martin*	*Hirundinidae*	Unlisted	Unlisted
Acrocephalus baeticatus	*Common Reed Warbler*	*Acrocephalidae*	Unlisted	Unlisted
Charadrius hiaticula	*Common Ringed Plover*	*Charadriidae*	Unlisted	Unlisted

Peliperdix coqui	*Coqui Francolin*	*Phasianidae*	Unlisted	Unlisted
Trachyphonus vaillantii	*Crested Barbet*	*Lybiidae*	Unlisted	Unlisted
Dendroperdix sephaena	*Crested Francolin*	*Phasianidae*	Unlisted	Unlisted
Laniarius atrococcineus	*Crimson-breasted Shrike*	*Malaconotidae*	Unlisted	Unlisted
Vanellus coronatus	*Crowned Lapwing*	*Charadriidae*	Unlisted	Unlisted
Anomalospiza imberbis	*Cuckoo Finch*	*Viduidae*	Unlisted	Unlisted
Calidris ferruginea	*Curlew Sandpiper*	*Scolopacidae*	LC	NT
Amadina fasciata	*Cut-throat Finch*	*Estrildidae*	Unlisted	Unlisted
Pycnonotus tricolor	*Dark-capped Bulbul*	*Pycnonotidae*	Unlisted	Unlisted
Cisticola aridulus	*Desert Cisticola*	*Cisticolidae*	Unlisted	Unlisted
Chrysococcyx caprius	*Diederik Cuckoo*	*Cuculidae*	Unlisted	Unlisted
Pterocles bicinctus	*Double-banded Sandgrouse*	*Pteroclidae*	Unlisted	Unlisted
Vidua funerea	*Dusky Indigobird*	*Viduidae*	Unlisted	Unlisted
Pinarocorys nigricans	*Dusky Lark*	*Alaudidae*	Unlisted	Unlisted
Mirafra fasciolata	*Eastern Clapper Lark*	*Alaudidae*	Unlisted	Unlisted
Certhilauda semitorquata	*Eastern Long-billed Lark*	*Alaudidae*	Unlisted	Unlisted
Alopochen aegyptiaca	*Egyptian Goose*	*Anatidae*	Unlisted	Unlisted
Turtur chalcospilos	*Emerald-spotted Wood Dove*	*Columbidae*	Unlisted	Unlisted
Falco subbuteo	*Eurasian Hobby*	*Falconidae*	Unlisted	Unlisted
Oriolus oriolus	*Eurasian Golden Oriole*	*Oriolidae*	Unlisted	Unlisted
Merops apiaster	*European Bee-eater*	*Meropidae*	Unlisted	Unlisted
Pernis apivorus	*European Honey Buzzard*	*Accipitridae*	Unlisted	Unlisted
Caprimulgus europaeus	*European Nightjar*	*Caprimulgidae*	Unlisted	Unlisted
Coracias garrulus	*European Roller*	*Coraciidae*	NT	LC
Stenostira scita	*Fairy Flycatcher*	*Muscicapidae*	Unlisted	Unlisted
Oenanthe familiaris	*Familiar Chat*	*Muscicapidae*	Unlisted	Unlisted
Calendulauda africanoides	*Fawn-colored Lark*	*Alaudidae*	Unlisted	Unlisted
Caprimulgus pectoralis	*Fiery-necked Nightjar*	*Caprimulgidae*	Unlisted	Unlisted
Melaenornis silens	*Fiscal Flycatcher*	*Muscicapidae*	Unlisted	Unlisted
Mirafra rufocinnamomea	*Flappet Lark*	*Alaudidae*	Unlisted	Unlisted
Dicrurus adsimilis	*Fork-tailed Drongo*	*Dicruridae*	Unlisted	Unlisted
Caprimulgus tristigma	*Freckled Nightjar*	*Caprimulgidae*	Unlisted	Unlisted

Dendrocygna bicolor	*Fulvous Whistling Duck*	*Anatidae*	Unlisted	Unlisted
Micronisus gabar	*Gabar Goshawk*	*Accipitridae*	Unlisted	Unlisted
Sylvia borin	*Garden Warbler*	*Sylviidae*	Unlisted	Unlisted
Megaceryle maxima	*Giant Kingfisher*	*Alcedinidae*	Unlisted	Unlisted
Plegadis falcinellus	*Glossy Ibis*	*Threskiornithidae*	Unlisted	Unlisted
Emberiza flaviventris	*Golden-breasted Bunting*	*Emberizidae*	Unlisted	Unlisted
Campethera abingoni	*Golden-tailed Woodpecker*	*Picidae*	Unlisted	Unlisted
Ardea goliath	*Goliath Heron*	*Ardeidae*	Unlisted	Unlisted
Ardea alba	*Great Egret*	*Ardeidae*	Unlisted	Unlisted
Passer motitensis	*Great Sparrow*	*Passeridae*	Unlisted	Unlisted
Podiceps cristatus	*Great Crested Grebe*	*Podicipedidae*	Unlisted	Unlisted
Acrocephalus arundinaceus	*Great Reed Warbler*	*Acrocephalidae*	Unlisted	Unlisted
Clamator glandarius	*Great Spotted Cuckoo*	*Cuculidae*	Unlisted	Unlisted
Phoenicopterus roseus	*Greater Flamingo*	*Phoenicopteridae*	NT	LC
Indicator indicator	*Greater Honeyguide*	*Indicatoridae*	Unlisted	Unlisted
Falco rupicoloides	*Greater Kestrel*	*Falconidae*	Unlisted	Unlisted
Rostratula benghalensis	*Greater Painted-snipe*	*Rostratulidae*	NT	LC
Cinnyris afer	*Greater Double-collared Sunbird*	*Nectariniidae*	Unlisted	Unlisted
Cecropis cucullata	*Greater Striped Swallow*	*Hirundinidae*	Unlisted	Unlisted
Tringa ochropus	*Green Sandpiper*	*Scolopacidae*	Unlisted	Unlisted
Phoeniculus purpureus	*Green Wood Hoopoe*	*Phoeniculidae*	Unlisted	Unlisted
Pytilia melba	*Green-winged Pytilia*	*Estrildidae*	Unlisted	Unlisted
Corythaixoides concolor	*Grey Go-away-bird*	*Musophagidae*	Unlisted	Unlisted
Ardea cinerea	*Grey Heron*	*Ardeidae*	Unlisted	Unlisted
Myioparus plumbeus	*Grey Tit-Flycatcher*	*Muscicapidae*	Unlisted	Unlisted
Camaroptera brevicaudata	*Grey-backed Camaroptera*	*Cisticolidae*	Unlisted	Unlisted
Eremopterix verticalis	*Grey-backed Sparrow-Lark*	*Alaudidae*	Unlisted	Unlisted
Malaconotus blanchoti	*Grey-headed Bush-shrike*	*Malaconotidae*	Unlisted	Unlisted
Chroicocephalus cirrocephalus	*Grey-headed Gull*	*Laridae*	Unlisted	Unlisted
Halcyon leucocephala	*Grey-headed Kingfisher*	*Alcedinidae*	Unlisted	Unlisted
Turdus litsitsirupa	*Groundscraper Thrush*	*Turdidae*	Unlisted	Unlisted
Bostrychia hagedash	*Hadada Ibis*	*Threskiornithidae*	Unlisted	Unlisted

Alcedo semitorquata	*Half-collared Kingfisher*	*Alcedinidae*	NT	LC
Scopus umbretta	*Hamerkop*	*Scopidae*	Unlisted	Unlisted
Coturnix delegorguei	*Harlequin Quail*	*Phasianidae*	Unlisted	Unlisted
Numida meleagris	*Helmeted Guineafowl*	*Numididae*	Unlisted	Unlisted
Apus horus	*Horus Swift*	*Apodidae*	Unlisted	Unlisted
Passer domesticus	*House Sparrow*	*Passeridae*	Unlisted	Unlisted
Hippolais icterina	*Icterine Warbler*	*Acrocephalidae*	Unlisted	Unlisted
Buteo rufofuscus	*Jackal Buzzard*	*Accipitridae*	Unlisted	Unlisted
Clamator jacobinus	*Jacobin Cuckoo*	*Cuculidae*	Unlisted	Unlisted
Lagonosticta rhodopareia	*Jameson's Firefinch*	*Estriididae*	Unlisted	Unlisted
Cercotrichas paena	*Kalahari Scrub Robin*	*Muscicapidae*	Unlisted	Unlisted
Turdus smithi	*Karoo Thrush*	*Turdidae*	Unlisted	Unlisted
Charadrius pecuarius	*Kittlitz's Plover*	*Charadriidae*	Unlisted	Unlisted
Chrysococcyx klaas	*Klaas's Cuckoo*	*Cuculidae*	Unlisted	Unlisted
Sarkidiornis melanotos	*Knob-billed Duck*	*Anatidae*	Unlisted	Unlisted
Ardeotis kori	*Kori Bustard*	*Otididae*	NT	NT
Turnix sylvaticus	*Kurrichane Buttonquail*	*Turnicidae*	Unlisted	Unlisted
Turdus libonyana	*Kurrichane Thrush*	*Turdidae*	Unlisted	Unlisted
Falco biarmicus	*Lanner Falcon*	*Falconidae*	VU	LC
Torgos tracheliotos	*Lappet-faced Vulture*	*Accipitridae*	EN	EN
Emberiza impetuani	*Lark-like Bunting*	*Emberizidae*	Unlisted	Unlisted
Spilopelia senegalensis	*Laughing Dove*	*Columbidae*	Unlisted	Unlisted
Cisticola aberrans	*Lazy Cisticola*	*Cisticolidae*	Unlisted	Unlisted
Phoeniconaias minor	*Lesser Flamingo*	*Phoenicopteridae*	NT	NT
Indicator minor	*Lesser Honeyguide*	*Indicatoridae*	Unlisted	Unlisted
Falco naumanni	*Lesser Kestrel*	*Falconidae*	Unlisted	Unlisted
Larus fuscus	*Lesser Black-backed Gull*	*Laridae*	Unlisted	Unlisted
Lanius minor	*Lesser Grey Shrike*	*Laniidae*	Unlisted	Unlisted
Ploceus intermedius	*Lesser Masked Weaver*	*Ploceidae*	Unlisted	Unlisted
Cecropis abyssinica	*Lesser Striped Swallow*	*Hirundinidae*	Unlisted	Unlisted
Acrocephalus gracilirostris	*Lesser Swamp Warbler*	*Acrocephalidae*	Unlisted	Unlisted
Cisticola tinniens	*Levaillant's Cisticola*	*Cisticolidae*	Unlisted	Unlisted

Clamator levaillantii	*Levaillant's Cuckoo*	*Cuculidae*	Unlisted	Unlisted
Coracias caudatus	*Lilac-breasted Roller*	*Coraciidae*	Unlisted	Unlisted
Merops pusillus	*Little Bee-eater*	*Meropidae*	Unlisted	Unlisted
Ixobrychus minutus	*Little Bittern*	*Ardeidae*	Unlisted	Unlisted
Egretta garzetta	*Little Egret*	*Ardeidae*	Unlisted	Unlisted
Tachybaptus ruficollis	*Little Grebe*	*Podicipedidae*	Unlisted	Unlisted
Accipiter minullus	*Little Sparrowhawk*	*Accipitridae*	Unlisted	Unlisted
Calidris minuta	*Little Stint*	*Scolopacidae*	Unlisted	Unlisted
Apus affinis	*Little Swift*	*Apodidae*	Unlisted	Unlisted
Bradypterus baboecala	*Little Rush Warbler*	*Locustellidae*	Unlisted	Unlisted
Kaupifalco monogrammicus	*Lizard Buzzard*	*Accipitridae*	Unlisted	Unlisted
Sylvietta rufescens	*Long-billed Crombec*	*Macrosphenidae*	Unlisted	Unlisted
Euplectes progne	*Long-tailed Widowbird*	*Ploceidae*	Unlisted	Unlisted
Vidua paradisaea	*Long-tailed Paradise Whydah*	*Viduidae*	Unlisted	Unlisted
Urolestes melanoleucus	*Magpie Shrike*	*Laniidae*	Unlisted	Unlisted
Corythornis cristatus	*Malachite Kingfisher*	*Alcedinidae*	Unlisted	Unlisted
Nectarinia famosa	*Malachite Sunbird*	*Nectariniidae*	Unlisted	Unlisted
Leptoptilos crumenifer	*Marabou Stork*	*Ciconiidae*	NT	LC
Melaenornis mariquensis	*Marico Flycatcher*	*Muscicapidae*	Unlisted	Unlisted
Cinnyris mariquensis	*Marico Sunbird*	*Nectariniidae*	Unlisted	Unlisted
Asio capensis	*Marsh Owl*	*Strigidae*	Unlisted	Unlisted
Tringa stagnatilis	*Marsh Sandpiper*	*Scolopacidae*	Unlisted	Unlisted
Acrocephalus palustris	*Marsh Warbler*	*Acrocephalidae*	Unlisted	Unlisted
Polemaetus bellicosus	*Martial Eagle*	*Accipitridae*	EN	EN
Mirafra cheniana	*Melodious Lark*	*Alaudidae*	Unlisted	Unlisted
Poicephalus meyeri	*Meyer's Parrot*	*Psittacidae*	Unlisted	Unlisted
Thamnolaea cinnamomeiventris	*Mocking Cliff Chat*	*Muscicapidae*	Unlisted	Unlisted
Mirafra passerina	*Monotonous Lark*	*Alaudidae*	Unlisted	Unlisted
Myrmecocichla monticola	*Mountain Wheatear*	*Muscicapidae*	Unlisted	Unlisted
Oena capensis	*Namaqua Dove*	*Columbidae*	Unlisted	Unlisted
Pternistis natalensis	*Natal Spurfowl*	*Phasianidae*	Unlisted	Unlisted
Cisticola fulvicapilla	*Neddicky*	*Cisticolidae*	Unlisted	Unlisted

Anthus nicholsoni	*Nicholson's Pipit*	*Motacillidae*	Unlisted	Unlisted
Afrotis afraoides	*Northern Black Korhaan*	*Otididae*	Unlisted	Unlisted
Hippolais olivetorum	*Olive-tree Warbler*	*Acrocephalidae*	Unlisted	Unlisted
Scleroptila gutturalis	*Orange River Francolin*	*Phasianidae*	Unlisted	Unlisted
Chlorophoneus sulfureopectus	*Orange-breasted Bush-shrike*	*Malaconotidae*	Unlisted	Unlisted
Amandava subflava	*Orange-breasted Waxbill*	*Estrildidae*	Unlisted	Unlisted
Accipiter ovampensis	*Ovambo Sparrowhawk*	*Accipitridae*	Unlisted	Unlisted
Melaenornis pallidus	*Pale Flycatcher*	*Muscicapidae*	Unlisted	Unlisted
Melierax canorus	*Pale Chanting Goshawk*	*Accipitridae*	Unlisted	Unlisted
Circus macrourus	*Pallid Harrier*	*Accipitridae*	NT	NT
Hirundo dimidiata	*Pearl-breasted Swallow*	*Hirundinidae*	Unlisted	Unlisted
Glaucidium perlatum	*Pearl-spotted Owlet*	*Strigidae*	Unlisted	Unlisted
Falco peregrinus	*Peregrine Falcon*	*Falconidae*	Unlisted	Unlisted
Recurvirostra avosetta	*Pied Avocet*	*Recurvirostridae*	Unlisted	Unlisted
Corvus albus	*Pied Crow*	*Corvidae*	Unlisted	Unlisted
Ceryle rudis	*Pied Kingfisher*	*Alcedinidae*	Unlisted	Unlisted
Lamprotornis bicolor	*Pied Starling*	*Sturnidae*	Unlisted	Unlisted
Pelecanus rufescens	*Pink-backed Pelican*	*Pelecanidae*	VU	LC
Spizocorys conirostris	*Pink-billed Lark*	*Alaudidae*	Unlisted	Unlisted
Vidua macroura	*Pin-tailed Whydah*	*Viduidae*	Unlisted	Unlisted
Anthus leucophrys	*Plain-backed Pipit*	*Motacillidae*	Unlisted	Unlisted
Ardea purpurea	*Purple Heron*	*Ardeidae*	Unlisted	Unlisted
Vidua purpurascens	*Purple Indigobird*	*Viduidae*	Unlisted	Unlisted
Coracias naevius	*Purple Roller*	*Coraciidae*	Unlisted	Unlisted
Ortygospiza atricollis	*Quailfinch*	*Estrildidae*	Unlisted	Unlisted

*(Taylor *et al*. 2015), + (IUCN 2021)

10.2 Appendix B: Species list during the field investigation

Common Name	Scientific Name	Family Name	RD (Regional, Global)
Acacia Pied Barbet	*Tricholaema leucomelas*	Lybiidae	0
African Fish Eagle	*Haliaeetus vocifer*	Accipitridae	0
African Hoopoe	*Upupa africana*	Upupidae	0
African Pipit	*Anthus cinnamomeus*	Motacillidae	0
African Stonechat	*Saxicola torquatus*	Muscicapidae	0
Black Sparrowhawk	*Accipiter melanoleucus*	Accipitridae	0
Black-winged Kite	*Elanus caeruleus*	Accipitridae	0
Blacksmith Lapwing	*Vanellus armatus*	Charadriidae	0
Capped Wheatear	*Oenanthe pileata*	Muscicapidae	0
Cardinal Woodpecker	*Dendropicos fuscescens*	Picidae	0
Chestnut-vented Warbler	*Curruca subcoerulea*	Sylviidae	0
Common Ostrich	*Struthio camelus*	Struthionidae	0
Crowned Lapwing	*Vanellus coronatus*	Charadriidae	0
Dark-capped Bulbul	*Pycnonotus tricolor*	Pycnonotidae	0
Desert Cisticola	*Cisticola aridulus*	Cisticolidae	0
European Bee-eater	*Merops apiaster*	Meropidae	0
Fiscal Flycatcher	*Melaenornis silens*	Muscicapidae	0
Fork-tailed Drongo	*Dicrurus adsimilis*	Dicruridae	0
Helmeted Guineafowl	*Numida meleagris*	Numididae	0
Laughing Dove	*Spilopelia senegalensis*	Columbidae	0
Long-billed Crombec	*Sylvietta rufescens*	Macrosphenidae	0
Namaqua Dove	*Oena capensis*	Columbidae	0
Pale Chanting Goshawk	*Melierax canorus*	Accipitridae	0
Pearl-breasted Swallow	*Hirundo dimidiata*	Hirundinidae	0
Pied Crow	*Corvus albus*	Corvidae	0
Red-eyed Dove	*Streptopelia semitorquata*	Columbidae	0
Red-faced Mousebird	*Urocolius indicus*	Coliidae	0
Ring-necked Dove	*Streptopelia capicola*	Columbidae	0
Rock Martin	*Ptyonoprogne fuligula*	Hirundinidae	0
Secretarybird	*Sagittarius serpentarius*	Sagittariidae	VU, EN
Southern Fiscal	*Lanius collaris*	Laniidae	0
Southern Grey-headed Sparrow	*Passer diffusus*	Passeridae	0
Southern Masked Weaver	*Ploceus velatus*	Ploceidae	0
Southern Red Bishop	*Euplectes orix*	Ploceidae	0
Speckled Pigeon	*Columba guinea*	Columbidae	0
Yellow-bellied Eremomela	*Eremomela icteropygialis*	Cisticolidae	0
Northern Black Korhaan	*Afrotis afraoides*	Otididae	0
Lilac-breasted Roller	*Coracias caudatus*	Coraciidae	0
White-browed Sparrow-Weaver	*Plocepasser mahali*	Ploceidae	0
Black-chested Prinia	*Prinia flavicans*	Cisticolidae	0
Brown-crowned Tchagra	*Tchagra australis*	Malaconotidae	0

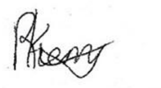
Scaly-feathered Weaver	*Sporopipes squamifrons*	Ploceidae	0
Black-faced Waxbill	*Brunhilda erythronotos*	Estrildidae	0
Tawny-flanked Prinia	*Prinia subflava*	Cisticolidae	0
Violet-eared Waxbill	*Granatina granatina*	Estrildidae	0
Blue Waxbill	*Uraeginthus angolensis*	Estrildidae	0
Crested Barbet	*Trachyphonus vaillantii*	Lybiidae	0
Common Myna	*Acridotheres tristis*	Sturnidae	0
White-bellied Sunbird	*Cinnyris talatala*	Nectariniidae	0
Black-throated Canary	*Crithagra atrogularis*	Fringillidae	0
Red-billed Quelea	*Quelea quelea*	Ploceidae	0
Brubru	*Nilaus afer*	Malaconotidae	0
Red-crested Korhaan	*Lophotis ruficrista*	Otididae	0
Black-collared Barbet	*Lybius torquatus*	Lybiidae	0
Yellow-fronted Canary	*Crithagra mozambica*	Fringillidae	0
Kalahari Scrub Robin	*Cercotrichas paena*	Muscicapidae	0
Cape Starling	*Lamprotornis nitens*	Sturnidae	0
Crimson-breasted Shrike	*Laniarius atrococcineus*	Malaconotidae	0
Southern Boubou	*Laniarius ferrugineus*	Malaconotidae	0
Chinspot Batis	*Batis molitor*	Platysteiridae	0
Southern Yellow-billed Hornbill	*Tockus leucomelas*	Bucerotidae	0
Grey Go-away-bird	*Corythaixoides concolor*	Musophagidae	0
African Grey Hornbill	*Lophoceros nasutus*	Bucerotidae	0
Yellow-fronted Tinkerbird	*Pogoniulus chrysoconus*	Lybiidae	0
Sabota Lark	*Calendulauda sabota*	Alaudidae	0
White-browed Scrub Robin	*Cercotrichas leucophrys*	Muscicapidae	0
Arrow-marked Babbler	*Turdoides jardineii*	Leiothrichidae	0
Rattling Cisticola	*Cisticola chiniana*	Cisticolidae	0
Marico Flycatcher	*Melaenornis mariquensis*	Muscicapidae	0
Fawn-colored Lark	*Calendulauda africanoides*	Alaudidae	0
Red-billed Oxpecker	*Buphagus erythrorynchus*	Buphagidae	0
Burnt-necked Eremomela	*Eremomela usticollis*	Cisticolidae	0
Southern Red-billed Hornbill	*Tockus rufirostris*	Bucerotidae	0
Fairy Flycatcher	*Stenostira scita*	Muscicapidae	0
Crested Francolin	*Dendroperdix sephaena*	Phasianidae	0
Brown-hooded Kingfisher	*Halcyon albiventris*	Alcedinidae	0
Magpie Shrike	*Urolestes melanoleucus*	Laniidae	0
Golden-breasted Bunting	*Emberiza flaviventris*	Emberizidae	0
Gabar Goshawk	*Micronisus gabar*	Accipitridae	0
Southern Pied Babbler	*Turdoides bicolor*	Leiothrichidae	0
Groundscraper Thrush	*Turdus litsitsirupa*	Turdidae	0
Green-winged Pytilia	*Pytilia melba*	Estrildidae	0
Grey-backed Camaroptera	*Camaroptera brevicaudata*	Cisticolidae	0
Jameson's Firefinch	*Lagonosticta rhodopareia*	Estriididae	0
Bearded Woodpecker	*Chloropicus namaquus*	Picidae	0

Lazy Cisticola	*Cisticola aberrans*	Cisticolidae	0
Bronze Mannikin	*Spermestes cucullata*	Estrildidae	0
Golden-tailed Woodpecker	*Campethera abingoni*	Picidae	0
Green Wood Hoopoe	*Phoeniculus purpureus*	Phoeniculidae	0
Marsh Owl	*Asio capensis*	Strigidae	0
Black-backed Puffback	*Dryoscopus cubla*	Malaconotidae	0
Wahlberg's Eagle	*Hieraaetus wahlbergi*	Accipitridae	0
Kurrichane Thrush	*Turdus libonyana*	Turdidae	0
African Hawk Eagle	*Aquila spilogaster*	Accipitridae	0
Natal Spurfowl	*Pternistis natalensis*	Phasianidae	0

10.3 Appendix C: Specialist Declaration of Independence

I, Ryno Kemp, 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 Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations, and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.



Ryno Kemp

Biodiversity Specialist

The Biodiversity Company

December 2023

10.4 Appendix D: CV

CV on request

forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002 Tel: +27 12 399 9000, Fax: +27 86 625 1042

SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE

Avifauna Assessment for the proposed Boshoek Solar 1 Photovoltaic (Pv) Facility

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Avifauna Assessment for the proposed Boshoek Solar 1 Photovoltaic (Pv) Facility
Specialist Company Name	The Biodiversity Company
Specialist Name	Ryno Kemp
Specialist Identity Number	9110095064083
Specialist Qualifications:	BSc Hons Zoology
Professional affiliation/registration:	SACNASP Pr Sci Nat registered (117462/17)
Physical address:	45 Fraser Street, Hunters Home, Knysna, 6571
Postal address:	45 Fraser Street, Hunters Home, Knysna, 6571
Postal address	45 Fraser Street, Hunters Home, Knysna, 6571
Telephone	0832733488
Cell phone	0832733488
E-mail	ryno@thebiodiversitycompany.com

SPECIALIST DECLARATION FORM – AUGUST 2023

2. DECLARATION BY THE SPECIALIST

I, Ryno Kemp declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

The Biodiversity Company

Name of Company:

15

01 Feb 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Ryno Kemp_________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

The Biodiversity Company

Name of Company

15 February 2024

Date

Signature of the Commissioner of Oaths

Click or tap to enter a date. 2024-02-15

Date

SUID-AFRIKAANSE POLISIE DIENS
CSC COMMANDER
15 FEB 2024
KNYSNA
SOUTH AFRICAN POLICE SERVICE

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Ryno Kemp

Registration Number: 117462

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule 1 of the Act)

Zoological Science (Professional Natural Scientist)

Effective **19 July 2017** Expires **31 March 2024**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

VISUAL IMPACT ASSESSMENT REPORT

BOSHOEK SOLAR PV CLUSTER, NORTH WEST PROVINCE

BOESHOEK SOLAR 1

PROPOSED BOSHOEK SOLAR 1 PV FACILITY, NORTH WEST PROVINCE

ASSESSMENT REPORT

BOSHOEK SOLAR 1

Submitted to:

ERM Southern Africa (Pty) Limited

1st Floor, Great Westerford

240 Main Road, Rondebosch, 7700

Prepared by:

GYLA

Graham A Young Landscape Architect

PO Box 331

Groenkloof

0027

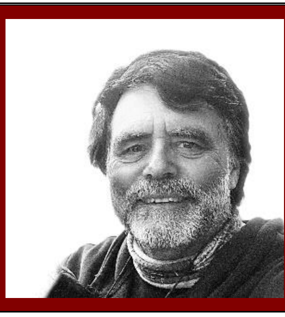
+27 (0)82 462 1491

Report Revision No:	*FINAL*
Date Issued:	17 June 2024
Prepared By:	Graham Young PrLArch, FILASA
Reviewed By:	Graham Young PrLArch, FILASA

Signed:

Reference: 117_2023: Boshoek Solar PV Cluster VIA – Boshoek 1

EXPERTISE OF SPECIALIST

Name:	**GRAHAM A YOUNG** 
Qualification:	BL (Toronto) ML (Pretoria)
Professional Registration:	South African Council for the Landscape Architectural Profession (SACLAP) Reg. No. 87001 Fellow Institute of Landscape Architects of South Africa (FILASA)
Experience in Years:	45 years
Experience	Graham Young is a registered landscape architect with an interest and experience in landscape architecture, urban design, and environmental planning. He holds a degree in landscape architecture from the Universities of Toronto (BL) and Pretoria (ML). He has conducted visual impact assessments in Canada and Africa, where he has spent most of his working life. He has served as President of the Institute of Landscape Architects of South Africa (ILASA) and vice president of the Board of Control for Landscape Architects. He is a Fellow of the ILASA and a professionally registered landscape architect in South Africa (SACLAP). He is Secretary-General for the International Federation of Landscape Architects, Africa Region (IFLA Africa) and Vice President of IFLA (world). He runs his practice, Graham A Young Landscape Architect (GYLA). A speciality is Visual Impact Assessments, for which he has been cited with an Institute of Landscape Architects of South Africa (ILASA) Merit Award (1999). This work also includes landscape characterisation studies, end-use studies for quarries, and computer modelling and visualisation. He has completed over three hundred specialist reports for projects and conducted VIA reviews. He has served as a specialist witness in legal cases involving visual impact issues. Mr Young helped develop the *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes* (Oberholzer 2005) and produced a research document for Eskom, *The Visual Impacts of Power Lines* (2009). In 2011 he produced '*Guidelines for involving visual and aesthetic specialists'* for the Aapravasi Ghat Trust Fund Technical Committee, which manages a World Heritage Site in Mauritius, along with the *Visual Impact Assessment Training Module Guideline Document* for the same client.

DECLARATION OF INDEPENDENCE

I, Graham Young, declare that –

- I am contracted as the Visual Impact Assessment Specialist for the BOSHOEK SOLAR 1 PV, North West Province, South Africa
- 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 no, 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; and

Graham A. Young FILASA PrLArch SACLAP Reg. No. 87001

25 March 2024

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SPECIALIST REPORTING REQUIREMENTS

Specialist Reporting Requirements According to Appendix 6 of the National Environmental Management Act (Act No. 107 of 1998), Environmental Impact Assessment (EIA) Regulation 2014 (as amended on 7 April 2017)	
Requirement	**Relevant section in report**
Details of the specialist who prepared the report	Pg iii and Appendix B
The expertise of that person to compile a specialist report including a curriculum vitae	Pg iii and Appendix B
A declaration that the person is independent in a form as may be specified by the competent authority	Pg iv
An indication of the scope of, and the purpose for which, the report was prepared;	Section 1.3 and 1.4
An indication of the quality and age of base data used for the specialist report;	Section 1.5
A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8.4
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.4 and 3.2
A description of the methodology adopted in preparing the report or conducting the specialised process inclusive of equipment and modelling used;	Section 3
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure	Section 6
An identification of any areas to be avoided, including buffers	N/A
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figures 5 and 6
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.5
A description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 8
Any mitigation measures for inclusion in the EMPr;	Section 9
Any conditions for inclusion in the environmental authorisation	Section 10
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 11

A reasoned opinion whether the proposed activity, activities or portions thereof should be authorised regarding the acceptability of the proposed activity or activities; and	Section 13
If the opinion is that the proposed activity, or activities or portions thereof should be authorised, any avoidance, management, and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 10
A description of any consultation process that was undertaken during the conducting the study	N/A this activity is being conducted by the EAP
A summary and copies of any comments that were received during any consultation process	N/A this activity is being carried out by the EAP and not completed by the time of authoring the report
Any other information requested by the competent authority.	N/A

ACRONYMS, ABBREVIATIONS & GLOSSARY

Acronyms & Abbreviations	
BAR	Basic Assessment Report
EIA	Environmental Impact Assessment
EAP	Environmental Assessment Practitioner
EMPr	Environmental Management Programme
ESIA	Environmental and Social Impact Assessment
GYLA	Graham Young Landscape Architect
kV	Kilovolt
MTS	Main Transmission Substation
MW	Megawatt
OHPL	Overhead Power Line
PV	Photovoltaic
SACLAP	South African Council for the Landscape Architectural Profession
SSVR	Site Sensitivity Verification Report
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment

Glossary	
Aesthetic Value	Aesthetic value is the emotional response derived from the experience of the environment with its natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings, and attitudes (Ramsay, 1993). Thus, aesthetic value encompasses more than the seen view, visual quality, or scenery, and includes atmosphere, landscape character and sense of place (Schapper, 1993).
Aesthetically significant place	A formally designated place visited by recreationists and others for the express purpose of enjoying its beauty. For example, tens of thousands of people visit Table Mountain on an annual basis. They come from around the country and even from around the world. By these measurements, one can make the case that Table Mountain (a designated National Park) is an aesthetic resource of national significance. Similarly, a resource that is visited by large numbers who come from across the region probably has regional significance. A place visited primarily by people whose place of

	origin is local is generally of local significance. Unvisited places either have no significance or are "no trespass" places. (After New York, Department of Environment 2000).
Aesthetic impact	Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Mere visibility, even startling visibility of a project proposal, should not be a threshold for decision making. Instead a project, by its visibility, must clearly interfere with or reduce (i.e. visual impact) the public's enjoyment and/or appreciation of the appearance of a valued resource e.g. cooling tower blocks a view from a National Park overlook (after New York, Department of Environment 2000).
Cumulative Effects	The summation of effects that result from changes caused by a development in conjunction with the other past, present, or reasonably foreseeable actions.
Glare	The sensation produced by luminance within the visual field that is sufficiently greater than the luminance to which the eyes are adapted, which causes annoyance, discomfort, or loss in visual performance and visibility. *See* Glint. (USDI 2013:314)
Glint	A momentary flash of light resulting from a spatially localised reflection of sunlight. *See* Glare. (USDI 2013:314)
Landscape Character	The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, woods, trees, water bodies, buildings, and roads. They are generally quantifiable and can be easily described.
Landscape Impact	Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced (Institute of Environmental Assessment & The Landscape Institute 1996).
Study area	For the purposes of this report this Project the study area refers to the proposed project footprint / project site as well as the 'zone of potential influence' (the area defined as the radius about the centre point of the Project beyond which the visual impact of the most visible features will be insignificant) which is a 5,0km radius surrounding the proposed project footprint / site.
Project Footprint / Site	For the purposes of this report the Project *site* / *footprint* refers to the actual layout of the Project as described.
Sense of Place (genius loci)	Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. *A genius locus literally means* 'spirit of the place'.
Sensitive Receptors	Sensitivity of visual receptors (viewers) to a proposed development.
Viewshed analysis	The two-dimensional spatial pattern created by an analysis that defines

	areas, which contain all possible observation sites from which an object would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1,8m above ground level.
Visibility	The area from which project components would potentially be visible. Visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation, and distance.
Visual Exposure	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion and visual acuity, which is also influenced by weather and light conditions.
Visual Impact	Visual effects relate to the changes that arise in the composition of available views because of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity.
Visual Intrusion	The nature of intrusion of an object on the visual quality of the environment resulting in its compatibility (absorbed into the landscape elements) or discord (contrasts with the landscape elements) with the landscape and surrounding land uses.
Visual absorption capacity	Visual absorption capacity is defined as the landscape's ability to absorb physical changes without transformation in its visual character and quality. The landscape's ability to absorb change ranges from low-capacity areas, in which the location of an activity is likely to cause visual change in the character of the area, to high-capacity areas, in which the visual impact of development will be minimal (Amir & Gidalizon 1990).
Worst-case Scenario	Principle applied where the environmental effects may vary, for example, seasonally to ensure the most severe potential effect is assessed.
Zone of Potential Visual Influence	By determining the zone of potential visual influence, it is possible to identify the extent of potential visibility and views which could be affected by the proposed development. Its maximum extent is the radius around an object beyond which the visual impact of its most visible features will be insignificant primarily due to distance.

EXECUTIVE SUMMARY

INTRODUCTION

Boshoek Solar 1 (Pty) Ltd, Boshoek Solar 2 (Pty) Ltd, and Boshoek Solar 3 (Pty) Ltd propose the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province. Since the projects trigger activities in all three listing notices, a full assessment and EIA application process will be followed. Each facility within the cluster will have its application and associated reporting and public participation process, i.e., 3 Applications and 3 S&EIA Reports will be compiled for the cluster. This report deals specifically with the *Boshoek Solar 1*.

ERM Southern Africa (Pty) Limited commissioned Graham Young Landscape Architect (GYLA) to conduct a visual impact assessment of the project. The *assessment* report focuses on the impact of the physical aspects of the Project (i.e. form, scale, and bulk) and its potential impact within the local landscape and receptor context. It is part of the abovementioned Environmental Impact Assessment (EIA) process. The proposed Project requires authorisation in terms of the National Environmental Management Act (Act no. 107 of 1998) ("NEMA") read with the EIA Regulations, 2014 (GNR 982 of 4 December 2014, as amended.

PROJECT SITE AND STUDY AREA

Boshoek Solar 1, divided into two areas, Area 1 (north) and Area 2 (south), is located approximately 30 - 33 km northwest of Rustenburg within the Kgetlengrivier and Rustenburg Local Municipality and the Bojanala District Municipality in the North West Province. The study area is defined as 5,0km about the centre of the Project site and 1km to either side of the centre line of the proposed 132kV power line corridor.

AIM OF THE SPECIALIST STUDY

The study's main aim is to document the baseline and ensure that the visual/aesthetic consequences of the proposed Project are understood.

TERMS AND REFERENCE

A specialist study is required to establish the visual baseline and identify and assess the impact of the Project based on the general requirements for a comprehensive VIA. The following terms of reference was established:

- Data collected during the site visit (22 and 23 August 2023) and from Google Earth will allow for a description and characterisation of the receiving environment.
- Describe the landscape's character and quality, and assess the visual resources of the study area.
- Describe the visual characteristics of the components of the Project.
- Qualitatively assess the potential for glint and glare.
- Rate the potential impact of the Project.
- Rate the potential cumulative effect of the Project.
- Propose mitigation measures to reduce the potential impact of the Project.

FINDINGS

The existing visual condition of the landscape that may be affected by the proposed Boshoek Solar 1 Project and associated OHPL infrastructure has been described. The study area's scenic quality has been rated *moderate* to *high* within the context of the sub-region. Sensitive viewing areas have been identified and mapped, indicating potential moderate to high sensitivity to the Project, mainly for nearby tourist accommodation.

Impacts on views are the highest when viewers are sensitive to change in the landscape and the view is focused on and dominated by the change. The Project's visual impact will cause noticeable changes in the landscape to people viewing the landscape from nearby farmsteads/game farms and along the east-west arterial road and local farm roads. The potential impact ratings are determined using the worst-case scenario and when the impacts of all aspects of the Project are taken together. It is anticipated that visual impacts could result from the activities and infrastructure in all the Project phases, i.e. construction, operational, and decommissioning.

The Visual Impact of the Project

Construction Phase

Construction activities include the removal of bushveld and grassland vegetation, earthworks required to create building terraces for substation and preparation of the internal roads, excavations for the array structures foundations, and the erection of the PV arrays and associated infrastructure. Construction activities would negatively affect the landscape's visual quality and sense of place relative to its baseline as they would contrast with the patterns that currently define the structure of the landscape. However, the most significant impact would be on the site itself.

The potential impact on the visual environment during the construction phase is assessed to be of a moderate severity over a localized area (but extend beyond the site boundary). It would occur over the short-term (less than the project's life). The probability of the unmitigated impact is medium, resulting in a predicted MEDIUM significance impact with negative implications. Implementing mitigation measures would not significantly reduce the anticipated impact, which would remain MEDIUM.

Operational Phase

Operational activities include the regular cleaning of the PV modules, vegetation management under and around the PV modules and maintenance of all other infrastructural components. Security lighting and other lighting associated with the movement of security vehicles at night. These activities and the physical presence of the Project components (solar arrays, support infrastructure and the OHPL) day and night constitute the visual impact.

The worst-case impact on the visual environment during the operational phase is assessed to be of medium severity over a localized area (but extend beyond the site boundary). It would occur over the medium term (i.e. reversible over the project's life). The probability of the unmitigated impact is medium, resulting in a predicted MODERATE significant negative impact. A moderate impact implies a noticeable impact with unavoidable consequences, which will need to be accepted if the project is allowed to proceed.

Mitigation measures are feasible and can reduce the visual impact over time (once the proposed tree screens are established). The impact, with mitigation, is predicted to be LOW.

Decommissioning Phase

Decommissioning and closure activities include the dismantling and removal of infrastructure and the rehabilitation of the site back to its current, mostly natural, state.

The worst-case impact on the visual environment during the construction phase is assessed to be of medium severity over a localized area (but extend beyond the site boundary). It would occur over the short-term (less than the life of the project). The probability of the unmitigated impact is medium, resulting in a predicted LOW significance of negative impact. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain LOW.

The Cumulative Impact of the Project

The cumulative impact of the Project during the operational phase is potentially MEDIUM when the Project site is considered along with the other two Boshoek solar PV facilities and the associate powerline and substation infrastructure. The intervisibility and these components along with the existing power lines would over time, result in the nature and character of the sub-region being impacted in a manner beyond the anticipated moderate to low (with mitigation) negative impact of the proposed Project alone.

The significance of the cumulative impact of the Boshoek Solar PV Cluster on the visual environment during their operational phase of the Project is assessed to have a medium severity and over the medium-term with an unmitigated sub-regional impact assessed as MEDIUM.

Author's Opinion

GYLA believes that the visual impacts associated with the proposed Project are of a nature, scale and duration that will require mitigation to reduce the predicted negative impact from MEDIUM to LOW during the operational phase. GYLA believes that the consequences associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels, provided the recommended measures are effectively implemented and managed in the long term.

***** GYLA *****

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1. INTRODUCTION

1.1 Project Overview and Background

Boshoek Solar 1 (Pty) Ltd, Boshoek Solar 2 (Pty) Ltd, and Boshoek Solar 3 (Pty) Ltd, propose the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province. Since the projects trigger activities in all three listing notices, a full assessment and EIA application process will be followed. Each facility within the cluster will have its own application and associated reporting and public participation process, i.e., 3 Applications and 3 S&EIA Reports will be compiled for the cluster. This report deals specifically with the *Boshoek Solar 1*. Refer to Figure 1: Locality Plan.

ERM Southern Africa (Pty) Limited commissioned Graham Young Landscape Architect (GYLA) to conduct a visual impact assessment for the project. The *assessment* report focuses on the potential high-level impact of the physical aspects of the Project (i.e. form, scale, and bulk), and its potential impact within the local landscape and receptor context and is part of the Environmental Impact Assessment (EIA) process described above. The proposed Project requires authorisation in terms of the National Environmental Management Act (Act no. 107 of 1998) ("NEMA") read with the EIA Regulations, 2014 (GNR 982 of 4 December 2014, as amended.

1.2 Project site

The Boshoek Solar 1 is located approximately 30 - 33 km north west of Rustenburg within the Kgetlenrivier and Rustenburg Local Municipalies and the Bojanala District Municipality, in the North West Province. The sub-regional location of the proposed Boshoek Solar 1 project area (divided into two areas – Area 1 north and Area 2 south) is indicated in Figure 1.

1.3 Aim of the Specialist Study

The study's main aim is to document the baseline and ensure that the visual/aesthetic consequences of the proposed Project are understood and that a high-level impact of the proposed activities can be predicted.

1.4 Terms and Reference

A specialist study is required to establish the visual baseline and to identify and assess the visual impacts arising from the Project based on the general requirements for a comprehensive VIA. The following terms of reference was established:

- Data collected during the site visit (22 and 23 August 2023) and from Google Earth will allow for a description and characterisation of the receiving environment.
- Describe the landscape character and quality and assess the visual resource of the study area.
- Describe the visual characteristics of the components of the Project.
- Qualitatively assess the potential for glint and glare.
- Rate (high-level) the potential impact of the Project. The significance of visual impact will be stated in the subsequent Assessment report, which will include additional modelling and the results of the public participation process.
- Rate the potential cumulative effect of the Project.
- Propose mitigation measures to reduce the potential impact of the Project.

1.5 Assumption, Uncertainties and Limitations

The following assumptions limitations have been made in the study:

- The description of project components is limited to what has been supplied to the author prior to the date of completion of this report.
- Site photos taken in winter and do not necessarily reflect the complete landscape character of the area as experienced through all seasons. The weather was sunny, with slight haze conditions.
- At the time of writing the report, the public participation process had not been completed.

1.6 Site Sensitivity Verification Report (SSVR)

The SSVR confirmed to a large extent the sensitivities highlighted in the Screening report. However, the sensitivity of receptors is deemed to be higher than stated, due to areas of low agricultural/grazing lands that do not provide adequate visual screening or visual diversity to blend or screen the development from sensitive receptor locations.

There are a number of farmsteads and lodges in the study area that could be subjected to the effects of the PV arrays, night lighting and the proposed overhead line.

The report concluded that a full visual impact assessment is required for the proposed Boshoek Solar 1 project and its associated powerline infrastructure. This Assessment Report is the first phase of this process.

Figure 1: LOCALITY - Boshoek 01 PV Solar Park

Graham A Young
Landscape Architect
082 462 1491

2. NATIONAL ENVIROMENTAL GUIDELINES

National Environmental Management Act (Act 107 of 1998), EIA Regulations

The specialist report is in accordance with the specification on conducting specialist studies as per Government Gazette (GN) R 982 (as amended) of the National Environmental Management Act (NEMA) Act 107 of 1998. The mitigation measures as stipulated in the specialist report can be used as part of the Environmental Management Programme Report (EMPR) and will be in support of the Environmental Impact Assessment (EIA) and Appendix 6 of the EIA Regulations 2014 (as amended).

Western Cape Department of Environmental Affairs & Development Planning: Guideline for Involving Visual and Aesthetic Specialists in EIA Processes Edition 1 (CSIR, 2005)

Although the guidelines were specifically compiled for the Province of the Western Cape, they provide guidance that is appropriate for any EIA process. The Guideline document also seeks to clarify instances when a visual specialist should get involved in the EIA process.[1]

[1] The Western Cape Guidelines are the only official guidelines for visual impact assessment reports in South Africa and can be regarded as best practice throughout the country.

3. APPROACH AND METHODOLOGY

3.1 Approach

The assessment of likely effects on a landscape resource and visual amenity is complex since it is determined through quantitative and qualitative evaluations. When assessing visual impact, the worst-case scenario is considered. Landscape and visual assessments are separate, although linked, procedures. The landscape, its analysis, and the assessment of impacts on the landscape all contribute to the visual impact assessment studies baseline. The potential impact on the landscape is assessed as an impact on an environmental resource, i.e. the physical landscape. On the other hand, visual impacts are assessed as one of the interrelated effects on people (i.e. the viewers and the result of an introduced object into a view or scene).

For a detailed description of the methodology to determine the value of a visual resource, refer to Appendix A. Appendices B and C list the criteria for determining the intensity and significance of visual impact. Image 1 below graphically illustrates the visual impact process used in this Project.

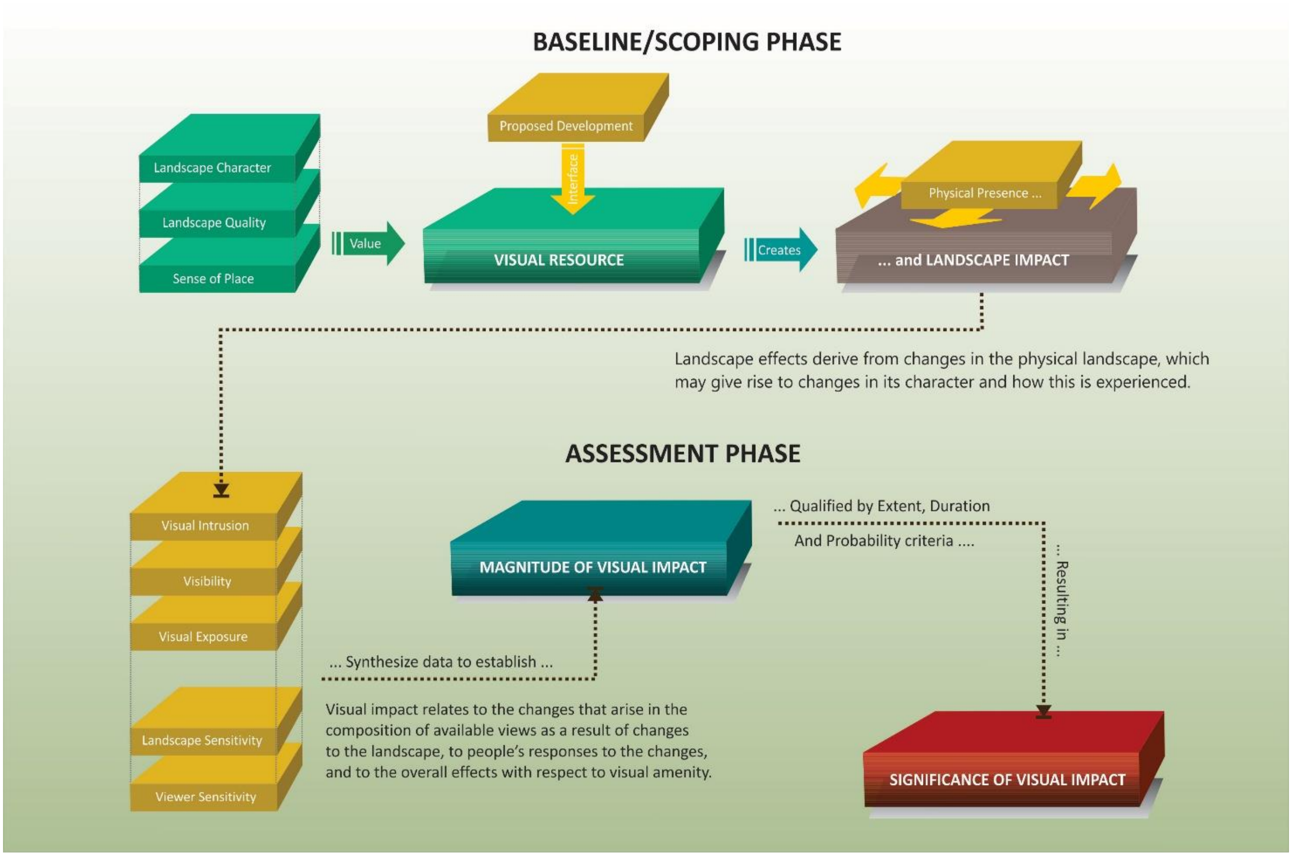

Image 1: Visual Impact Process

3.2 Methodology

The following method was used:

- Site visit: The field survey was undertaken on 22 and 23 August 2023.
- Project components: The physical characteristics of the project components are described and illustrated based on information supplied by the EAP.

- The landscape's character is described and rated in terms of its aesthetic appeal using recognised contemporary research in perceptual psychology as the basis, and its sensitivity as a landscape receptor.
- The sense of place of the study area is described as to its uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations associated with the historical/current use of the land.
- The visibility of the proposed Project was determined using on-site observations (viewshed modelling will be done in the Assessment Phase).
- The potential visual impact (high level) of the proposed Project is rated based on a professional opinion, the method described above and the risk analysis criteria in Appendix C; and
- Measures to mitigate the negative impacts of the Project are recommended
- The cumulative impact is discussed.

4. DESCRIPTION OF THE PROJECT

4.1 Technical Details Boshoek 1 Solar Project

Boshoek Solar 1 is part of a cluster of solar PV facilities. The proposed technical details for Boshoek Solar 1 is presented in the table below

Table 1: Boshoek Solar 1 Technical Details

Development	Boshoek Solar 1
Developer / Applicant	Boshoek Solar 1 (Pty) Ltd
DFFE Reference	To be confirmed
Solar Facility	
Capacity of Solar Facility	Up to 150 MW
Assessment Area, including the associated grid connection	~ 290 ha
Roads	
Description of roads	The majority of the access road will follow existing, gravel farm roads that may require widening up to 10 m (inclusive of storm water infrastructure). Where new sections of road need to be constructed (/lengthened), this will be gravel/hard surfaced access road and only tarred if necessary. A network of gravel internal access roads and a perimeter road (cumulatively up to 33 km in length), each with a width of up to ± 6 m, will be constructed to provide access to the various components of the PV development.
Site Access	Site access is proposed directly off an unnamed gravel road surrounding the site; however, this will be confirmed based on the outcome of the traffic impact assessment.
Length of site access road	To be confirmed based on the outcome of the traffic impact assessment.
Width of site access road	up to 10 m (inclusive of storm water infrastructure)

Length of internal roads	up to 33 km
Width of internal roads	up to 6 m
Facility Auxiliary Infrastructure	
Operations and maintenance buildings (O&M building) with parking area	An area of up to 1 ha will be occupied by buildings which will include (but not limited to) a 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre.
On-site substation capacity	Up to 132 kV
On-site switching station capacity	Up to 132 kV
Grid Connection Capacity	Up to 132 kV
Overhead Powerline	A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.
Main Transmission Substation (MTS)	-
Connection to National Grid	The future planned Eskom collector switching station will facilitate the connection of the facility substation to the Ngwedi 400/132kV MTS via a single or double circuit 132 kV overhead powerline. The connection infrastructure associated with this grid solution (i.e. between the collector switching station and the MTS) falls outside of the scope of this EIA and will be assessed as part of a separate Environmental Application.
Cabling network	Medium voltage cables (up to 33 kV)
BESS Area	up to 5 ha
Height of fencing	up to 3.5 ha
Type of fencing	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.

4.2 Project Description – Boshoek Solar 1

Boshoek Solar 1 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province. The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW. The development area is situated approximately 33 km north west of Rustenburg within the Kgetlengrivier and Rustenburg Local Municipality and the Bojanala District Municipality, in the North West Province. The development area for the PV facility and associated infrastructure will be located on the following properties:

Farm Name	Farm No.	Portion No.
Boshoek Solar 1 PV Facility		
Farm Rhenosterdoorns	531	0
Farm Zwaarverdiend	234	1
Boshoek Solar 1 PV Grid Connection		
Paul Bodenstein Landgoed 571 JG	571	RE
Elandsfontein 102 JG	102	1
Onderstepoort 98 JG	98	RE

The project is planned as part of a larger cluster, which includes two additional PV facilities (Boshoek Solar 2 and Boshoek Solar 3) up to 150 MW and 50 MW, respectively. An assessment area of approximately 290 ha is being assessed as part of this EIA process and the infrastructure associated with the 150 MW facility includes:

- PV modules (mono- or bifacial) and mounting structures;
- Inverters and transformers;
- Battery Energy Storage System (BESS);
- Site access road;
- Internal access roads;
- Auxiliary buildings (switch room, gatehouse and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Temporary and permanent laydown area; and
- Grid connection infrastructure, including:
  - Underground medium-voltage cabling between the project components and the facility substation;
  - Up to 132kV facility substation;
  - Switching station;
  - A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.

Refer to Figure 2 Project Components Layout below.

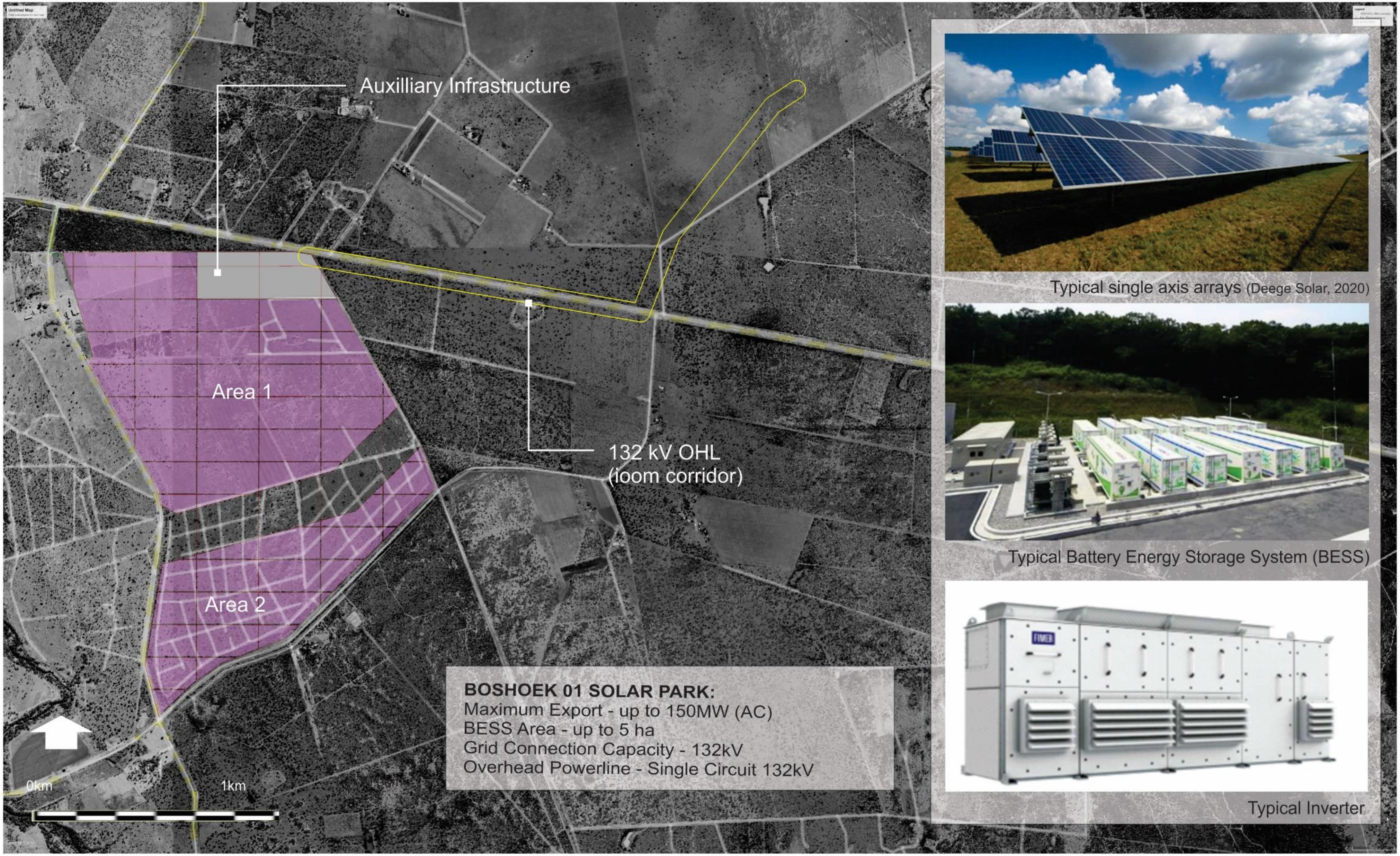

Figure 02: PROJECT COMPONENTS LAYOUT - Boshoek 01 Solar PV

5. POTENTIAL VISUAL ISSUES

PV solar projects typically include medium to large-scale infrastructure that can cause change to the fabric and character of an area and possible visual intrusion in sensitive landscapes due to their physical presence.

Typical issues associated with solar PV projects are:

- Who will be able to see the new development?
- What will it look like, and will it contrast with the receiving environment?
- Will the development affect sensitive views in the area, and if so, how?
- What will be the impact of the development during the day and at night?
- What will the cumulative impact be, if any?

These issues will be considered, and the significance of impact rated in the Assessment Phase of the project. In this assessment phase a high-level rating of potential impacts is predicted. At the time of writing, the public participation process had not been completed. Therefore, it is unknown if the public would raise visual issues and potentially indicate a sensitivity to visual and aesthetic concerns. It is assumed, based on the generic sensitivity criteria listed in Appendix B and context of the area, and the findings of the SSVR that receptor sensitivity would be moderate.

5.1 Glint and Glare

In addition to these common visual and aesthetic issues, the potential of glint and glare can be of concern. PV panel surfaces are designed to absorb the sunlight, therefore substantially reducing the potential for glint and glare. The glass layer covering the PV modules is made of high transmission tempered glass with an anti-reflective (AR) coating. Consequently, the percentage of the reflected light from PV modules can vary from 2% to 30% depending on the angle of incidence (PagerPower 2020:24). However, published guidance shows that the intensity of solar reflections from solar panels are equal to or less than those from water. It also shows that reflections from solar panels are significantly less intense than other reflective surfaces, which are common in an outdoor environment (PagerPower 2020:24). By comparison, a mirror can reflect a percentage of the incident light above 98% (Tata 2015:3).

However, the panels and other components reflect light that may result in glinting (but only at minimal angles), and glare depending on panel orientation, sun angle, viewing angle, viewer distance, and other visibility factors (USDI 2013:77). The images in Figure 2-1 illustrate this effect, where the arrays can vary in colour from black, to blue, to a bright silvery sheen (worst case scenario). The result can also be distributed across a single project site when differing sky conditions exist, as is illustrated in the images of a solar park near Touws Rivier. The southern section of the solar park is in the sun, causing a silver sheen, while the park's northern area, which is in cloud shade, appears dull grey. The effect of glint (a sharp focus of light) is not generally associated with PV arrays; however, glare can occur with certain climatic and orientation conditions, as has been illustrated (USDI 2013:77) in Figure 2-1.

Figure 2-2 illustrates a typical installation of PV arrays in the Northern Cape and suggests that glint would not normally occur for extended periods from low angles and any given static viewpoint. For the most part the arrays would appear as a dark blue line in the landscape as shown in the figure.

The South African Civil Aviation Authority (SACAA) obstacle notice 3/2020[2] Additional Requirements for Solar Project Applications states that a Glint and Glare Assessment would be required if the solar PV facility is within a 3km radius of the aerodrome (Part 139.01.30 (3)[3] and/or it occurs in the landing and take-off flight paths. There are no aerodromes, which occur within these parameters and therefore a Glint and Glare Assessment is not required.

[2] Obstacle Notice 3/2020 (Replacement for 17/11/2017): Additional Requirements for Solar Project Applications
Kindly note that with immediate effect, A Glint & Glare Assessment will be required as soon as the proposed site is located on the extended runway centreline within the ICAO Annex 14 Approach Surface, Take-Off Climb Surface & Departure Surface, and within 3km radius around an Aerodrome/helistop as pe Part 139.01.30 (3).

Apparent colour changes with differing sun angles and viewing geometry at a PV facility. (USDI 2013:78)
Credit: Robert Sullivan, Agganne National Laboratory.

PV panel surfaces are not designed to reflect light and therefore have reduced potential for glint and glare; however, the panels and other components do reflect light that may result in glinting, glare and other visual effects that would vary depending on panel orientation, sun angle, viewing angle, viewer distance, and other visibility factors (USDI 2013:77)

Figure 2-1: POTENTIAL FOR GLINT AND GLARE

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Figure 2-2: EFFECT OF DISTANCE ON VISUAL EXPOSURE
Note: Scales of the two options are relative to each other

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6. THE ENVIRONMENTAL SETTING

6.1 Landscape Character and Nature of the Study Area

The landscape is the backdrop against which all cultural activities (primarily agriculture, with game farming and some power infrastructure) occur and comprises a varied landscape which includes open agricultural grasslands and the remnants of the original savannah bushveld (Zeerust Thornveld – Mucina and Rutherford 2006:461). This savannah type comprises deciduous open to dense short thorny woodland, dominated by *Vachellia (Acacia)* species with an herbaceous layer of mainly grasses.

The visual absorption capacity (VAC) in these areas is relatively high (bushveld) and low for the open, gently rolling, agricultural lands. Refer to Figure 5, which illustrates the various landscape types within the study area and rates their relative scenic quality value and sensitivity toward development.

The areas to the east and north of the study exhibit a high aesthetic appeal imparted by the hills associated with the end of the Magaliesberg Range. These areas are natural in character and have a relatively high scenic quality, within the context of the sub region and consequently are sensitive to development. Development is not proposed in these areas

The majority of the zone of potential influence (study area) comprises cultivated/grazing lands and remnants of the bushveld. The project site occurs across these landscape types. These landscape types have a moderate visual quality within the context of the sub-region and are moderately sensitive to development.

The Selons River flows from south to north across the study area and is west of the project sites. Its relative scenic quality rating is moderate to high. Development is not proposed within this landscape type, however, the moderate buffer zones (Relative Landscape (Solar) Theme Sensitivity, associated with the river protrude onto the north western corner of Area 1 and the far western side of Area 2.

The 132kV overhead powerline is aligned along the local arterial road and then turns north along a farm road, in bushveld and open grazing and cultivated farm land.

Together these landscape types and associated topographic relief form a landscape setting of mixed character as illustrated in Figure 5 and the panoramas in Figures 4-1 to 4-3.

6.2 Sense of Place

The sense of place for the study area derives from the combination of all landscape types and their impact on the senses. The bushveld and the Magaliesberg along the east and north of the study area provide a natural backdrop to area and give it its strong sense of place, one of rolling bushveld interspersed with cultivated farmland and grazing areas. Refer to the panoramas in Figures 4-1 to 4-3

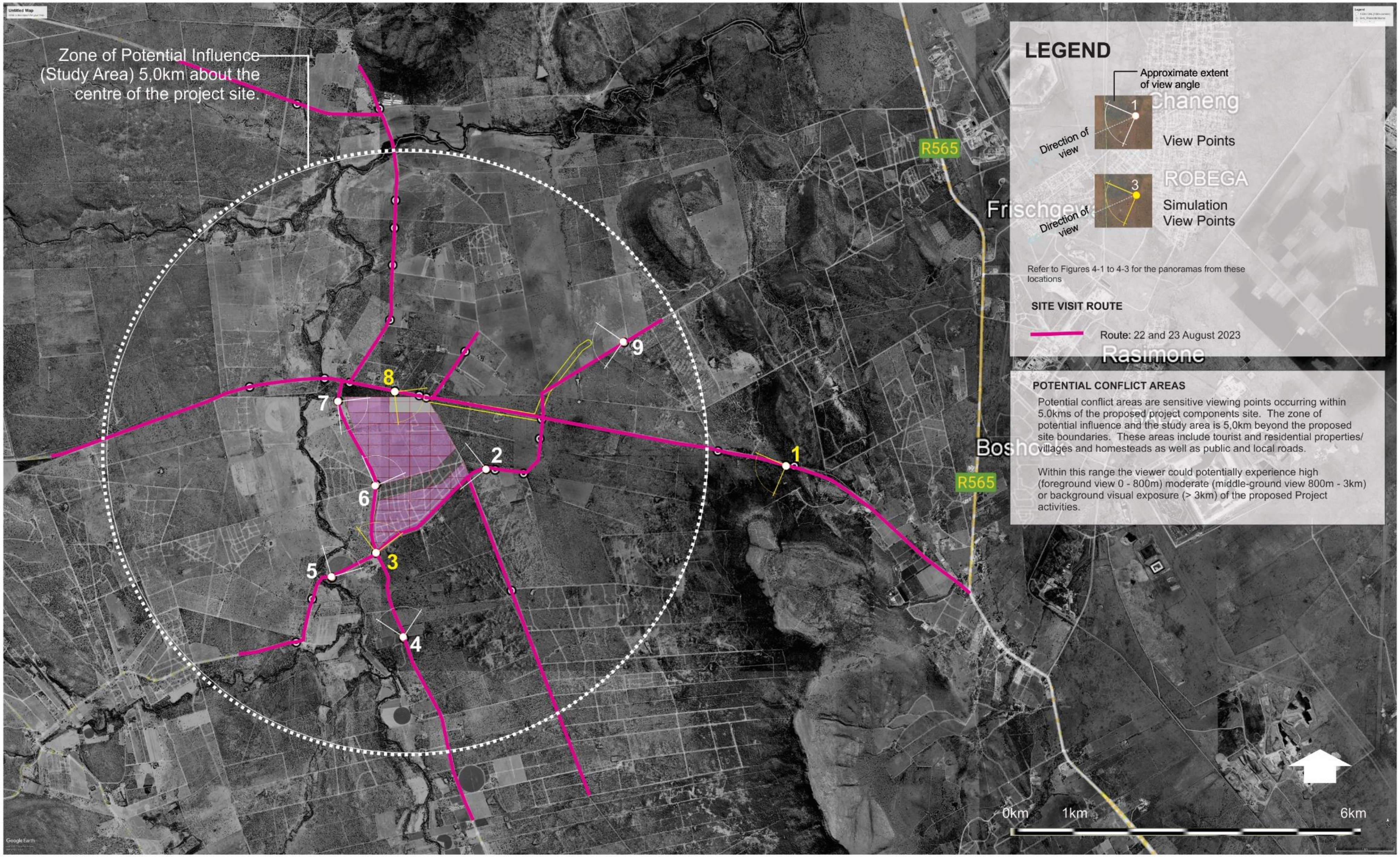

Figure 03: PANORAMA VIEW POINT LOCATIONS - Boshoek 01 Solar PV

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Figure 04-1: LANDSCAPE CHARACTER - Views 1, 2 and 3

Refer to Figure 3 for location of viewing points

Figure 04-2: LANDSCAPE CHARACTER - Views 4, 5 and 6

Refer to Figure 3 for location of viewing points

Figure 04-3: LANDSCAPE CHARACTER - Views 7, 8 and 9

Refer to Figure 3 for location of viewing points

7. VISUAL RESOURCE

7.1 Visual Resource Value, Scenic Quality and Landscape Sensitivity

The spatial distribution of the landscape types discussed in 6.1 are illustrated in Figure 5. The figure also rates the relative scenic quality of each landscape type and its sensitivity to intrusion caused by proposed Project activities. Scenic quality ratings (using the scenic quality rating criteria described in Appendix A) were assigned to each of the landscape types defined in Figure 5. The *highest* value is assigned to the hills with savannah (Gold Reef Mountain Bushveld – Mucina and Rutheford 2006:466) and the systems associated with the Selons River, which are considered sensitive to development.

The intact bushveld areas scattered about the study area, have a moderately high scenic quality rating and due to their height relative to the proposed solar PV arrays, would provide adequate visual screening from ground level views. The open grazing and cultivated lands have a moderate to low rating and due to their openness would also be visually sensitive to development .

When the landscape character types are considered together, the combination of assigned scenic quality ratings suggests an overall rating of *moderate* to *high* for the study area. This must be understood within the context of the region. Because of this rating, the study area, and particularly the landscape surrounding the Project site (savannah and agricultural lands), is rated moderately sensitive to change that might occur due to Project activities. A summary of the visual resource values is tabulated in Table 1 below.

Table 2: Value of the Visual Resource (After: LIEMA 2013)

High The hills in the east and north of the study area	**Moderate** Riverine areas, the natural bushveld and grazing/agricultural lands under irrigation.	**Low** Power infrastructure (ESKOM transmission line west of the project site – Figure 7)
This landscape type is considered to have a *high* value because it is a: Distinct landscape that exhibits a positive character with valued features that combine to give the experience of unity, richness and harmony. It is a landscape that may be of particular importance to conserve, and which has an intense sense of place.	This landscape type is considered to have a *moderate* value because it is a: Common landscape that exhibits some positive character, but which has evidence of alteration / degradation/ erosion of features resulting in areas of more mixed character.	This landscape type is considered to have a *low* value because it is a: Minimal landscape generally negative in character with few, if any, valued features.
Sensitivity: It is sensitive to change in general and will be detrimentally affected if change is inappropriately dealt with.	Sensitivity: It is potentially sensitive to change in general and change may be detrimental if inappropriately dealt with.	Sensitivity: It is not sensitive to change in general and change.

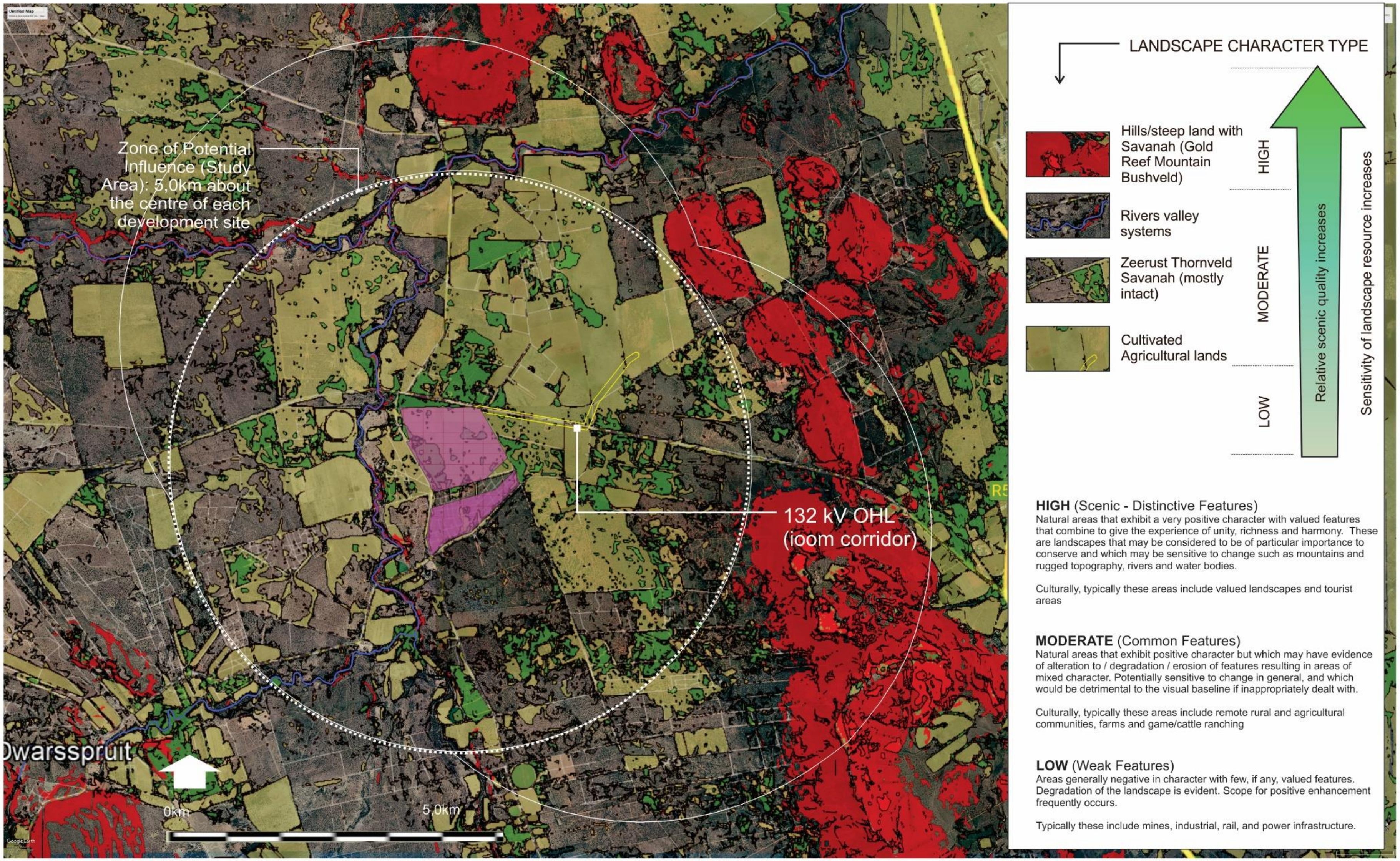

Figure 05: LANDSCAPE CHARACTER and SENSITIVITIES - Boshoek 01 Solar PV Park

8. LANDSCAPE IMPACT

Landscape impacts derive from changes in the physical landscape, which may give rise to changes in its character and from effects to the scenic values of the landscape. This may in turn affect the perceived value ascribed to the landscape. The proposed Project sites occur in a moderately rated scenic landscape, within the context of the sub-region and as discussed above.

During the construction phase, a number of activities, as described in **Section 4** will result in the clearing of the bushveld in order to establish the development areas for the PV modules, cable trenches, inverter stations etc. Gravel will be laid between the rows of arrays and construction activities for the PV arrays and support powerline infrastructure will start. The activities at the Project sites will have a major impact on the landscape, resulting in a high intensity landscape impact due to the exposure of large areas of soil, which would contrast noticeably with the hues of the baseline vegetation, and which would potentially be seen from the surrounding sensitive areas and adjacent public roads.

9. SEVERITY OF VISUAL IMPACTS

In addition to the landscape impacts described in **Section 8**, it is anticipated that visual impacts will result from the activities and infrastructure in all Project phases i.e. establishment, operational, and closure. Activities associated with the Project will be partially visible to the public, to varying degrees from varying distances around the Project site.

Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (caused by the physical presence of a new development) and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the area.

Typical issues associated with Solar PV projects are:

- Who will be able to see the new development?
- What will it look like, and will it contrast with the receiving environment?
- Will the development affect sensitive views in the area and if so, how?
- What will be the impact of the development during the day and at night?
- Will glint and glare be an issue
- What will the cumulative impact be if any?

These potential impacts will be considered and rated in the assessment **Section 11** below. At the time of writing the public participation process had not been completed and it is, therefore, not known if visual issues would be raised by the public and indicate a sensitivity to visual and aesthetic concerns. Sensitivity towards the development would likely be low.

9.1 Visual Receptors

Areas and sites considered potentially sensitive to project activities in the study area are public roads, farmsteads and tourist activities. **Figure 6** identifies these places relative to the project sites and overhead powerlines where potential conflict could occur i.e. visibility of the Project activities could impact negatively on sensitive receptors. Typically, high receptor sensitivity, includes people using outdoor recreational / tourism facilities, public rights of way and residents of housing areas, whose intention or interest may be focused on the landscape; medium sensitivity relates to people engaged in outdoor sport or recreation (other than appreciation of the landscape); and low sensitivity would be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view (i.e. office, industrial areas and active sports such as soccer).

9.2 Sensitive Viewers and locations

The most sensitive visual receptors include people visiting tourist lodges and game farms, living in farmsteads and travellers along the local east-west arterial. The remaining receptors would be people travelling along and through the study are on local farm roads.

Within the context of the study area and the region, the following receptors (**Table 3**) are identified as potentially sensitive viewers. Receptor sensitivity is most likely *moderate* for most of the study area, although receptor sensitivities could increase for the tourist locations associated lodges and game farms and for people living in nearby farmsteads.

Table 3: Sensitivity and Location of Visual Receptors

High	Moderate	Low
Tourists visiting local lodges and residents of farmsteads	Travellers along the east-west and local farm roads	People working or travelling to work in the study area and related to the power infrastructure.

9.3 Visibility, Exposure and Intrusion

Activities associated with the Project, the PV solar park and the overhead power lines will be visible to varying degrees and distances from the sensitive viewing areas described above and as indicated in **Figure 6**. During the construction phase (approximately 18 to 24 months), the Project's visibility will be influenced due to the preparatory activities, primarily earthworks and building works. During the operational phase (approximately 30 years), the visibility of the Project will be caused by the established solar PV arrays and associated infrastructure, including the 132 kV powerline. Refer to **Figure 7** for the theoretical visibility of the Project.

Project components are planned within a landscape which has a moderate to high visual absorption capacity (savannah bushveld) for the PV arrays and low for the powerline (i.e. adjacent the main road and through open grazing land), due to the nature of land immediately adjacent and in the general vicinity of the sites and the OHPL servitude. The low profile of the PV arrays (maximum height 4m) increases the capacity of the savannah landscape to screen project components from public views. The PV arrays will likely be screened from most sensitive viewing areas as described above, other than along the northern, western and southern boundaries which are adjacent to public roads. Refer to the simulations in **Figures 8-2** and **8-3** where the landscape would be more open and lack the visual screening effect of the bushveld. Visibility of Project activities is relatively low for all other areas, in spite of the outcome of the viewshed analysis in **Figure 7**. **Figure 8-1** illustrates a distant, elevated view towards the Project sites.

The overhead powerline would be highly visible along the arterial road and into the farm land north of the road, due to its proximity to the viewer and the openness of the land, respectively. Refer to the simulation in **Figure 8-3**.

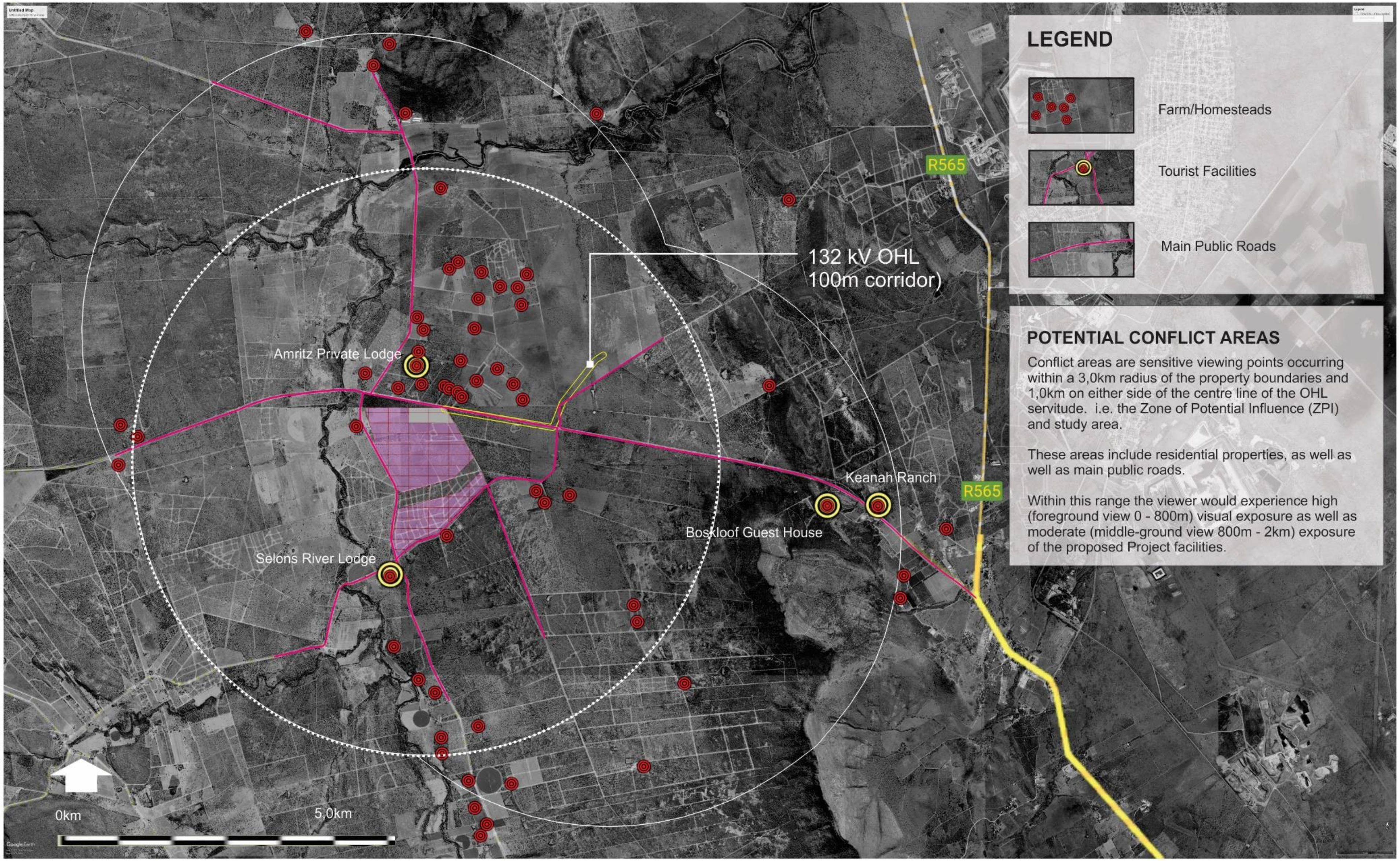

Figure 06: RECEPTOR SENSITIVITIES - Boshoek 01 Solar PV Park

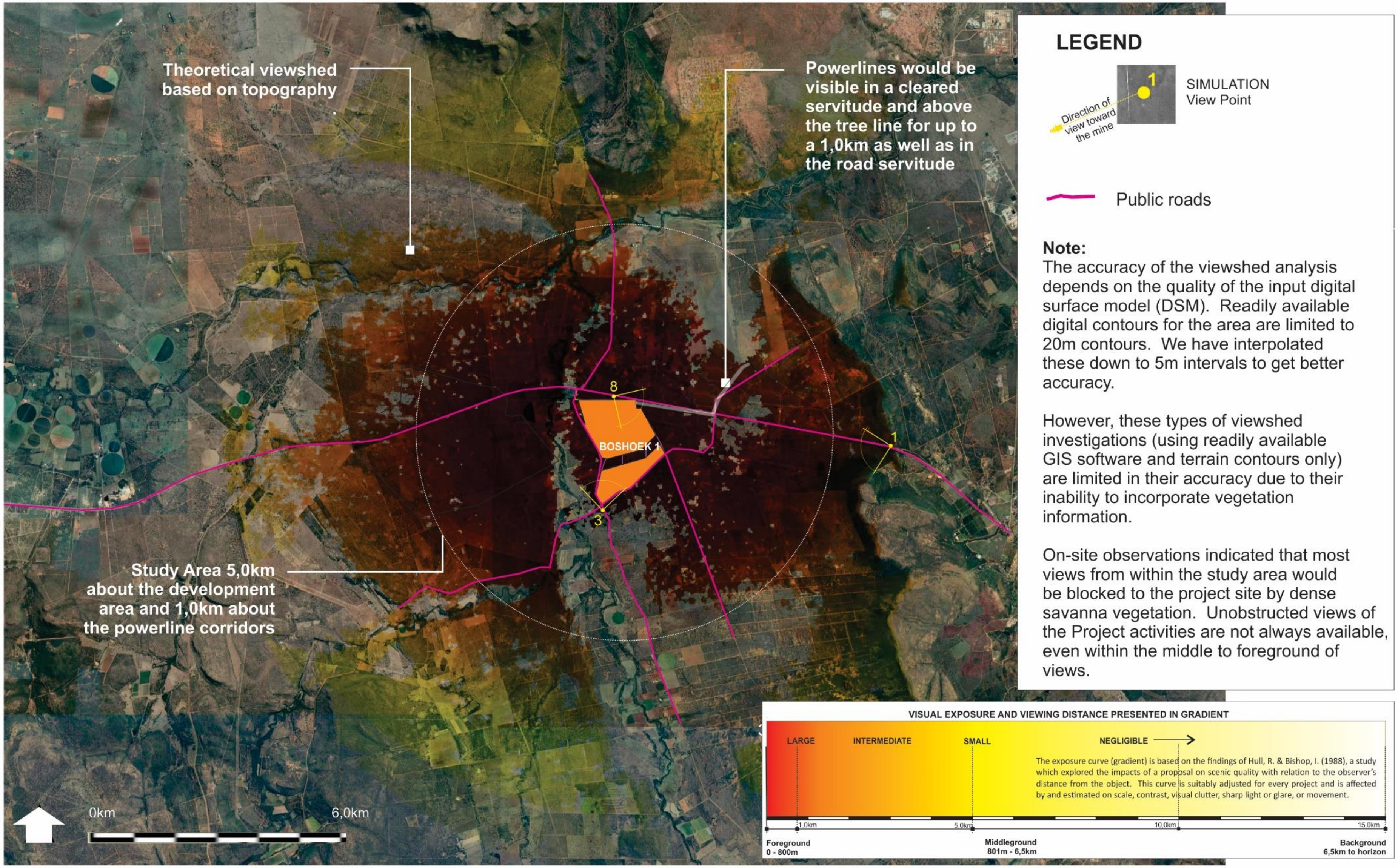

Figure 07: VIEWSHED ANALYSIS - Boshoek 1 Solar PV

Figure 8-1: SIMULATION VIEW 1 - Boshoek 1

Refer to Figure 3 for the location of the view point

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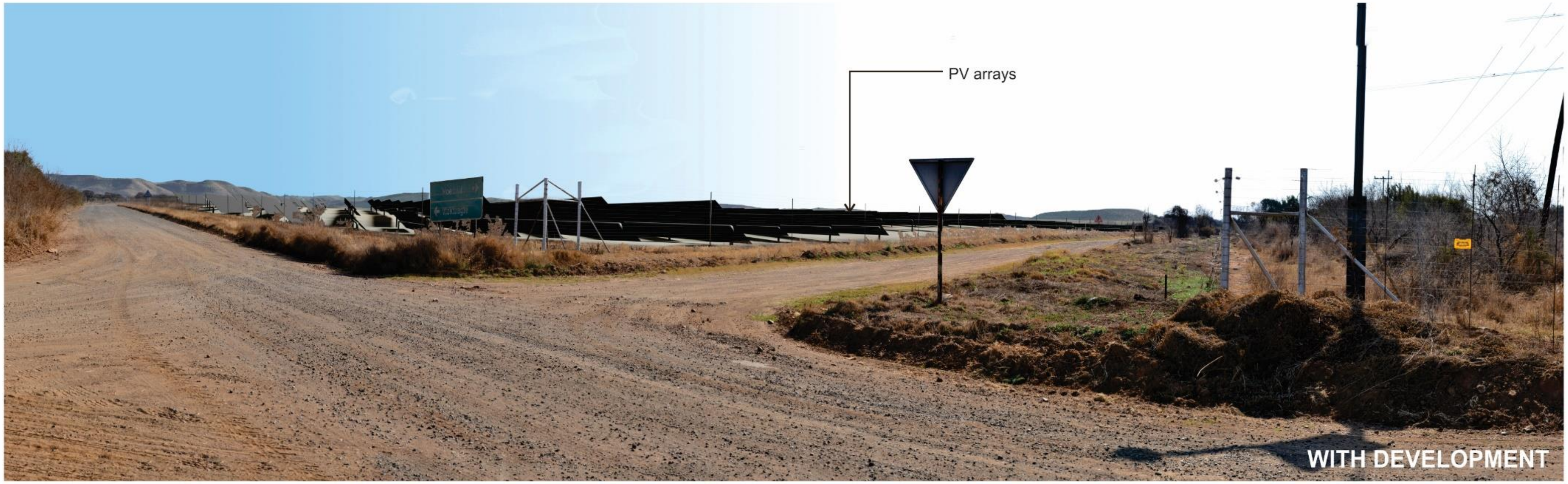

Figure 8-2: SIMULATION VIEW 3 - Boshoek 1

Refer to Figure 3 for the location of the view point

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Figure 8-3: SIMULATION VIEW 8 - Boshoek 1

Refer to Figure 3 for the location of the view point

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9.4 Effects of Night Lighting

I&APs consistently raise the impact of night lighting, specifically when they can be seen from tourist or residential sites and when the effect would continue for the Project's life. The negative effect of night lighting caused by the Project would be seen against a night sky already impacted by lights from surrounding urban areas along with the lights associated the two main road, which are busy roads at all times of day and night.

Lighting can contribute to night time light pollution, especially in areas where there are not many other light sources, as is the case for the study area. Light pollution caused by project activities, specifically at the auxiliary infrastructure area at the north eastern corner of Area 1, where the BESS, buildings, and the on-site substation are proposed. Lighting associated with this area will add to the cumulative effect of night lighting within the study area but will not significantly increase the current negative impact of existing light pollution sources. In spite of this, the management measures, as proposed in Section 10, should be implemented to limit the spillage of light beyond the Project's site boundaries.

9.5 The Severity of Visual Impact

Referring to the discussions in the previous sections and using the criteria listed in Appendix B, the *severity* of the worst-case scenario visual impact of the Project is rated in **Table 4** below for all phases of the Project. To assess the *severity* of visual impact four main factors are considered.

- *Visual Intrusion:* The nature of intrusion or contrast (physical characteristics) of a project component on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding land use within the context of the landscape's VAC.
- *Visibility:* The area/points from which project components will be visible.
- *Visual exposure:* Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion.
- *Sensitivity:* Sensitivity of visual receptors to the proposed development

In synthesising the criteria, a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful and should not be used as a substitute for reasoned professional judgement (LI-IEMA 2013). According to the worst-case scenario results tabulated below in **Table 4**, the *severity* of visual impact will be *medium* during construction and operational phases and *low* during decommissioning, from potentially sensitive viewing areas.

Table 4: *Severity* of visual impact without mitigation during construction, operational and decommissioning phases

High None	**Moderate** During the Construction and Operational Phases	**Low** During the Decommissioning Phase	**Negligible to None** Post closure with rehabilitation of the site
Major loss of or alteration to key elements / features / characteristics of the baseline in the immediate vicinity of the site.	Partial loss of or alteration to key elements / features / characteristics of the baseline. i.e. Pre-development landscape or view and / or	Minor loss of or alteration to key elements / features / characteristics of the baseline. i.e. Pre-development landscape or view and / or	Very minor or no loss or alteration to key elements/features/characteristics of the baseline. i.e. Pre-development landscape or view and / or

i.e. Pre-development landscape or view and / or introduction of elements considered to be uncharacteristic when set within the attributes of the receiving landscape. Result: A *high* scenic quality impact would result.	introduction of elements that may be prominent but may not necessarily be substantially problematic when set within the attributes of the receiving landscape. Result: A *moderate* scenic quality impact would result	introduction of elements that may not be problematic when set within the attributes of the receiving landscape. Result: A *low* scenic quality impact would result.	introduction of elements that is not problematic with the surrounding landscape – approximating the 'no change' situation. Result: *Negligible* to *no* scenic quality impacts would result.

10. MANAGEMENT MEASURES

In considering mitigating measures, three rules are considered - the measures should be feasible (economically), effective (how long will it take to implement and what provision is made for management/maintenance) and acceptable (within the framework of the existing landscape and land use policies for the area).

The following generic mitigation measures are suggested for the Project. The following general actions are recommended:

10.1 Planning and site development

- With the preparation of the land within the full extent of the site and servitude onto which activities will take place, the minimum amount of existing vegetation and topsoil should be removed.
- Specifications with regards to the placement of construction camps (if required), as well as a site plan of the construction camp, indicating waste areas, storage areas and placement of ablution facilities, should be included in the EMPr. These areas should either be screened or positioned in areas where they would be less visible from the public road north of the Project site.
- Construction activities should be limited to between 08:00 and 17:00 or in conjunction with the ECO.
- Adopt responsible construction practices that strictly contain the construction/establishment activities to demarcated areas.
- Building or waste material discarded should be undertaken at an authorised location, which should not be within any sensitive areas.

10.2 Earthworks and vegetation

- Earthworks should be executed so that only the footprint and a small 'construction buffer zone' around the proposed activities are exposed. In all other areas, the naturally occurring vegetation should be retained, especially along the periphery of the site(s) where they are adjacent to public roads.
- Disturbed soil must be exposed for the minimum time possible once cleared of vegetation to avoid prolonged exposure to wind and water erosion and to minimise dust generation.
- Maintain a 10m vegetative buffer (of existing and/or established indigenous trees) outside the project footprint and along the adjacent public roads to restrict visibility and to shield against potential glare to motorists.

10.3 Landscaping and ecological approach

- Where new vegetation is proposed to be introduced to the site, an ecological approach to rehabilitation, as opposed to a horticultural approach should be adopted. For example, communities of indigenous plants will enhance biodiversity, a desirable outcome for the area. This approach can significantly reduce long-term costs as less maintenance would be required over conventional landscaping methods as well as the introduced landscape being more sustainable.
- Progressive rehabilitation of all construction areas should be conducted immediately after they have been established.
- Undertake planting of screening vegetation along the boundaries of the Project site where required i.e. where there are open views from the adjacent public roads to the arrays or an adjacent sensitive receptor. Retain and maintain all existing vegetation outside the project footprint.

10.4 Mounting Structures and associated infrastructure

- Paint the outer rows, which face sensitive viewing sites/public roads, of the mounting structures with a dark colour that reflects and compliments the colours of the surrounding landscape. See the image below which is an indicative example of this approach.
- Ensure the perimeter fence is of a 'see through' variety and that its colour blends with the environment.

(Photo Credit: BLM 2013:198)

10.5 Good housekeeping

- "Housekeeping" procedures should be developed for the Project to ensure that the Project site and lands adjacent to the Project site are kept clean of debris, garbage, graffiti, fugitive trash, or waste generated onsite; procedures should extend to control of "track out" of dirt on vehicles leaving the active construction site and controlling sediment in stormwater runoff and the proposed wetlands.
- During construction, temporary fences surrounding the material storage yards and laydown areas should be covered with 'shack' cloth (khaki coloured).

- Operating facilities should be actively maintained during operation.

10.6 Lighting

Light pollution is largely the result of bad lighting design, which allows artificial light to shine outward and upward into the sky, where it is not wanted, instead of focusing the light downward, where it is needed. Ill-designed lighting washes out the darkness of the night sky and radically alters the light levels in rural areas where light sources shine as 'beacons' against the dark sky and are generally not wanted.

Of all the pollutions faced, light pollution is perhaps the most easily remedied. Simple changes in lighting design and installation yield immediate changes in the amount of light spilled into the atmosphere. The following are measures that must be considered in the lighting design of the Project, particularly at the management and service platforms:

- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the site i.e. lights (specifically spotlights) are to be aimed away from the nearby farmsteads (north west and south of the site), the east-west arterial road and the local feeder farm roads.
- Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on illegal entry to the site.
- Minimise the number of light fixtures to the bare minimum, including security lighting.

11. SIGNIFICANCE OF VISUAL IMPACT

The potential impact ratings are based on the worst-case scenario and when the impacts of all aspects of the Project are taken together i.e. this includes the Boshoek Solar 1 Facility and the Boshoek Solar 1 PV Grid Connection, as described in **Table 1**. It is anticipated that visual impacts could result from the activities and infrastructure in all the Project phases i.e. construction, operational, and decommissioning.

The method used for the assessment of potential impacts is set out in **Appendix C**. This assessment methodology enables the assessment of environmental impacts including cumulative impacts. Referring to the discussions in previous sections, the potential for visual impacts is rated. The estimated period for the construction phase is eighteen months and the operational phase is approximately twenty-five years. Decommissioning is estimated to be eighteen months.

The significance of potential impacts can be reduced to some degree, should the proposed mitigation options listed in **Section 10** be rigorously applied and managed throughout the life of the Project.

Tables 5 to **8** below summarise the potential visual impact for all phases of the project, as well as the potential cumulative impact.

11.1 Construction Phase

Construction activities include the removal of bushveld and grassland vegetation, earthworks required to create building terraces for substation and preparation of the internal roads as well as excavations for the array structures foundations, and the erection of the PV arrays and associated infrastructure. Construction activities would negatively affect the landscape's visual quality and sense of place relative to its baseline as they would contrast with the patterns that currently define the structure of the landscape. However, the greatest impact would be on the site itself.

The worst-case impact on the visual environment during the construction phase is assessed to have a moderate severity over a localized area (but extend beyond the site boundary) and would occur over the short-term (less than the life of the project). The probability of the unmitigated impact is medium, resulting in a predicted MEDIUM significance of negative impact. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain MEDIUM.

Table 5 summarises the assessment ratings.

Table 5 Impact Summary:

Change of landscape characteristics and key views in the CONSTRUCTION Phase

	Impact Phase: CONSTRUCTION							
	Potential impact description: Visual Impact Change of the landscape characteristics and key views i.e. visual intrusion							
	Severity	**Extent**	**Duration**	**Status**	**Consequence**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	**MEDIUM**	Medium
With Mitigation	Medium	Medium	Low	Negative	Medium	Medim	MEDIUM	Medium

Can the impact be reversed?		YES – by removing the infrastructure and rehabilitating the disturbed areas
Will impact cause irreplaceable loss or resources?		No – the resource will be returned to almost its original state after rehabilitation
Can impact be avoided, managed, or mitigated?		No – the impact is highly visible from the arterial and local access roads, and it is not possible to significantly reduce the visibility during the construction phase
	• Suppress dust during construction. • Limit area of disturbance for access roads, substations and construction camp sites • Locate construction camps and all related facilities such as stockpiles, lay-down areas, batching plants in areas already impacted such as existing farmyards or in unobtrusive locations away from the main visual receptors. Place a sack cloth screen between around construction and laydown areas. • Limit access tracks for construction and maintenance vehicles to existing roads where possible. Once established do not allow random access through the veld. • Suppress dust during construction. • Blend edges of road and platforms with surrounding landscape • Rehabilitate exposed disturbed areas as soon as is possible. • Avoid vegetation stripping in straight lines but rather non-geometric shapes that blend with the landscape. Maintain a 10m vegetative buffer (of existing and/or established indigenous trees) outside the project footprint and along the adjacent public roads to restrict visibility and to shield against potential glare to motorists. • Limit need for security lighting and ensure it is aimed away from sensitive receptor areas • Use non-reflective materials. • Paint all other project infrastructure elements such as operational buildings a dark colour to blend with the general environment.	
Residual impact		Medium significance after mitigation

Monitoring and Reporting

Monitoring or reporting of adherence to the proposed management measures should be conducted in line with the EMPr .

11.2 Operational Phase

Operational activities include the regular cleaning of the PV modules, vegetation management under and around the PV modules and maintenance of all other infrastructural components. Security lighting and other lighting associated with the movement of security vehicles at night. These activities along with the physical presence of the Project components (solar arrays, support infrastructure and the OHPL) day and night, constitute the visual impact.

The worst-case impact on the visual environment during the operational phase is assessed to have a <u>medium severity</u> over a <u>localized area</u> (but extend beyond the site boundary) and would occur over the <u>medium</u> terms (reversible over the life of the project). The probability of the unmitigated impact is <u>medium</u> resulting in a <u>MODERATE</u> predicted significance negative impact. A moderate impact implies a noticeable impact with unavoidable consequence, which will need to be accepted if the project is allowed to proceed.

Mitigation measures are feasible and can reduce the visual impact over time (once the proposed tree screens are established). The impact with mitigation is predicted to be <u>LOW</u>.

Table 6 below summarized the assessment ratings.

Table 6 Impact Summary:

Change of landscape characteristics and key views in the OPERATIONAL Phase

	Impact Phase: OPERATIONAL							
	Potential impact description: Visual Impact Change of the landscape characteristics and key views i.e. visual intrusion and potential glint and glare							
	Severity	**Extent**	**Duration**	**Status**	**Consequence**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Medium	Negative	Medium	Medium	**MEDIUM**	Medium
With Mitigation	Low	Medium	Low	Negative	Low	Low	**LOW**	Medium
Can the impact be reversed?				YES – by removing the infrastructure and rehabilitating the disturbed area				
Will impact cause irreplaceable loss or resources?				No – the resource will be returned to almost its original state after rehabilitation				
Can impact be avoided, managed, or mitigated?				Yes – by ensuring that existing bushveld is maintained in a 20m buffer zone around the properties and where there is no bushveld, planting indigenous tree screens and maintaining them.				
	• Suppress dust during operation by maintaining access roads, substations and office/admin areas with appropriate dust suppressants. • Ensure effect maintenance of the tree screens around the property. • Limit need for security lighting and ensure it is aimed away from sensitive receptor areas • Use non-reflective materials. • Paint all other project infrastructure elements such as operational buildings a dark colour to blend with the general environment.							
Residual impact			Low significance with successful mitigation					

Monitoring and Reporting

Monitoring or reporting of adherence to the proposed management measures should be conducted in line with the EMPr .

11.3 Decommissioning

Decommissioning and closure activities include the dismantling and removal of infrastructure and the rehabilitation of the site back to its current, mostly natural, state.

The worst-case impact on the visual environment during the construction phase is assessed to have a <u>medium severity</u> over a <u>localized area</u> (but extend beyond the site boundary) and would occur over the <u>short-term </u>(less than the life of the project). The probability of the unmitigated impact is <u>medium</u>*,* resulting in a predicted <u>LOW</u> significance of negative impact. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain <u>LOW.</u>

Table 7 below, summarises the assessment ratings.

Table 7 Impact Summary:

Change of landscape characteristics and key views in the DECOMMISIONING Phase

	Impact Phase: DECOMMISSIONING							
	Potential impact description: Visual Impact Change of the landscape characteristics and key views i.e. visual intrusion							
	Severity	**Extent**	**Duration**	**Status**	**Consequence**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Low	Medium	Low	Negative	Low	Medium	MEDIUM	Medium
With Mitigation	Low	Medium	Low	Negative	Low	Medim	MEDIUM	Medium
Can the impact be reversed?				YES – by removing the infrastructure and rehabilitating the disturbed area				
Will impact cause irreplaceable loss or resources?				No – the resource will be returned to almost its original state after rehabilitation				
Can impact be avoided, managed, or mitigated?				No – the impact is highly visible from the arterial road, and it is not possible to significantly reduce the visibility during the construction phase				
	• Remove all project components from site • Rip all compacted hard surfaces such as platforms, words areas, access and service roads etc. and reshape to blend with the surrounding landscape • Rehabilitate/revegetate all disturbed areas to visually the original state by shaping and planting							
Residual impact			Minor but generally none (The rehabilitated areas might not be visually compatible with the existing surrounding vegetation).					

Monitoring and Reporting

Monitoring or reporting of adherence to the proposed management measures should be conducted in line with the EMPr .

11 CUMULATIVE EFFECT

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the near future. They may also affect how the landscape is experienced, and cumulative effects may be positive or negative. Where they comprise a range of benefits, they may form part of the mitigation measures. Cumulative effects can also arise from the intervisibility of a range of developments and the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual developments may not be significant, but they may adversely impact visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, vegetative cover or other visual obstruction, elevation and distance, as this affects visually acuity, which is also influenced by weather and light conditions (LI-IEMA (2013)). Refer also to Figure 9 – Viewshed Analysis Boshoek Solar PV Cluster and Figure 9-1, which illustrates the proposed three projects from viewpoint number 1.

11.1 The cumulative effect of the Project

The cumulative impact of the Project during the operational phase is potentially MEDIUM when the Project site is considered along with the other two Boshoek solar PV facilities and the associated powerline and substation infrastructure. The intervisibility and these components along with the existing power lines would over time, result in the nature and character of the sub-region being impacted in a manner beyond the anticipated moderate (without mitigation) negative impact of the proposed Project alone.

The significance of the cumulative impact of these activities on the visual environment during their operational phase of the Project is assessed to have a medium severity and over the medium-term with an unmitigated sub-regional impact assessed as MEDIUM. **Table 8** below summarises the potential cumulative impact.

Table 8 Impact Summary:

Change of landscape characteristics and key views: CUMULATIVE EFFECT

	Impact Phase: OPERATIONAL							
	Potential impact description: Visual Impact Change of the landscape characteristics and key views and potential glint and glare							
	Severity	**Extent**	**Duration**	**Status**	**Consequence**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Medium	Negative	Medium	Medium	MEDIUM	Medium
With Mitigation	Low	Medium	Low	Negative	Low	Low	LOW	Medium
Can the impact be reversed?				YES – by removing the infrastructure and rehabilitating the disturbed areas – existing elements (ESKOM powerline) would most likely remain				
Will impact cause irreplaceable loss or resources?				No – but there will be a loss during all phases of the project. However, the Project sites can be rehabilitated post-closure.				
Can impact be avoided, managed, or mitigated?				NO but can be managed at night by managing the light design and placement and maintaining/establishing tree screens along the site's boundaries with adjacent public roads.				
Residual impact			*Yes, but would reduce once solar PVs and associated power distribution infrastructure is removed and the residual impact would revert back to the current cumulative infrastructure consisting of transmission lines.*					

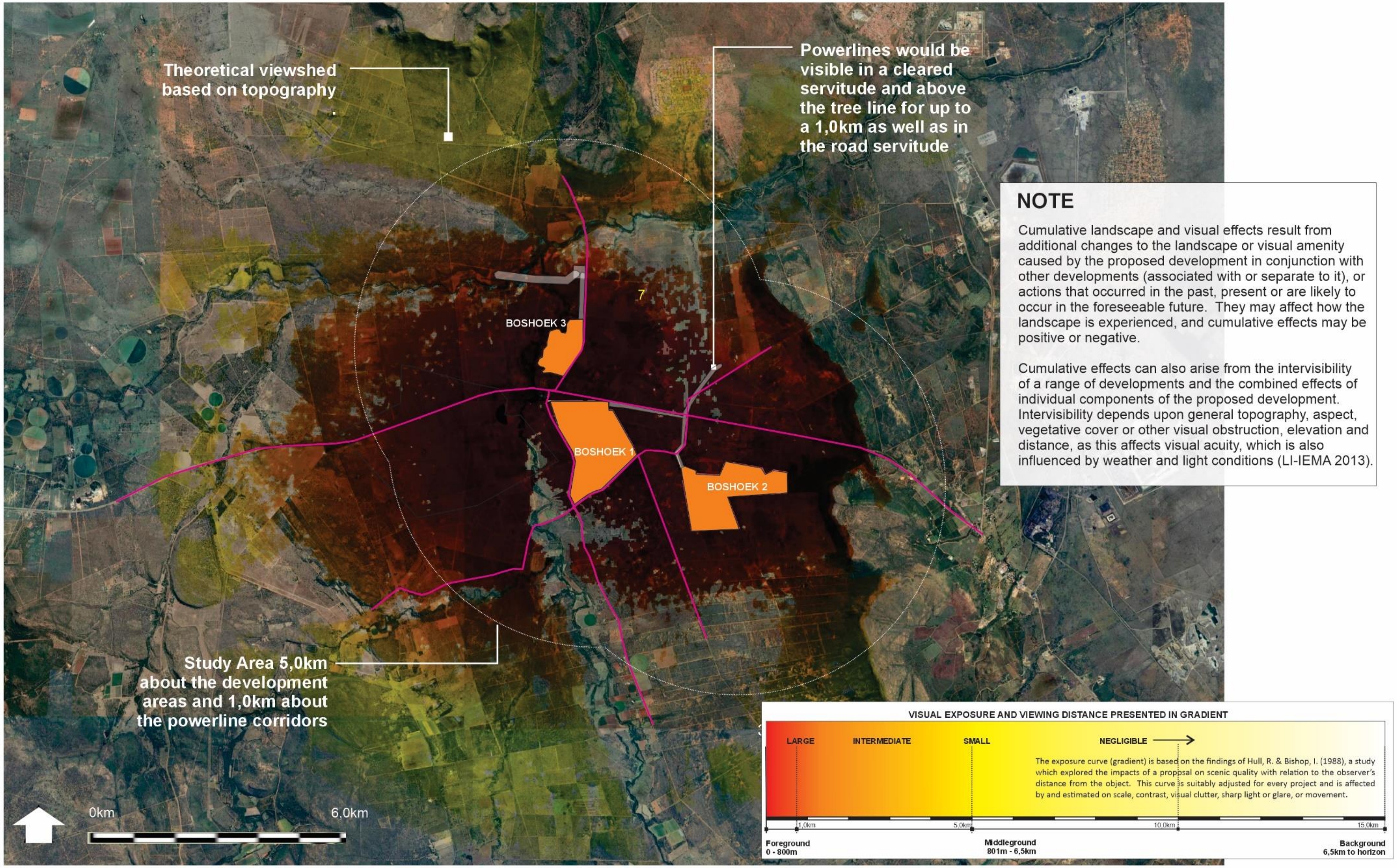

Figure 09: VIEWSHED ANALYSIS CUMULATIVE - Boshoek Cluster Solar PV

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Landscape Architect
082 462 1491

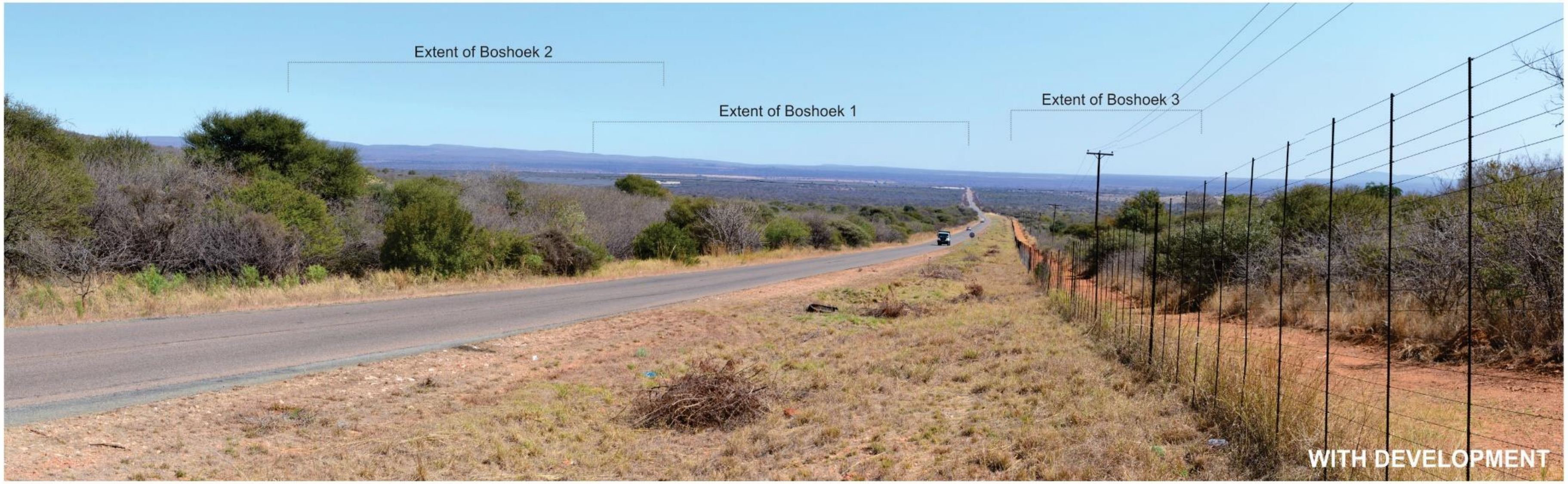

Figure 9-1: SIMULATION VIEW 1 - Boshoek Cluster Cumulative

Refer to Figure 3 for the location of the view point

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12 CONCLUSION

The existing visual condition of the landscape that may be affected by the proposed Boshoek Solar 1 Project and associated OHPL infrastructure has been described. The study area's scenic quality has been rated *moderate* to *high* within the context of the sub-region. Sensitive viewing areas have been identified and mapped, indicating potential moderate to high sensitivity to the Project, mainly for nearby tourist accommodation and adjacent roads.

Impacts on views are the highest when viewers are sensitive to change in the landscape, and the view is focused on and dominated by the change. The Project's visual impact will cause changes in the landscape that are noticeable to people viewing the landscape from nearby farmsteads/game farms and along the east west arterial road and local farm roads. The potential impact ratings are based on the worst-case scenario and when the impacts of all aspects of the Project are taken together. It is anticipated that visual impacts could result from the activities and infrastructure in all the Project phases i.e. construction, operational, and decommissioning, however, due to the screening effect and the relatively high VAC of the bushveld vegetation, the potential for high visual impacts is limited. There is also the possibility of glint and glare that would affect road users of the adjacent public roads.

12.1 The visual impact of the Project

The worst-case impact on the visual environment during the construction phase is assessed to have a moderate severity over a localized area (but extend beyond the site boundary) and would occur over the short-term (less than the life of the project). The probability of the unmitigated impact is medium, resulting in a predicted MEDIUM significance of negative impact. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain MEDIUM.

The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain MEDIUM.

The worst-case impact on the visual environment during the operational phase is assessed to have a medium severity over a localized area (but extend beyond the site boundary) and would occur over the medium terms (reversible over the life of the project). The probability of the unmitigated impact is medium resulting in a MODERATE predicted significance negative impact. A moderate impact implies a noticeable impact with unavoidable consequence, which will need to be accepted if the project is allowed to proceed.

Mitigation measures are feasible and can reduce the visual impact over time (once the proposed tree screens are established). The impact with mitigation is predicted to be LOW.

Decommissioning and closure activities include the dismantling and removal of infrastructure and the rehabilitation of the site back to its current, mostly natural, state.

The worst-case impact on the visual environment during the construction phase is assessed to have a medium severity over a localized area (but extend beyond the site boundary) and would occur over the short-term (less than the life of the project). The probability of the unmitigated impact is medium, resulting in a predicted LOW significance of negative impact. The implementation of mitigation measures would not significantly reduce the anticipated impact, which would remain LOW.

12.2 The Cumulative Impact of the Project

The significance of the cumulative impact of the Boshoek Solar PV Cluster on the visual environment during their operational phase of the Project is assessed to have a medium intensity and over the medium-term with an unmitigated sub-regional impact assessed as MEDIUM.

12.3 Author's Opinion

It is the opinion of GYLA that the visual impacts associated with the proposed Project are of a nature, scale and duration that will require mitigation to reduce the predicted impact from MEDIUM to LOW during the operational phase. GYLA believes that the impacts associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels provided the recommended measures are effectively implemented and managed in the long term.

****GYLA****

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APPENDIX A: DETERMINING THE VISUAL RESOURCE VALUE OF A LANDSCAPE

To reach an understanding of the effect of development on a landscape resource, it is necessary to consider the distinct aspects of the landscape as follows:

Landscape Elements and Character

The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, savannah, trees, water bodies, buildings and roads are generally quantifiable and can be easily described.

Landscape character is therefore the description of pattern, resulting from combinations of natural (physical and biological) and cultural (land use) factors and how people perceive these. The visual dimension of the landscape reflects the way in which these factors create repetitive groupings and interact to create areas that have a specific visual identity. The process of landscape character assessment can increase appreciation of what makes the landscape distinctive and what is important about an area. The description of landscape character thus focuses on the *nature of the land*, rather than the response of a viewer.

Landscape Value – all encompassing (Aesthetic Value)

Aesthetic value is the emotional response derived from the experience of the environment with its natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes (Ramsay 1993). Thus, aesthetic value encompasses more than the seen view, visual quality or scenery, and includes atmosphere, landscape character and sense of place (Schapper 1993).

Aesthetic appeal (value) is considered high when the following are present (Ramsay 1993):

- *Abstract qualities*: such as the presence of vivid, distinguished, uncommon or rare features or abstract attributes.
- *Evocative responses*: the ability of the landscape to evoke particularly strong responses in community members or visitors.
- *Meanings*: the existence of a long-standing special meaning to a particular group of people or the ability of the landscape to convey special meanings to viewers in general.
- *Landmark quality*: a particular feature that stands out and is recognised by the broader community.

Sense of Place

Central to the concept of a sense of place is that the place requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape together with the cultural transformations and traditions associated with historic use and habitation. According to Lynch (1992) sense of place "is the extent to which a person can recognise or recall a place as being distinct from other places - as having a vivid, or unique, or at least particular, character of its own". Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. In some cases, these values allocated to the place are similar for a wide spectrum of users or viewers, giving the place a universally recognised and therefore, strong sense of place.

Scenic Quality

Assigning values to visual resources is a subjective process. The phrase, "beauty is in the eye of the beholder," is often quoted to emphasise the subjectivity in determining scenic values. Yet, researchers have found consistent levels of agreement among individuals asked to evaluate visual quality.

Studies for perceptual psychology have shown human preference for landscapes with a higher visual complexity particularly in scenes with water, over homogeneous areas. Based on contemporary research landscape quality increases when:

- Topographic ruggedness and relative relief increase.
- Where water forms are present.
- Where diverse patterns of grasslands and trees occur.
- Where natural landscape increases and human-caused landscape decreases.
- And where land use compatibility increases, and land use edge diversity decreases (Crawford 1994).

Scenic Quality - Explanation of Rating Criteria:

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Landform: Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental, as the Fish River or Blyde River Canyon, the Drakensberg or other mountain ranges, or they may be exceedingly artistic and subtle as certain pinnacles, arches, and other extraordinary formations.

Vegetation: (Plant communities) Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular (wildflower displays in the Karoo regions). Consider also smaller scale vegetational features, which add striking and intriguing detail elements to the landscape (e.g., gnarled or wind beaten trees, and baobab trees).

Water: That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.

Colour: Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast, and harmony.

Adjacent Scenery: Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0-8 kilometres, depending upon the characteristics of the topography, the vegetative cover, and other such factors. This factor is generally applied to units which would normally rate extremely low in score, but the influence of the adjacent unit would enhance the visual quality and raise the score.

Scarcity: This factor provides an opportunity to give added importance to one or all the scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is several not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognise this type of area and give it the added emphasis it needs.

Cultural Modifications: Cultural modifications in the landform / water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit.

Scenic Quality Inventory and Evaluation Chart

(After The Visual Resource Management System, Department of the Interior of the USA Government, Bureau of Land Management)

Key factors	Rating Criteria and Score

Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major Badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers. **5**	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features which are interesting though not dominant or exceptional. **3**	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. **1**
Vegetation and landcover	A variety of vegetative types as expressed in interesting forms, textures, and patterns. **5**	Some variety of vegetation, but only one or two major types. **3**	Little or no variety or contrast in vegetation. **1**
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. **5**	Flowing, or still, but not dominant in the landscape. **3**	Absent, or present, but not noticeable. **0**
Colour	Rich colour combinations, variety, or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. **5**	Some intensity or variety in colours and contrast of the soil, rock, and vegetation, but not a dominant scenic element. **3**	Subtle colour variations, contrast, or interest; generally mute tones. **1**
Influence of adjacent scenery	Adjacent scenery greatly enhances visual quality. **5**	Adjacent scenery moderately enhances overall visual quality. **3**	Adjacent scenery has little or no influence on overall visual quality. **0**
Scarcity	One of a kind; or unusually memorable, or exceedingly rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. National and provincial parks and conservation areas *** 5+**	Distinctive, though somewhat like others within the region. **3**	Interesting within its setting, but common within the region. **1**
Cultural modifications	Modifications add favourably to visual variety while promoting visual harmony.	Modifications add little or no visual variety to the area and introduce no discordant elements.	Modifications add variety but are very discordant and promote strong disharmony.

	2	0	4

Scenic Quality (i.e. value of the visual resource)

In determining the quality of the visual resource both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is very high.

When considering both objective and subjective factors associated with the landscape there is a balance between landscape character and individual landscape features and elements, which would result in the values as follows:

Value of Visual Resource – expressed as Scenic Quality
(After The Landscape Institute with the Institute of Environmental Management and Assessment (2002))

High	Moderate	Low
Areas that exhibit an incredibly positive character with valued features that combine to give the experience of unity, richness, and harmony. These are landscapes that may be of particular importance to conserve, and which may be sensitive change in general and which may be detrimental if change is inappropriately dealt with.	Areas that exhibit positive character, but which may have evidence of alteration to /degradation/erosion of features resulting in areas of more mixed character. Potentially sensitive to change in general; again, change may be detrimental if inappropriately dealt with, but it may not require special or particular diligence.	Areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.

APPENDIX B: METHOD FOR DETERMINING THE *SEVERITY / INTESITY* OF LANDSCAPE AND VISUAL IMPACT

A visual impact study analysis addresses the importance of the inherent aesthetics of the landscape, the public value of viewing the natural landscape, and the contrast or change in the landscape from the Project.

For some topics, such as water or air quality, it is possible to use measurable, technical international or national guidelines or legislative standards, against which potential effects can be assessed. The assessment of likely effects on a landscape resource and on visual amenity is more complex, since it is determined through a combination of quantitative and qualitative evaluations. (The Landscape Institute with the Institute of Environmental Management and Assessment (2002).

Landscape impact assessment includes a combination of objective and subjective judgements, and it is therefore important that a structured and consistent approach is used. It is necessary to differentiate between judgements that involve a degree of subjective opinion (as in the assessment of landscape value) from those that are normally more objective and quantifiable (as in the determination of severity of change). Judgement should always be based on training and experience and be supported by clear evidence and reasoned argument. Accordingly, suitably qualified and experienced landscape professionals carry out landscape and visual impact assessments (The Landscape Institute with the Institute of Environmental Management and Assessment (2002),

Landscape and visual assessments are separate, although linked, procedures. The landscape baseline, its analysis and the assessment of landscape effects all contribute to the baseline for visual assessment studies. The assessment of the potential effect on the landscape is carried our as an effect on an environmental resource, i.e. the landscape. Visual effects are assessed as one of the interrelated effects on population.

Landscape Impact

Landscape impacts derive from changes in the physical landscape, which may give rise to changes in its character and from effects to the scenic values of the landscape. This may in turn affect the perceived value ascribed to the landscape. The description and analysis of effects on a landscape resource relies on the adoption of certain basic principles about the positive (or beneficial) and negative (or adverse) effects of change in the landscape. Due to the inherently dynamic nature of the landscape, change arising from a development may not necessarily be significant (Institute of Environmental Assessment & The Landscape Institute (2002)).

Visual Impact

Visual impacts relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity. Visual impact is therefore measured as the change to the existing visual environment (caused by the physical presence of a new development) and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the area.

To assess the severity of visual impact four main factors are considered.

Visual Intrusion:	The nature of intrusion or contrast (physical characteristics) of a project component on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding land use.
Visibility:	The area/points from which project components will be visible.
Visual exposure:	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion.
Sensitivity:	Sensitivity of visual receptors to the proposed development

Visual Intrusion / contrast

Visual intrusion deals with the notion of contextualism i.e. how well does a project component fit into the ecological and cultural aesthetic of the landscape as a whole? Or conversely what is its contrast with the receiving environment. Combining landform / vegetation contrast with structure contrast derives overall visual intrusion/contrast levels of high, moderate, and low.

Landform / vegetation contrast is the change in vegetation cover and patterns that would result from construction activities. Landform contrast is the change in landforms, exposure of soils, potential for erosion scars, slumping, and other physical disturbances that would be noticed as uncharacteristic in the natural landscape. Structure contrast examines the compatibility of the proposed development with other structures in the landscape and the existing natural landscape. Structure contrast is typically strongest where there are no other structures (e.g., buildings, existing utilities) in the landscape setting.

Photographic panoramas from key viewpoints before and after development are presented to illustrate the nature and change (contrast) to the landscape created by the proposed development. A computer simulation technique is employed to superimpose a graphic of the development onto the panorama. The extent to which the component fits or contrasts with the landscape setting can then be assessed using the following criteria.

- Does the physical development concept have a negative, positive, or neutral effect on the quality of the landscape?
- Does the development enhance or contrast with the patterns or elements that define the structure of the landscape?
- Does the design of the Project enhance and promote cultural continuity, or does it disrupt it?

The consequence of the intrusion / contrast can then be measured in terms of the sensitivity of the affected landscape and visual resource given the criteria listed below. For instance, within an industrial area, a new sewage treatment works may have an insignificant landscape and visual impact; whereas in a *valued* landscape it might be considered to be an intrusive element. (Institute of Environmental Assessment & The landscape Institute (1996)).

Visual Intrusion

High	Moderate	Low	Positive
If the Project: - Has a substantial negative effect on the visual quality of the landscape. - Contrasts dramatically with the patterns or elements that define the structure of the landscape. - Contrasts dramatically with land use, settlement, or enclosure patterns. - Is unable to be 'absorbed' into the	If the Project: - Has a moderate negative effect on the visual quality of the landscape. - Contrasts moderately with the patterns or elements that define the structure of the landscape. - Is partially compatible with land use, settlement, or enclosure patterns. - Is partially 'absorbed' into the landscape.	If the Project: - Has a minimal effect on the visual quality of the landscape. - Contrasts minimally with the patterns or elements that define the structure of the landscape. - Is mostly compatible with land use, settlement, or enclosure patterns. - Is 'absorbed' into the landscape.	If the Project: - Has a beneficial effect on the visual quality of the landscape. - Enhances the patterns or elements that define the structure of the landscape. - Is compatible with land use, settlement, or enclosure patterns.

landscape.

Result	*Result*	*Result*	*Result*
Notable change in landscape characteristics over an extensive area and/or intensive change over a localised area resulting in major changes in key views.	Moderate change in landscape characteristics over localised area resulting in a moderate change to key views.	Imperceptible change resulting in a minor change to key views.	Positive change in key views.

Visual intrusion also diminishes with scenes of higher complexity, as distance increases, the object becomes less of a focal point (more visual distraction), and the observer's attention is diverted by the complexity of the scene (Hull and Bishop (1988)).

Visibility

A viewshed analysis was carried out to define areas, which contain all possible observation sites from which the development would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1.8m above ground level. Topographic data was captured for the site and its environs at 10 m contour intervals to create the Digital Terrain Model (DTM). The DTM includes features such as vegetation, rivers, roads and nearby urban areas. These features were 'draped' over the topographic data to complete the model used to generate the viewshed analysis. It should be noted that viewshed analyses are not absolute indicators of the level of significance (severity) of the impact in the view, but merely a statement of the fact of potential visibility. The visibility of a development and its contribution to visual impact is predicted using the criteria listed below:

Visibility

High	Moderate	Low
Visual Receptors If the development is visible from over half the zone of potential influence, and/or views are mostly unobstructed and/or most viewers are affected.	*Visual Receptors* If the development is visible from less than half the zone of potential influence, and/or views are partially obstructed and or many viewers are affected	*Visual Receptors* If the development is visible from less than a quarter of the zone of potential influence, and/or views are mostly obstructed and/or few viewers are affected.

Visual Exposure

Visual exposure relates directly to the distance of the view. It is a criterion used to account for the limiting effect of increased distance on visual impact. The impact of an object in the foreground (0 – 800m) is greater than the impact of that same object in the middle ground (800m – 5.0 km) which, in turn is greater than the impact of the object in the background (greater than 5.0 km) of a particular scene.

Distance from a viewer to a viewed object or area of the landscape influences how visual changes are perceived in the landscape. Generally, changes in form, line, colour, and texture in the landscape become less perceptible with increasing distance.

Areas seen from 0 to 800m are considered foreground; foliage and fine textural details of vegetation are normally perceptible within this zone.

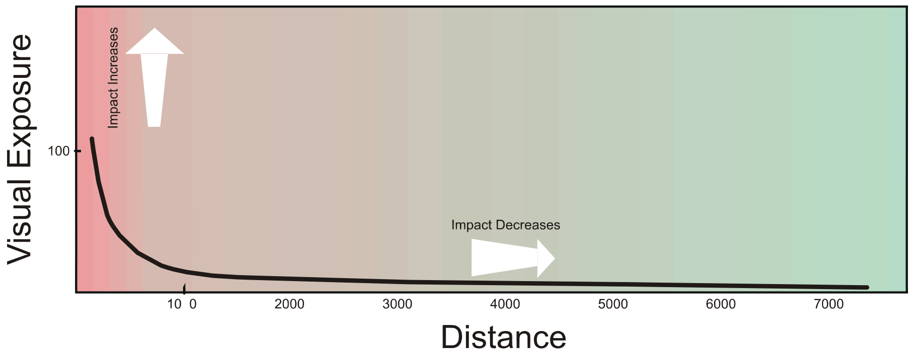
Areas seen from 800m to 5.0km are considered middle ground; vegetation appears as outlines or patterns. Depending on topography and vegetation, middle ground is sometimes considered to be up to 8.0km.

Areas seen from 5.0km to 8.0km and sometimes up to 16km and beyond are considered background. Landforms become the most dominant element at these distances.

Seldom seen areas are those portions of the landscape that, due to topographic relief or vegetation, are screened from the viewpoint or are beyond 16km from the viewpoint. Landforms become the most dominant element at these distances.

The impact of an object diminishes at an exponential rate as the distance between the observer and the object increases. Thus, the visual impact at 1000 m would be 25% of the impact as viewed from 500 m. At 2000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (e.g.: Hull and Bishop (1988)) and is used as an important criteria for the study. This principle is illustrated in the Figures below.

Effect of Distance on Visual Exposure



View from 10 000 metres

View from 5 000 metres

View from 3 000 metres

View from 1 000 metres

Sensitivity of Visual Receptors

When visual intrusion, visibility and visual exposure are incorporated, and qualified by sensitivity criteria (visual receptors) the severity of the impact of the development can be determined.

The sensitivity of visual receptors and views will be depended on:

- The location and context of the viewpoint.
- The expectations and occupation or activity of the receptor.
- The importance of the view (which may be determined with respect to is popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art).

The most sensitive receptors may include:

- Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape.
- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community.
- Occupiers of residential properties with views affected by the development.
- These would all be high

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value).
- People travelling through or past the affected landscape in cars, on trains or other transport routes.
- People at their place of work.

The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view.

In this process more weight is usually given to changes in the view or visual amenity which are greater in scale, and visible over a wide area. In assessing the effect on views, consideration should be given to the effectiveness of mitigation measures, particularly where planting is proposed for screening purposes (Institute of Environmental Assessment & The Landscape Institute (1996).

Sensitivity of Visual Receptors

High	Moderate	Low

Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape. Communities where the development results in changes in the landscape setting or valued views enjoyed by the community. Occupiers of residential properties with views affected by the development.	People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value). People travelling through or past the affected landscape in cars, on trains or other transport routes.	The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view (i.e. office and industrial areas). Roads going through urban and industrial areas

Severity of the Visual Impact

Potential visual impacts are determined by analysing how the physical change in the landscape, resulting from the introduction of a project, are viewed and perceived from sensitive viewpoints. Impacts to views are the highest when viewers are identified as being sensitive to change in the landscape, and their views are focused on and dominated by the change. Visual impacts occur when changes in the landscape are noticeable to viewers looking at the landscape from their homes or from parks, and conservation areas, highways and travel routes, and important cultural features and historic sites, especially in foreground views.

The severity of impact is assessed through a synthesis of visual intrusion, visibility, visual exposure and viewer sensitivity criteria. Once the severity of impact has been established this value is further qualified with spatial, duration and probability criteria to determine the *significance* of the visual impact.

For instance, the fact that visual intrusion and exposure diminishes significantly with distance does not necessarily imply that the relatively small impact that exists at greater distances is unimportant. The level of impact that people consider acceptable may be dependent upon the purpose they have in viewing the landscape. A particular development may be unacceptable to a hiker seeking a natural experience, or a household whose view is impaired, but may be barely noticed by a golfer concentrating on his game or a commuter trying to get to work on time (Ittleson *et al.,* 1974).

In synthesising these criteria a numerical or weighting system is avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement. (Institute of Environmental Assessment and The landscape Institute (1996)).

Intensity (Severity) of Visual Impact

High	Moderate	Low	Negligible
Total loss of or major alteration to key elements/features/characteristics of the baseline.	Partial loss of or alteration to key elements/features/characteristics of the baseline.	Minor loss of or alteration to key elements/features/characteristics of the baseline.	Very minor loss or alteration to key elements/features/characteristics of the baseline.

I.e. Pre-development landscape or view and/or introduction of elements considered to be totally uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and/or introduction of elements that may be prominent but may not necessarily be substantially uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and/or introduction of elements that may not be uncharacteristic when set within the attributes of the receiving landscape.	I.e. Pre-development landscape or view and/or introduction of elements that are not uncharacteristic with the surrounding landscape – approximating the 'no change' situation.
High scenic quality impacts would result.	Moderate scenic quality impacts would result	Low scenic quality impacts would result.	Negligible scenic quality impacts would result.

Cumulative effects

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the intervisibility (visibility) of a range of developments and /or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effect on visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions. (Institute of Environmental Assessment and The landscape Institute (1996)).

APPENDIX C: CRITERIA FOR SIGNIFICANCE OF IMPACT ASSESSMENT (AGES)

The significance of environmental aspects can be determined and ranked by considering the criteria presented in Table 1. In some cases it may be necessary to undertake the impact assessment to determine whether a particular aspect is significant. Therefore, a fair degree of iteration is unavoidable during the assessment process.

Table 1: Criteria used to determine the significance of environmental aspects

Significance Ranking	Negative Aspects	Positive Aspects
H (High)	Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.	Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.
M (Moderate)	Has characteristics that could cause negative impacts.	Has characteristics that could cause positive impacts.
L (Low)	Will never exceed legislation or standards. Unlikely to cause significant negative impacts.	Will always comply with all legislation and standards. Unlikely to cause significant positive impacts.

SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Where significant environmental aspects are present ("high" or "moderate"), significant environmental impacts ***may*** result. The significance of the impacts associated with the significant aspects can be determined by considering the risk:

Significance of Environmental Impact (Risk) = Probability x Consequence

The consequence of impacts can be described by considering the severity, spatial extent and duration of the impact.

Severity of Impacts

Table 2 presents the ranking criteria that can used to determine the severity of impacts on the bio-physical and socio-economic environment. Table 3 provides additional ranking criteria for determining the severity of negative impacts on the bio-physical environment.

Table 2: Criteria for ranking the *Severity* of environmental impacts

Type of Criteria	Negative			Positive		
	H-	M-	L-	L+	M+	H+
Qualitative	Substantial deterioration. Death, illness, or injury.	Moderate deterioration. Discomfort.	Minor deterioration. Nuisance or minor irritation.	Minor improvement.	Moderate improvement.	Substantial improvement.
Quantitative	Measurable deterioration.		Change not measurable i.e., will remain within current range.		Measurable improvement.	
	Recommended level will often be violated.	Recommended level will occasionally be violated.	Recommended level will never be violated.		Will be within or better than recommended level.	

Community Response	Vigorous community action.	Widespread complaints.	Sporadic complaints.	No observed reaction.	Favorable publicity

Table 3: Criteria for ranking the *Severity* of negative impacts on the bio-physical environment

Environment	Ranking Criteria		
	Low (L-)	**Medium (M-)**	**High (H-)**
Soils and land capability	Minor deterioration in land capability. Soil alteration resulting in a low negative impact on one of the other environments (e.g., ecology).	Partial loss of land capability. Soil alteration resulting in a moderate negative impact on one of the other environments (e.g., ecology).	Complete loss of land capability. Soil alteration resulting in a high negative impact on one of the other environments (e.g., ecology).
Ecology (Plant and animal life)	Disturbance of areas that are degraded, have little conservation value or are unimportant to humans as a resource. Minor change in species variety or prevalence.	Disturbance of areas that have some conservation value or are of some potential use to humans. Complete change in species variety or prevalence.	Disturbance of areas that are pristine, have conservation value or are an important resource to humans. Destruction of rare or endangered species.
Surface and Groundwater	Quality deterioration resulting in a low negative impact on one of the other environments (ecology, community health etc.)	Quality deterioration resulting in a moderate negative impact on one of the other environments (ecology, community health etc.).	Quality deterioration resulting in a high negative impact on one of the other environments (ecology, community health etc.).

Table 4: Ranking the *Duration* and *Spatial Scale* of impacts

	Ranking Criteria		
	L	**M**	**H**
Duration	Quickly reversible Less than the project life Short-term	Reversible over time Life of the project Medium-	Permanent Beyond closure Long-
Spatial Scale	Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary

Where the severity of an impact varies with distance, the severity should be determined at the point of compliance or the point at which sensitive receptors will be encountered. This position corresponds to the spatial extent of the impact.

Consequence of Impacts

Having ranked the severity, duration and spatial extent, the overall consequence of impacts can be determined using the following qualitative guidelines:

Table 5: Ranking the *Consequence* of an impact

SEVERIT Y = L

DURATION	Long-term	**H**			
	Medium-term	**M**			**MEDIUM**
	Short-term	**L**	**LOW**		

SEVERITY = M

DURATION	Long-term	**H**			**HIGH**
	Medium-term	**M**		**MEDIUM**	
	Short-term	**L**	**LOW**		

SEVERITY = H

DURATION	Long-term	**H**			
	Medium-term	**M**			**HIGH**
	Short-term	**L**	**MEDIUM**		
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary
			SPATIAL SCALE		

To use Table 5, firstly go to one of the three "layers" based on the severity ranking obtained from Table 2 and/ or Table 3. Thereafter determine the consequence ranking by locating the intersection of the appropriate duration and spatial scale rankings.

Overall Significance of Impacts

Combining the consequence of the impact and the probability of occurrence, as shown by Table 6, provides the overall significance (risk) of impacts.

Table 6 – Ranking the *Overall Significance* of impacts

PROBABILITY	Definite Continuou	**H**	**MEDIUM**		**HIGH**
	Possibl e	**M**		**MEDIUM**	
	Unlikely Seldom	**L**	**LOW**		**MEDIUM**
			L	**M**	**H**
			CONSEQUENCE (from Table 5)		

Table 6: Ranking the *Overall Significance* of impacts

PROBABILITY	Definite Continuous	**H**	**MEDIUM**		**HIGH**
	Possible Frequent	**M**		**MEDIUM**	
	Unlikely Seldom	**L**	**LOW**		**MEDIUM**
			L	**M**	**H**
			CONSEQUENCE (from Table 5)		

The overall significance ranking of the negative environmental impacts provides the following guidelines for decision making:

Table 7: Guidelines for decision-making

Overall Significance Ranking	Nature of Impact	Decision Guideline
High	Unacceptable impacts.	Likely to be a fatal flaw.
Moderate	Noticeable impact.	These are unavoidable consequence, which will need to be accepted if the project is allowed to proceed.
Low	Minor impacts.	These impacts are not likely to affect the project decision.

APPENDIX D: CRITERIA FOR PHOTO / COMPUTER SIMULATION

To characterise the nature and severity of visual intrusion of the proposed Project, a photographic simulation technique was used. This method was used according to Sheppard (in Lange 1994), where a visual simulation is good quality when the following five criteria are met.

Representativeness:	A simulation should represent important and typical views of a project.
Accuracy:	The similarity between a simulation and the reality after the Project has been realised.
Visual clarity:	Detail, parts and overall contents have to be clearly recognisable.
Interest:	A simulation should hold the attention of the viewer.
Legitimacy:	A simulation is defensible if it can be shown how it was produced and to what degree it is accurate.

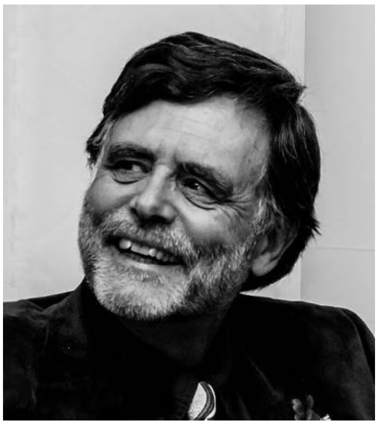
To comply with this standard it was decided to produce a stationary or static simulation (Van Dortmont in Lange, 1994), which shows the proposed development from a typical static observation points (Critical View Points).

Photographs are taken on site during a site visit with a manual focus, 50mm focal depth digital camera. All camera settings are recorded and the position of each panoramic view is recorded by means of a GPS. These positions, coordinates are then placed on the virtual landscape (see below).

A scale model of the proposal is built in virtual space, scale 1:1, based on CAD (vector) information as supplied by the architect / designers. This model is then placed on a virtual landscape, scale 1:1, as produced by means of GIS software. The accuracy of this depends on the contour intervals.

The camera views are placed on the points as recorded on the virtual landscape. The respective photographs are overlaid onto the camera views, and the orientation of the cameras adjusted accordingly. The light source is adjusted to suit the view. Each view is then rendered as per the process above.

APPENDIX E: CURRICULUM VITAE



Graham Young PrLArch FILASA

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Graham is a registered landscape architect with interest and experience in landscape architecture, urban design, and environmental planning. He holds a degree in landscape architecture from the University of Toronto and has practiced in Canada and Africa, where he has spent the greater part of his working life. He has served as President of the Institute of Landscape Architects of South Africa (ILASA) and as Vice President of the Board of Control for Landscape Architects.

During his 30 years plus career he has received ILASA and other industry awards. He has published widely on landscape architectural issues and has had projects published both locally and internationally in, scientific and design journals and books. He was a being a founding member of Newtown Landscape Architects and is also a senior lecturer, teaching landscape architecture and urban design at post and undergraduate levels, at the University of Pretoria. He has been a visiting studio critic at the University of Witwatersrand and University of Cape Town and in 2011 was invited to the University of Rhode Island, USA as their Distinguished International Scholar for that year. Recently, Graham resigned from NLA and now practices as a Sole Proprietor.

A niche specialty of his is Visual Impact Assessment for which he was cited with an ILASA Merit Award in 1999. He has completed over 250 specialist reports for projects in South Africa, Canada and other African countries. He was on the panel that developed the *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes* (2005) and produced a research document for Eskom, *The Visual Impacts of Power Line* (2009). In 2011, he produced '*Guidelines for involving visual and aesthetic specialists'* for the Aapravasi Ghat Trust Fund Technical Committee (they manage a World Heritage Site) along with the *Visual Impact Assessment Training Module Guideline Document.*

*** GYLA ***

forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE
Boshoek Solar Cluster: Boshoek Solar 1 – Visual Impact Assessment Report

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with 't*he Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Visual Impact
Specialist Company Name	Graham Young Landscape Architect
Specialist Name	**Graham A Young**
Specialist Identity Number	530223 5681 082
Specialist Qualifications:	BL (Toronto) ML)Pretoria)
Professional affiliation/registration:	SCALAP No. 87001
Physical address:	608 Leyds Street, Muckleneuk
Postal address:	Box 331
Postal address	Groenkloof, 0027
Telephone	
Cell phone	+27 (0)824621491
E-mail	Grahamyounglandarch@gmail.com

2. DECLARATION BY THE SPECIALIST

I, Graham A Young declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

Graham Young Landscape Architect

Name of Company:

14 Aug 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Graham A Young_________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Graham Young Landscape Architect

Name of Company

14 Aug 2024

Date

Signature of the Commissioner of Oaths

14 Aug 2024

Date

Proposed Boshoek Solar PV Cluster

Boshoek Solar 1

On Portion 0 of the farm Rhenosterdoorns 531, portion 1 and 18 of the farm Zwaarverdiend 234, portion 1 of the farm Elandsfontein 102, Paul Bodenstein Landgoed 571 JG and the farm Onderstepoort 98, within the Rustenburg Local Municipality and the Bojanala District Municipality in the North West Province

Heritage Scoping Report

Template Number	Document Number	Revision	Date
PGS PJ REP 007 06	735HIA-001	3.0	02/05/ 2024

REVISION HISTORY

Version	Issue Date	Description of Changes
01	29 September 2023	First draft
02	29 March 2024	EIA update
03	02 May 2024	Minor comments updated

Declaration of Independence

- I, Jessica Angel, declare that –
- General declaration:
- I act as the independent heritage practitioner 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 heritage impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, 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;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected from a heritage practitioner in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

HERITAGE CONSULTANT: PGS Heritage (Pty) Ltd

CONTACT PERSON: Jessica Angel – Senior Archaeologist

Tel: +27 (0) 12 332 5305

Email: jessica@pgsheritage.co.za

SIGNATURE: J Angel

ACKNOWLEDGEMENT OF RECEIPT

Report Title	Heritage Scoping report for the Proposed Boshoek Solar PV Cluster – Boshoek Solar 1		
Control	**Name**	**Signature**	**Designation**
Author	J Angel		PGS Heritage – Senior Archaeologist
Reviewer	W Fourie		PGS Heritage -Project Manager/Archaeologist
Reviewed	A Alwie		Client

CLIENT: **ERM Southern Africa (Pty) Ltd.**

CONTACT PERSON: **Aneesah Alwie**

Email: Aneesah.Alwie@erm.com

SIGNATURE: ____________________________________

The Heritage Impact Assessment Report has been compiled considering the National Environmental Management Act (Act No. 107 of 1998) (NEMA): Appendix 6 of the Environmental Impact Assessment (EIA) Regulations of 2014 (as amended, 2017) requirements for specialist reports as indicated in the table below.

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii of Report – Contact details and company
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 1.2 – refer to Appendix C
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
(cA) An indication of the quality and age of base data used for the specialist report	N/A
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 4.3
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix A and B
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 5
(g) An identification of any areas to be avoided, including buffers	Section 5
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 4.3
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
(k) Any mitigation measures for inclusion in the EMPr	Section 6
(l) Any conditions for inclusion in the environmental authorization	Section 6
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorization	Section 6
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and (n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and	Section 6 and 7
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 6
(o) A description of any consultation process that was undertaken during the course of carrying out the study	Informal consultation in fieldwork.
(p) A summary and copies if any comments that were received during any consultation process	Not applicable. To date no comments regarding heritage resources that require input from a specialist have been raised.
(q) Any other information requested by the competent authority.	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	No protocols or minimum standards for HIAs or PIAs

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd was appointed by ERM Southern Africa (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) process for the proposed Boshoek Solar PV Cluster - Boshoek Solar 1 on Portion 0 of the farm Rhenosterdoorns 531, portion 1 and 18 of the farm Zwaarverdiend 234, portion 1 of the farm Elandsfontein 102, Paul Bodenstein Landgoed 571 JG and the farm Onderstepoort 98, within the Rustenburg Local Municipality and the Bojanala District Municipality in the North West Province

A further standalone Palaeontological Desktop Assessment (PDA) was completed for PGS by Dr Elize Butler of Banzai Environmental.

During the fieldwork no heritage resources were identified.

Mitigation considerations and buffers to consider from the EIA phase are:

- No heritage resources were located, however, not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and existing vegetation cover. It should be noted most of the study area was accessible for the fieldwork survey, but the vegetation is thick bush and visibility of sites such as Stone Age or Iron Age are difficult to locate.
- During the construction phase, it is important to recognize any significant material being unearthed, making the correct judgment on which actions should be taken. It is recommended that the following chance find procedure should be implemented.
    - A heritage practitioner / archaeologist should be appointed to develop a heritage induction program and conduct training for the ECO as well as team leaders in the identification of heritage resources and artefacts **during the implementation of the EMPr**.
    - An appropriately qualified heritage practitioner / archaeologist must be identified to be called upon in the event that any possible heritage resources or artefacts are identified.
    - Should an archaeological site or cultural material be discovered during construction (or operation), the area should be demarcated, and construction activities halted.
    - The qualified heritage practitioner / archaeologist will then need to come out to the site and evaluate the extent and importance of the heritage resources and make the necessary recommendations for mitigating the find and the impact on the heritage resource.
    - The contractor therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the materials and data are recovered.

Mitigation measures

Mitigation measures are described in **Table 10** of this report.

Conclusion

It is the combined considered opinion of the heritage specialists that the proposed project will not have a direct impact on heritage resources.

With the implementation of recommended mitigation measures the overall impact on heritage resources will be at an acceptable level during the activities of the project.

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TERMINOLOGY AND ABBREVIATIONS

Archaeological resources

This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age between 700 000 and 2 500 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

Holocene

The most recent geological time period which commenced 10 000 years ago.

Late Stone Age

The archaeology of the last 30 000 years associated with fully modern people.

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's, associated with iron-working and farming activities such as herding and agriculture.

Middle Stone Age

The archaeology of the Stone Age between 30 000-300 000 years ago, associated with early modern humans.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Abbreviations	Description
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
ECO	Environmental Control Officer
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHRA-G	Gauteng Provincial Heritage Resources Authority
PHS	Provincial Heritage Site
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

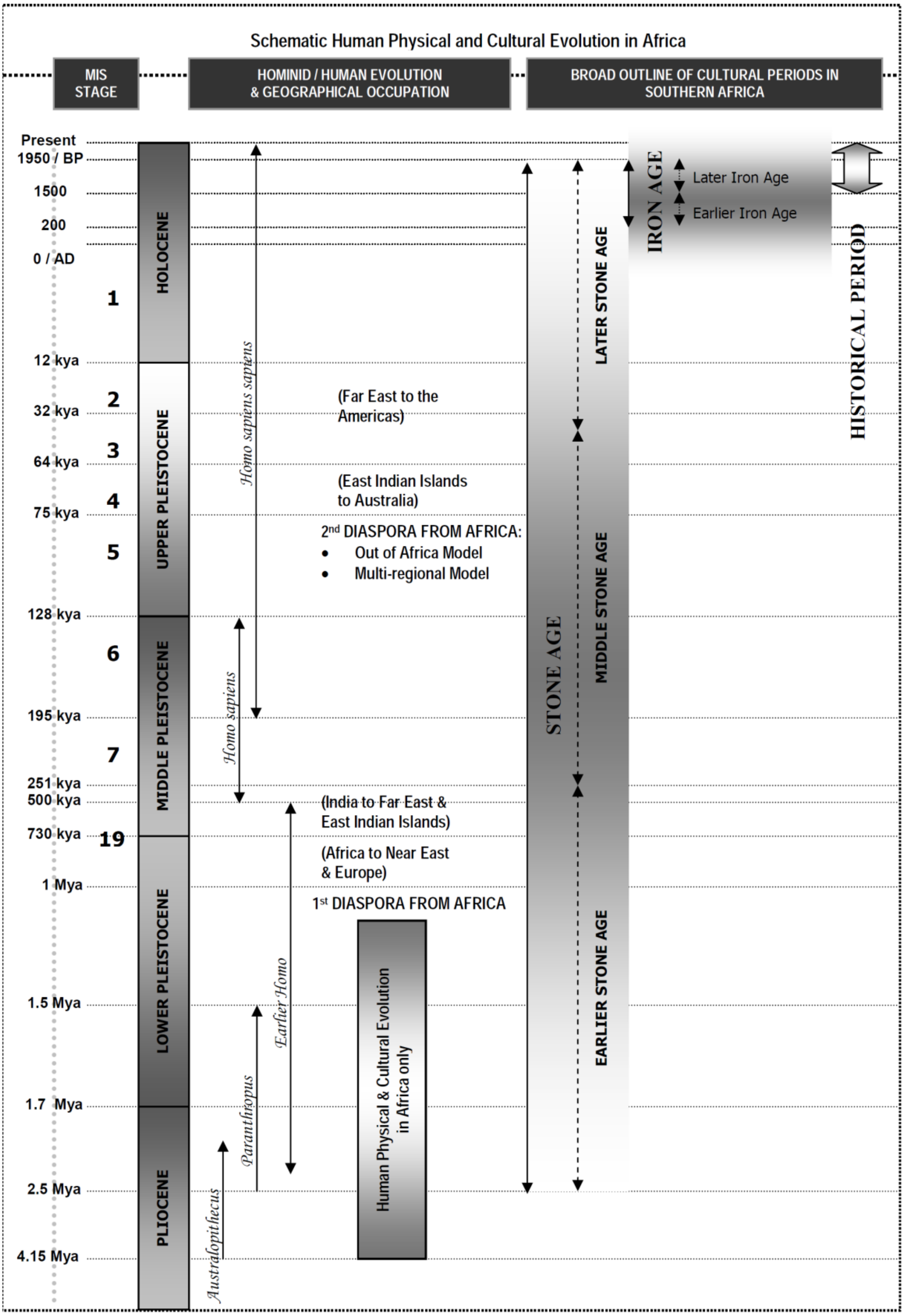

Figure 1 – Human and Cultural Timeline in Africa

1 INTRODUCTION

PGS Heritage (Pty) Ltd was appointed by ERM Southern Africa (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) process for the proposed Boshoek Solar PV Cluster - Boshoek Solar 1 on Portion 0 of the farm Rhenosterdoorns 531, portion 1 and 18 of the farm Zwaarverdiend 234, portion 1 of the farm Elandsfontein 102, Paul Bodenstein Landgoed 571 JG and the farm Onderstepoort 98, within the Rustenburg Local Municipality and the Bojanala District Municipality in the North West Province

A further standalone Palaeontological Desktop Assessment (PDA) was completed for PGS by Dr Elize Butler of Banzai Environmental.

1.1 Scope of the Study

The study aims to identify heritage sites and finds that may occur in the proposed project area. The HIA will identify and demarcate heritage sensitivities in the project area that will guide the developer in developing a project footprint. This to assist the developer in managing the discovered heritage resources in a responsible manner, to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 Specialist Qualifications

This HIA was compiled by PGS

The staff at PGS has a combined experience of nearly 70 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Jessica Angel, the author of this report, is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA). She has 10 years of experience in the heritage assessment field and holds a Master’s degree (MSc) in Archaeology from the University of the Witwatersrand.

Wouter Fourie, the Project Coordinator and Archaeologist is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited as a Principal Investigator; he is further an Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners (APHP).

1.3 Assumptions and Limitations

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and existing vegetation cover. It should be noted most of the study area was accessible for the fieldwork survey.

Fieldwork was also focussed on area that was not previously ploughed or disturbed by farming activity, thus focussing on areas with the highest potential to yield heritage resources.

Therefore, should any heritage features and/or objects be located or observed outside the identified heritage sensitive areas during the construction activities, a heritage specialist must be contacted immediately. Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. If any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below.

1.4 Legislative Context

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation:

- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified
- National Environmental Management Act (NEMA), Act 107 of 1998 – Appendix 6
- National Heritage Resources Act (NHRA), Act 25 of 1999

1.4.1 Notice 648 of the Government Gazette 45421

Although minimum standards for archaeological (2007) and palaeontological (2012) assessments were published by SAHRA, GN.648 requires sensitivity verification for a site selected on the national web based environmental screening tool for which no specific assessment protocol related to any theme has been identified. The requirements for this Government Notice (GN) are listed in **Table 1** and the applicable section in this report noted.

Table 1: Reporting requirements for GN648

GN 648	Relevant section in report	Where not applicable in this report
2.2 (a) a desktop analysis, using satellite imagery;	section 4.2	
2.2 (b) a preliminary on-site inspection to identify if there are any discrepancies with the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web-based environmental screening tool, such as new developments, infrastructure, indigenous/pristine vegetation, etc.	4.3	-
2.3(a) confirms or disputes the current use of the land and environmental sensitivity as identified by the national web-based environmental screening tool;	section 4.2	-
2.3(b) contains motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity;	section 4.1	-

1.4.2 NEMA – Appendix 6 requirements

The HIA report has been compiled considering the NEMA Appendix 6 requirements for specialist reports as indicated in **Table 1.** For ease of reference, the table provides cross-references to the report sections where these requirements have been addressed.

1.4.3 The National Heritage Resources Act

- National Heritage Resources Act (NHRA) Act 25 of 1999
  - Protection of Heritage Resources – Sections 34 to 36; and
  - Heritage Resources Management – Section 38

The NHRA is utilized as the basis for the identification, evaluation, and management of heritage resources and in the case of Cultural Resource Management (CRM) those resources specifically impacted on by development as stipulated in Section 38 of NHRA. This study falls under s38(8) and requires comment from the relevant heritage resources authority.

Section 24(2) of the NEMA requires environmental authorisation from the environmental authority for certain activities that have been identified and must undergo an EIA or Basic Assessment (BA) process. Similarly, Section 38 NHRA lists specific development activities that require notice to the heritage resources authority to determine if an HIA process is necessary. Approval from the heritage authority is mandatory before proceeding with the development activities.

To avoid redundancy and facilitate coordination between NEMA and NHRA requirements, Section 38(8) of the NHRA states that if the development activities listed in Section 38(1) require an EIA under NEMA, a separate HIA and approval from the heritage resources authority are unnecessary. However, the environmental authority must ensure that the heritage resources authority's requirements for HIA are fulfilled and that its comments and recommendations are considered before granting environmental authorisation.

Therefore, if a NEMA EIA is required for the development activities listed under Section 38 of the NHRA, separate HIA and EIA processes may not be followed, and different decisions may not be issued under NHRA and NEMA. The EIA process will be followed, and if the heritage resources authority requires HIA, it must be conducted as one of the EIA specialist studies.

The environmental authority must ensure that the heritage resources authority's requirements for the assessment are met. A separate heritage approval may not be issued, but the environmental authority must consider the heritage resources authority's comments and recommendations before granting or refusing environmental authorisation.

It must however be noted that if no environmental process is required, but the proposed development still triggers the requirements for and HIA under section 38(1) of the NHRA, SAHRA or the relevant provincial heritage authority will be the authorising authority. This entity could then require a full HIA completed considering the requirements for public participation and stakeholder engagement as contemplate in the regulations under the NHRA.

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Locality

The proposed Boshoek Solar PV cluster is located approximately 30 – 33 km north west of Rustenburg within the Rustenburg Local Municipality and the Bojanala District Municipality, in the North West Province (**Figure 2**).

2.1.1 Site Description

The application area is situated on on Portion 0 of the farm Rhenosterdoorns 531, portion 1 and 18 of the farm Zwaarverdiend 234, portion 1 of the farm Elandsfontein 102, Paul Bodenstein Landgoed 571 JG and the farm Onderstepoort 98 with a footprint area of approximately 290ha (**Figure 2**).

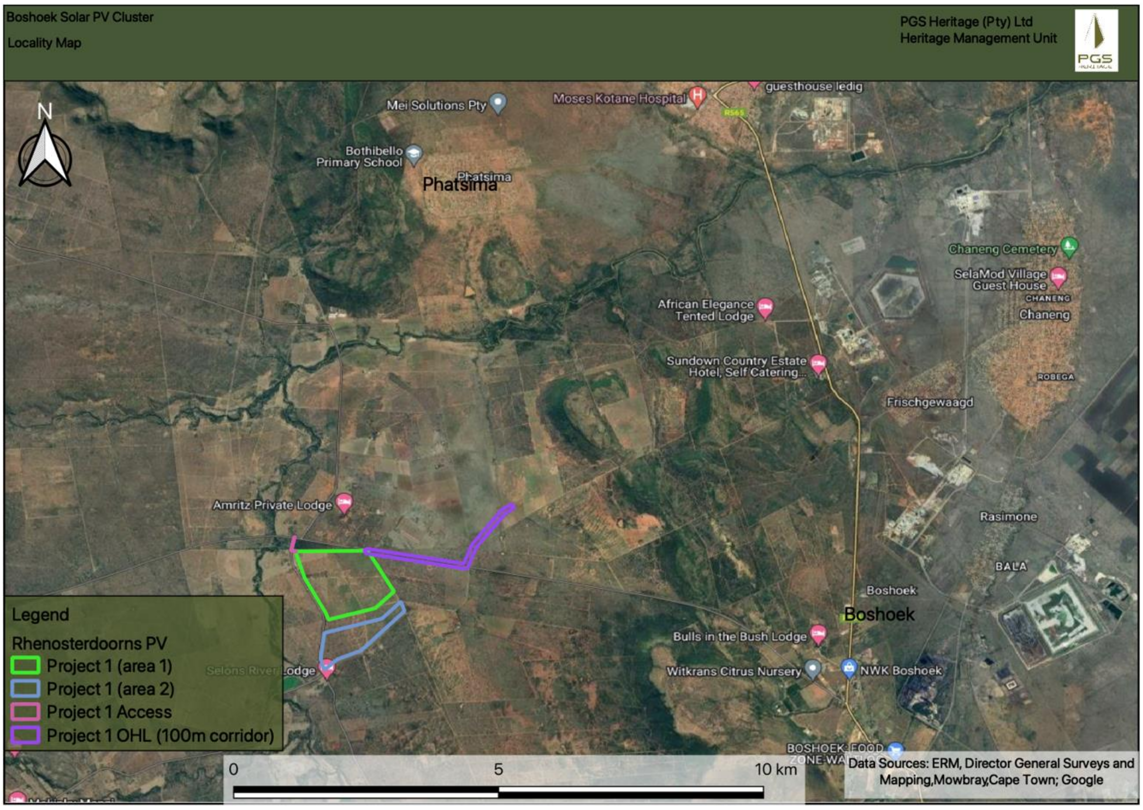

Figure 2 - Regional Locality of study area (green and blue polygon) and PV Grid connection (purple polygon)

2.2 Technical Project Description

2.2.1 Project description

Boshoek Solar 1 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province.

The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW. The development area is situated approximately 33 km north west of Rustenburg within the Rustenburg Local Municipality and the Bojanala District Municipality, in the North West Province.

The development area for the PV facility and associated infrastructure will be located on the following properties:

Farm Name	Farm No.	Portion No.
Boshoek Solar 1 PV Facility		
Farm Rhenosterdoorns	531	0
Farm Zwaarverdiend	234	1

Farm Name	Farm No.	Portion No.
Boshoek Solar 1 PV Facility		
Boshoek Solar 1 PV Grid Connection		
Zwaarverdiend 234 JP	234	18
Paul Bodenstein Landgoed 571 JG	571	RE
Elandsfontein 102 JG	102	1
Onderstepoort 98 JG	98	RE

The project is planned as part of a larger cluster, which includes two additional PV facilities (Boshoek Solar 2 and Boshoek Solar 3) up to 150 MW and 50 MW respectively.

An assessment area of approximately 290 ha is being assessed as part of this EIA process and the infrastructure associated with the 150 MW facility includes:

- PV modules (mono- or bifacial) and mounting structures;
- Inverters and transformers;
- Battery Energy Storage System (BESS);
- Site access road;
- Internal access roads;
- Auxiliary buildings (switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Temporary and permanent laydown area; and
- Grid connection infrastructure, including:
    - Underground medium-voltage cabling between the project components and the facility substation;
    - Up to 132kV facility substation;
    - Switching station;
    - A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.

3 ASSESSMENT METHODOLOGY

The section below outlines the assessment methodologies utilised in the study.

3.1 Methodology for Assessing Heritage Site significance

This HIA report was compiled by PGS for the proposed Boshoek Solar Cluster. The applicable maps, tables and figures are included, as stipulated in the NHRA (no 25 of 1999) and the National Environmental Management Act (NEMA) (No. 107 of 1998). The HIA process consists of three steps:

Step I – Literature Review and initial site analysis: The background information to the field survey relies greatly on the Heritage Background Research which was undertaken through archival research and evaluation of satellite imagery and topographical maps of the study area.

Step II – Physical Survey: A physical survey was conducted by a combination of vehicle and pedestrian access through the proposed project area by two qualified heritage (between 21 and 25 August 2023), aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

Step III – The final step involved the recording and documentation of relevant heritage resources identified in the physical survey, the assessment of these resources in terms of the HIA criteria and report writing, as well as mapping to provide demarcated sensitivity areas for the developer to consider during project planning and the evaluation in the EIA phase of the project.

The significance of heritage sites is based on four main criteria:

- Site integrity (i.e. primary vs. secondary context),
- Amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter)
    - Low - <10/50m2
    - Medium - 10-50/50m2
    - High - >50/50m2
- Uniqueness; and
- Potential to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

A - No further action necessary;

B - Mapping of the site and controlled sampling required;

C - No-go or relocate development activity position;

D - Preserve site, or extensive data collection and mapping of the site; and

E - Preserve site.

Impacts on these sites by the development will be evaluated as follows:

3.1.1 Site Significance

Site significance classification standards use is based on the heritage classification of s3 in the NHRA and developed for implementation keeping in mind the grading system approved by SAHRA for archaeological impact assessments. The update classification and rating system as developed by Heritage Western Cape (2016) is implemented in this report.

Site significance classification standards prescribed by the Heritage Western Cape Guideline (2016), were used for the purpose of this report (**Table 2** and **Table 3**).

Table 2: Rating system for archaeological resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Langebaanweg (West Coast Fossil Park), Cradle of Humankind	May be declared as a National Heritage Site managed by SAHRA. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Highest Significance
II	Heritage resources with special qualities which make them significant, but do not fulfil the criteria for Grade I status. Current examples: Blombos, Paternoster Midden.	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Exceptionally High Significance
III	Heritage resources that contribute to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. Current examples: Varschedrift; Peers Cave; Brobartia Road Midden at Bettys Bay	Resource must be retained. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree.	Resource must be retained where possible where not possible it must be fully investigated and/or mitigated.	Medium Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
IIIC	Such a resource is of contributing significance.	Resource must be satisfactorily studied before impact. If the recording already done (such as in an HIA or permit application) is not sufficient, further recording or even mitigation may be required.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant or the consultant and approved by the authority.	No research potential or other cultural significance

Table 3: Rating system for built environment resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Robben Island	May be declared as a National Heritage Site managed by SAHRA.	Highest Significance
II	Heritage resources with special qualities which make them significant in the context of a province or region, but do not fulfil the criteria for Grade I status. Current examples: St George's Cathedral, Community House	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority.	Exceptionally High Significance
II	Such a resource contributes to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. These are heritage resources which are significant in the context of an area.	This grading is applied to buildings and sites that have sufficient intrinsic significance to be regarded as local heritage resources; and are significant enough to warrant that any alteration, both internal and external, is regulated. Such buildings and sites may be representative, being excellent examples of their kind, or may be rare. In either case, they should receive maximum protection at local level.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree. These are heritage resources which are significant in the context	Like Grade IIIA buildings and sites, such buildings and sites may be representative, being excellent examples of their kind, or may be rare, but less so than Grade IIIA examples.	Medium Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
	of a townscape, neighbourhood, settlement or community.	They would receive less stringent protection than Grade IIIA buildings and sites at local level.	
IIIC	Such a resource is of contributing significance to the environs These are heritage resources which are significant in the context of a streetscape or direct neighbourhood.	This grading is applied to buildings and/or sites whose significance is contextual, i.e. in large part due to its contribution to the character or significance of the environs. These buildings and sites should, as a consequence, only be regulated if the significance of the environs is sufficient to warrant protective measures, regardless of whether the site falls within a Conservation or Heritage Area. Internal alterations should not necessarily be regulated.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant and approved by the authority. Section 34 can even be lifted by HWC for structures in this category if they are older than 60 years.	No research potential or other cultural significance

3.2 Methodology used in determining the significance of environmental impacts

The methodology used to determine the projected environmental impact significance during the scoping phase and to be utilised during the final HIA (this document) was provided by ERM and is explained in **Appendix B**.

4 CURRENT STATUS QUO

4.1 Site Description

The proposed Boshoek Solar cluster footprint area is characterised by thornveld land divided into various grazing camps by various barbed wire fences (**Figure 3** to **Figure 7**). Some tracks of the property were previously ploughed for crop cultivation since the early 1960s as is evident from historic topographical maps.

In terms of vegetation, the study area is located within the Zeerust Thornveld vegetation type, which is described as "…*deciduous, open to dense short thorny woodland, dominated by Acacia species* *with herbaceous layer of mainly grasses on deep, high base-status and some clay soils on plains and lowlands, also between rocky ridges of Dwarsbery-Swartruggens Mountain Bushveld*…" (www.sanbi.org). Sections of the study area are characterised by reasonably dense vegetation, which made the fieldwork sometimes difficult.

In terms of geology and soils, of the Zeerust Thornveld "…*sediments of the Pretoria Group (Transvaal Supergroup) in this area, particularly the Silverton and Rayton Formations are mostly shale with less quartzite and conglomerate. Catbonates, volcanic rocks, breccias and diamicites also occur in the Pretoria Group. Soils are mostly deep, red-yellow, apedal, freely drained with a high base status also with some vertic or melanic clays…"* (www.sanbi.org).

Figure 3 – View from the eastern side of the northern section of the property

Figure 4 – View from the centre of the northern section of property

Figure 5 – View of the southern point on the southern section of the property

Figure 6 – View of the western edge of the proposed grid

Figure 7 – View of the eastern section of the grid

4.2 Overview of the study area and surrounding landscape

DATE	DESCRIPTION
2.5 million to 250 000 years ago	The Earlier Stone Age is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these is known as Oldowan and is associated with crude flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates back to approximately 1.5 million years ago.

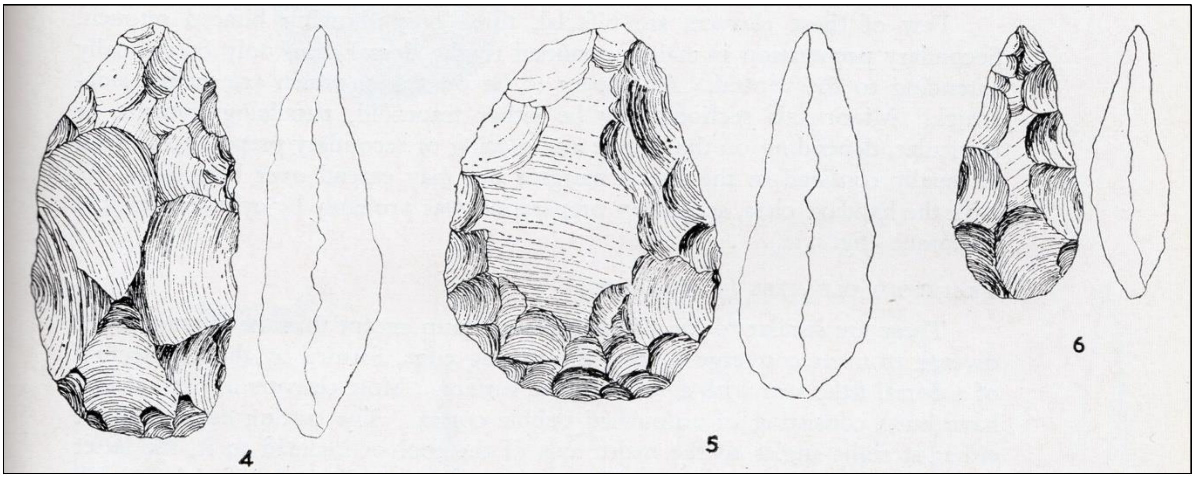

Figure 8 – Example of Early Stone Age Later Acheulian handaxes. These handaxes were identified at Blaaubank near Rooiberg. Cropped section of an illustration published in Mason (1962:199).

DATE	DESCRIPTION
250 000 to 40 000 years ago	The Middle Stone Age is the second oldest phase identified in South Africa's archaeological history. This phase is associated with flakes, points and blades manufactured by means of the so-called 'prepared core' technique.
40 000 years ago to the historic past	The Later Stone Age is the third archaeological phase identified and is associated with an abundance of very small artefacts known as microliths.
AD 350 – AD 650	The Bambata facies of the Benfica Sub-Branch of the Kalundu Ceramic Tradition represents the earliest known Iron Age period within the surroundings of the study area. The decoration on the ceramics from this facies is characterised by "...*fine decoration, multiple bands and cross-hatching on long*

	rim, alternating blocks of stamped and incised lines in neck." (Huffman, 2007:215).
AD 1000 – AD 1300	The Eiland facies of the Kalundu Ceramic Tradition represents the fourth known Iron Age period within the surroundings of the study area. The decoration on the ceramics from this facies is characterised by "...*fine herringbone with stamping*." (Huffman, 2007:221).
1500 AD – 1700 AD	The Olifantspoort facies of the Moloko Branch of the Urewe Ceramic Tradition is the second Iron Age facies to be identified within the surroundings of the study area. The Olifantspoort facies can likely be dated to between AD 1500 and AD 1700. The key features of the decoration used on the ceramics from this facies include multiple bands of fine stamping or narrow incision separated by colour (Huffman, 2007). The type site for this facies is located on the farm Olfantspoort 328 JQ, which is situated approximately 38km south-east of the present study area. After an archaeological team under Professor R.J. Mason of the University of the Witwatersrand identified a number of stonewalled settlements on the farm Olifantspoort by using aerial photographs, archaeological field research and excavations were undertaken during 1971 at eight of these sites located on the farm Olifantspoort as well as another site located on an adjacent farm. These sites were numbered 20/71, 21/71, 26/71, 27/71, 28/71, 60/71, 61/71, 62/71, 64/71 and 65/71. The focus of the research turned to Site 20/71 which proved to be a very large stonewalled site. A total of 85 huts as well as a number of middens were excavated here during the 1971 season alone. As many as 80 individual rock engraving panels were identified in the vicinity of the site. These engravings all depict settlement plans (Mason, 1973). A copper mine was also identified on the farm (Steel, 1987). In the following year sites 2/72 and 29/72 were added and researched, with sites 38/73 and 47/73 added the year after. A few years later in 1984 an Olifantspoort site was identified at Broederstroom and in 1985 another Olifantspoort site was identified at Ifafi (Huffman, 2007). The Olifantspoort facies holds an important position in the sequence of the Moloko or Sotho-Tswana group. The earliest facies to be associated with the Moloko is the Icon facies (AD 1300 – 1500), with sites found across large sections of what is today the Limpopo Province. The Icon facies resulted in three different and parallel Iron Age facies, namely the Madikwe facies (AD 1500 – 1700) (which in turn led to the Buispoort facies between AD 1700 and 1850), the Letsibogo facies (AD 1500 – 1700) and thirdly the Olifantspoort facies. The Olfantspoort facies developed into the Thabeng facies (AD 1700 – 1850) (Huffman, 2007). It is therefore evident that the Olifantspoort facies represents a key pillar in our understanding of the origins and sequence of the Sotho-Tswana people of today (Huffman, 2007).
1500 AD – 1700 AD	The Madikwe facies of the Blackburn Branch of the Urewe Ceramic Tradition represents the next phase in the Iron Age of the study area and surroundings. This facies can likely be dated to between AD 1500 and AD 1700. The decoration on the ceramics associated with this facies is characterised by multiple bands of cord impressions, incisions, stabs and punctates separated by colour (Huffman, 2007). As indicated above, the Madikwe facies represents one of three parallel Iron Age facies which had developed from the original Moloko facies known as Icon. As such, the Madikwe facies was the contemporary of the Olifantspoort and Letsibogo facies, and developed into the Buispoort facies (AD 1700 – AD 1850) (Huffman, 2007).

1650 AD – 1820 AD	The Uitkomst facies of the Blackburn Branch of the Urewe Ceramic Tradition represents another Iron Age period identified for the surroundings of the study area. This facies can likely be dated to between AD 1650 and AD 1820. The decoration on the ceramics associated with this facies is characterised by stamped arcades, appliqué of parallel incisions, stamping and cord impressions and is described as a mixture of the characteristics of both Ntsuanatsatsi (Nguni) and Olifantspoort (Sotho) (Huffman, 2007). The type-site is Uitkomst Cave, which is situated some distance south-east of the study area. The site was excavated by Professor R.J. Mason of the University of the Witwatersrand as part of a project to excavate five cave sites in the Witwatersrand-Magaliesberg area. These five sites are Glenferness, Hennops River, Pietkloof, Zwartkops and Uitkomst. Uitkomst was chosen as the type site for the particular Iron Age material excavated at these sites as the Uitkomst deposit was found to be well stratified and the site "...*illustrates the combination of a certain kind of pottery with evidence for metal and food production and stone wall building found at the open sites*..." (Mason, 1962:385). The Uitkomst pottery is viewed as a combination of Ntsuanatsatsi and Olifantspoort, and with the Makgwareng facies is seen as the successors to the Ntsuanatsatsi facies. The Ntsuanatsatsi facies is closely related to the oral histories of the Early Fokeng people and represents the earliest known movement of Nguni people out of Kwazulu-Natal into the inland areas of South Africa. Regarding this theory, the Bafokeng settled at Ntsuanatsatsi Hill in the present-day Free State Province. Subsequently, the BaKwena lineage had broken away from the Bahurutshe cluster and crossed southward over the Vaal River to encounter the Bafokeng. As a result of this contact a Bafokeng-Bakwena cluster was formed, which moved northward and became further 'Sotho-ised' by coming into increasing contact with other Sotho-Tswana groups. According to this theory, this eventually resulted in the appearance of Uitkomst facies type pottery which contained elements of both Nguni and Sotho-Tswana speakers (Huffman, 2007). Huffman states that that the Uitkomst facies is directly associated with the Bafokeng (Huffman, 2007). However, it worth noting that not all researchers agree with this preposition of the Bafokeng origins. In their book on the history of the Bafokeng, Bernard Mbenga and Andrew Mason indicate that the research of Prof. R.J. Mason and Dr. J.C.C. Pistorius "...*would indicate that the Bafokeng originated from the Bahurutshe-Bakwena-Bakgatla lineage cluster. Tom Huffman holds a different view..."* (Mbenga & Mason, 2010).

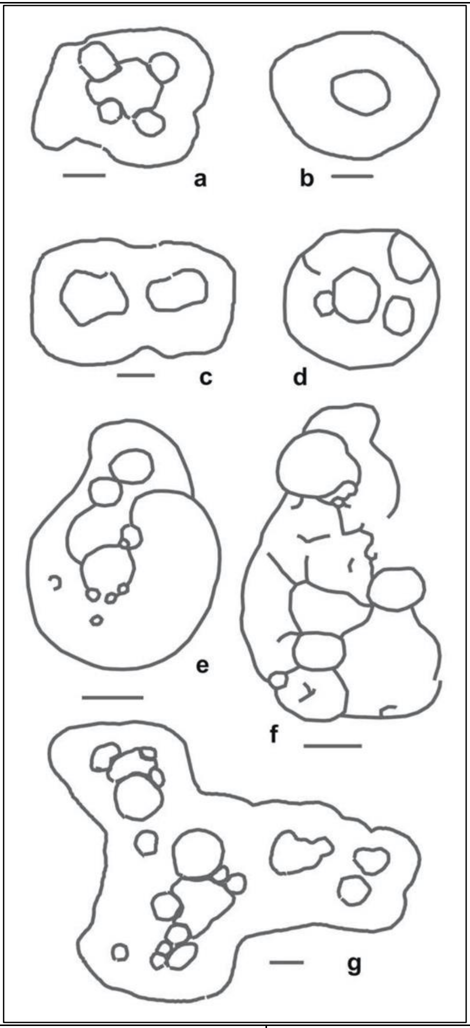

Figure 9 - Examples of so-called Group I settlements as published by Sadr & Rodier (2012:3). The settlement layout as depicted in illustration 'b' provides an example of a simple Type N settlement which has the appearance of a 'fried egg'. Illustration 'a' provides one example of a more elaborate Type N settlement. The settlement layouts as depicted in this figure can be associated with the Ntsuanatsatsi facies and the Bafokeng as well.

1700 AD – 1840 AD	The Buispoort facies of the Moloko branch of the Urewe Ceramic Tradition is the next phase to be identified within the study area's surroundings. It is most likely dated to between AD 1700 and AD 1840. The key features on the decorated ceramics include rim notching, broadly incised chevrons and white bands, all with red ochre (Huffman, 2007). It is believed that the Madikwe facies developed into the Buispoort facies. The Buispoort facies is associated with sites such as Buffelshoek, Kaditshwene, Molokwane and Olifantspoort (Huffman, 2007). Molokwane is the nearest of these sites to the study area, and is located on the farm Selonskraal 317 JQ some 19.5km to the south by south-west (Pistorius, 1992). During the early 1980s, Dr. J.C.C. Pistorius conducted archaeological excavations at Molokwane. His research was aimed at "…*proving that the site's settlement style is representative of the settlement system of historical and contemporary Sotho-Tswana villages (metse) in its ground plan, composition and settlement layout*." (Pistorius, 1992:1). The available oral history was also assessed in this research, which revealed that Molokwane was the home of the Bakwena Bamodimosa Bammatau from c. 1600 AD to the early 1800s (Pistorius, 1992). The research at Molokwane focussed on a settlement unit named SEL 1. This settlement unit is comprised of three main spatial features, namely an outer

scalloped wall (where the dwellings of the settlement were located), a centrally located cluster of enclosures and kraal complexes (that is enclosed by the outer scalloped wall) and lastly the intervening space between the outer scalloped wall and the centrally located cluster of enclosures (Pistorius, 1992).

A number of excavations were also undertaken, which focussed on the settlement unit at SEL 1. The excavations focussed on all three spatial features of SEL 1 as outlined above. The excavations yielded pottery (including intact vessels), iron tools, bone tools, stone artefacts, clay figurines, ochre figurines and beads (Pistorius, 1992).

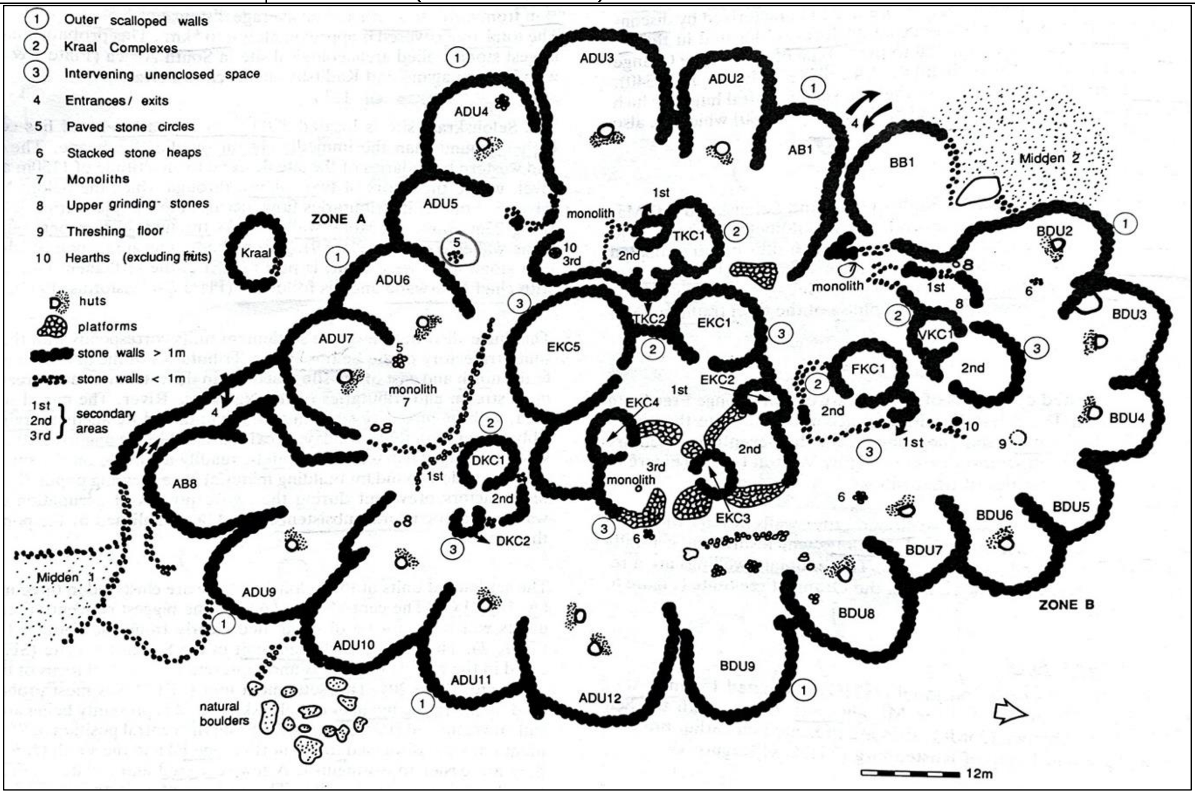

Figure 10 – Layout plan of settlement unit SEL 1 at Molokwane as recorded by Pistorius (1992:18).

c. 1650 – c. 1700	During this time the Bathlako were living in proximity to the area today known as Cullinan, east of Pretoria. During the second half of the seventeenth century Kgosi Thatwe, the Bathlako chief, dispatched a reconnaissance party to the west of his chiefdom to assess the grazing conditions there. His sons Leema, Matutu and Modisane subsequently established themselves at Pharami (Boschoek) before settling along the Toelanie River near Pella. As the present study area is located on the farm Boschoek, the indication that the Bathlako lived at this farm during the late 17th century, is very interesting. At Pella the chiefdom was split with Leema and his followers establishing the Batlhako ba Leema chiefdom and Matutu and his followers establishing the Batlhako ba Leemana chiefdom. In turn, the ancestors of the Batloung moved to Mabjanatsiri near the present day farm Grootwagendrift 233 JP, situated roughly 12 km west by north-west of the present study area (Breutz, 1957). Later, the son of Matutu, namely Seutlwane moved with his followers to Maseletsane on the northern end of the Pilwe Hills (Breutz, 1957). The northern end of the Pilwe Hills is situated roughly 18km north-west of the present study area.

Early 1700s	At the time, and possibly for some time before this date, the area surrounding present-day Rustenburg would have been occupied by the Bafokeng and the Tlokwa people (Hall et al., 2008). Mbenga and Mason (2010) indicate that Prof. R.D. Coertze estimation was that the Bafokeng had settled in the vicinity of Rustenburg at the end of the 17th century. Their land at the time stretched from the "...*Ngwaritsi (Selons) River to the west, the Bakwena-ba-Mogopa to the east, the Magaliesberg to the south and the Kgetleng (Elands) River to the north* (Mbenga & Mason, 2010: 7). From this description it is evident that at the time, the study area formed part of the land of the Bafokeng.
1750s	During the mid eighteenth century the Batlokwa ba ga Sedumedi under Kgosi Mosima Tsele moved from Tlokwe (in proximity to present-day Potchefstroom) to the Pilanesberg. They settled at Bote, which is presently located on the farm of Houwater 54 JQ in the Pilanesberg National Park (Hall et.al., 2008) (Anderson, 2009). While at Bote, Mosima passed away and was succeeded by Monaheng (Hall et.al., 2008) (Anderson, 2009). The farm Houwater is located 20.6 km north of the present study area. At roughly the same time, the son of Seutlwane, namely Mabe, moved with his followers from Maseletsane on the northern end of Pilwe Hill to Mothoutlung situated on the present day farm Palmietfontein 208 JP (Breutz, 1953).
Late 1700s	During the reign of kgosi Sekete IV the Bafokeng had "...*relations of conflict*..." with their Batswana neighbours (Mbenga & Mason, 2010).
1760 – 1770	As a result of the conflict between the Bafokeng and its neighbours (including the Batlokwa ba ga Sedumedi), Kgosi Monaheng moved with his people from Bote to Itlholanoga (Hall et.al., 2008) (Anderson, 2009). They remained here from 1760 to 1770 (Anderson, 2009). Itlholanoga is believed to be located on the present day farm Doornhoek 91 JQ. Sections of both the Pilanesberg National Park and Sun City are located on this farm. The farm is located 14.3km north of the present study area. During the 1980s, Professor Revil Mason of the University of the Witwatersrand excavated a stonewalled Iron Age site on the hills above Sun City named Site 33/81. Mason (1986:688) describes the site as follows "…*on the crest of a ridge about 150 metres vertically above the Sun City workers' residences, on the radio tower hill…the Site 33/81 complex is in two parts. The main part covers an area of about 250 x 250 metres on the upslope edge of the road. The second part is a line of three separate structures extending for 300 metres on the north-west corner of the main part*." Professor Revil Mason excavated seven ash heaps and nine huts at the site, and recovered 69 decorated potsherds, 338 undecorated potsherds, one drilled ceramic pendant, 15 dagga pipes, six conical figurines, one cattle figurine, one sliding door trackway, one iron arrowhead, two iron fragments, two slag bits and two shell beads (Mason, 1986). The decorated ceramics recovered by Mason could identified as Uitkomst and Buispoort pottery (Huffman, 2007) (Mason, 1986). Mason (1986) was able to date the site to AD 1800 using C^{14} dating that was obtained from samples recovered from Ash Heaps 3 and 7. He associated both the ceramics and settlement layout of the site with Kaditshwene and suggested that the site may have been built by Sotho-Tswana people associated with the Hurutshe group. Professor Tom Huffman (2007) of the University of the Witwatersrand mapped the same complex in 2005 and identified a multi-component site comprising Molokwane walling associated with Buispoort pottery as the second more recent occupation with Uitkomst pottery found in middens associated with the remnants of earlier walling from a previous occupation. Huffman (2007)

	concludes that the Kgatla were responsible for the Molokwane walling whereas the Tlokwa can most likely be associated with the earlier walling.
1780 – 1785	The Batlokwa ba ga Sedumedi chiefdom moved from Itlholanoga to Mankwe in c. 1780. The settlement of Mankwe coincided with the rule of Kgosi Taukobong. Mankwe is located on the farm Zwaarverdiend 234 JP. This farm is situated 7.5km north-west of the present study area.

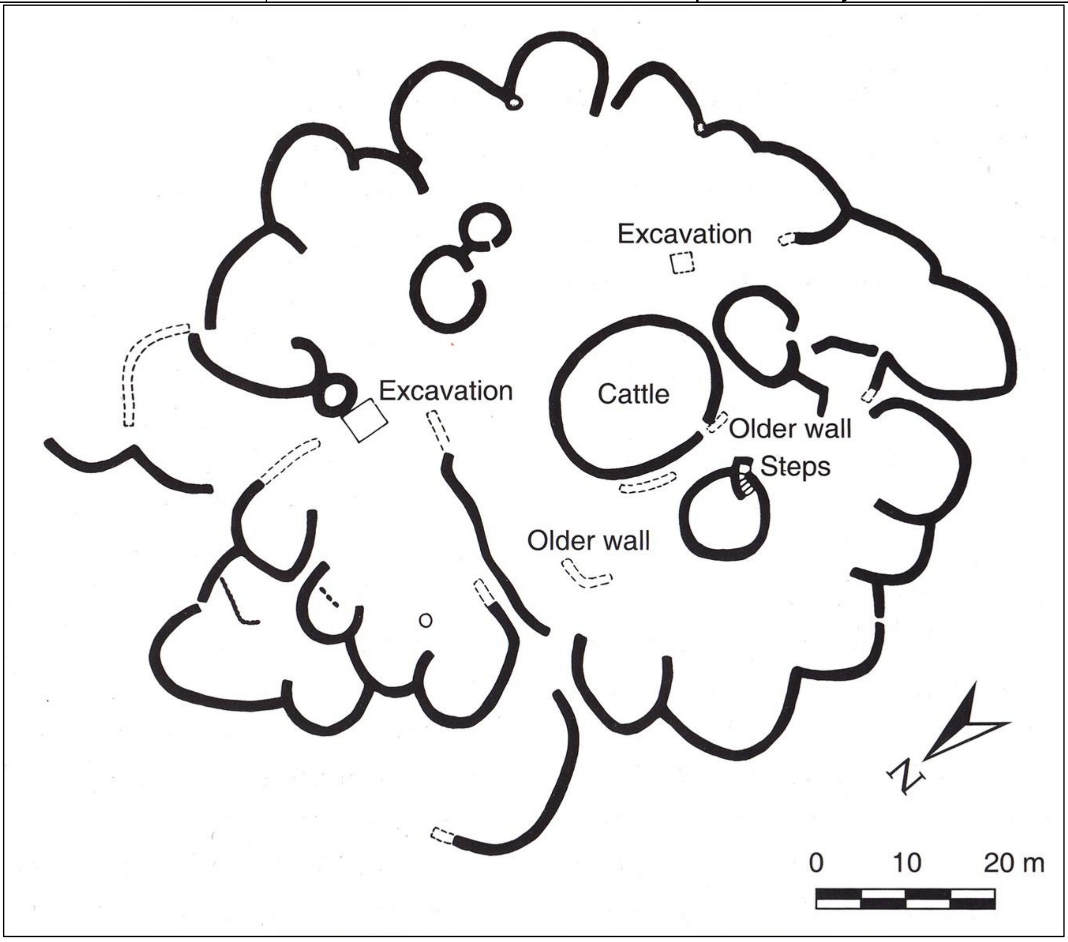

Figure 11 – Layout plan of Itlholanoga as recorded by Huffman (2007:438).

1785 – 1815	In c. 1785 Kgosi Taukobong led the Batlokwa ba ga Sedumedi chiefdom from Mankwe to Maruping, which is located in the Pilwe Hills (Anderson, 2009). A succession battle during the early nineteenth century split the Tlokwa chiefdom in two, with Kgosi Molefe and his followers fleeing 30 miles to the west to establish themselves at Kolontwaneng (present day farm Grootfontein 225 JP). Molefe and his followers established the Batlokwa ba ga Bogatsu at Kolontwaneng. Meanwhile, the balance of the Batlokwa ba ga Sedumedi remained at the Pilwe Hills until 1815 (Anderson, 2009).

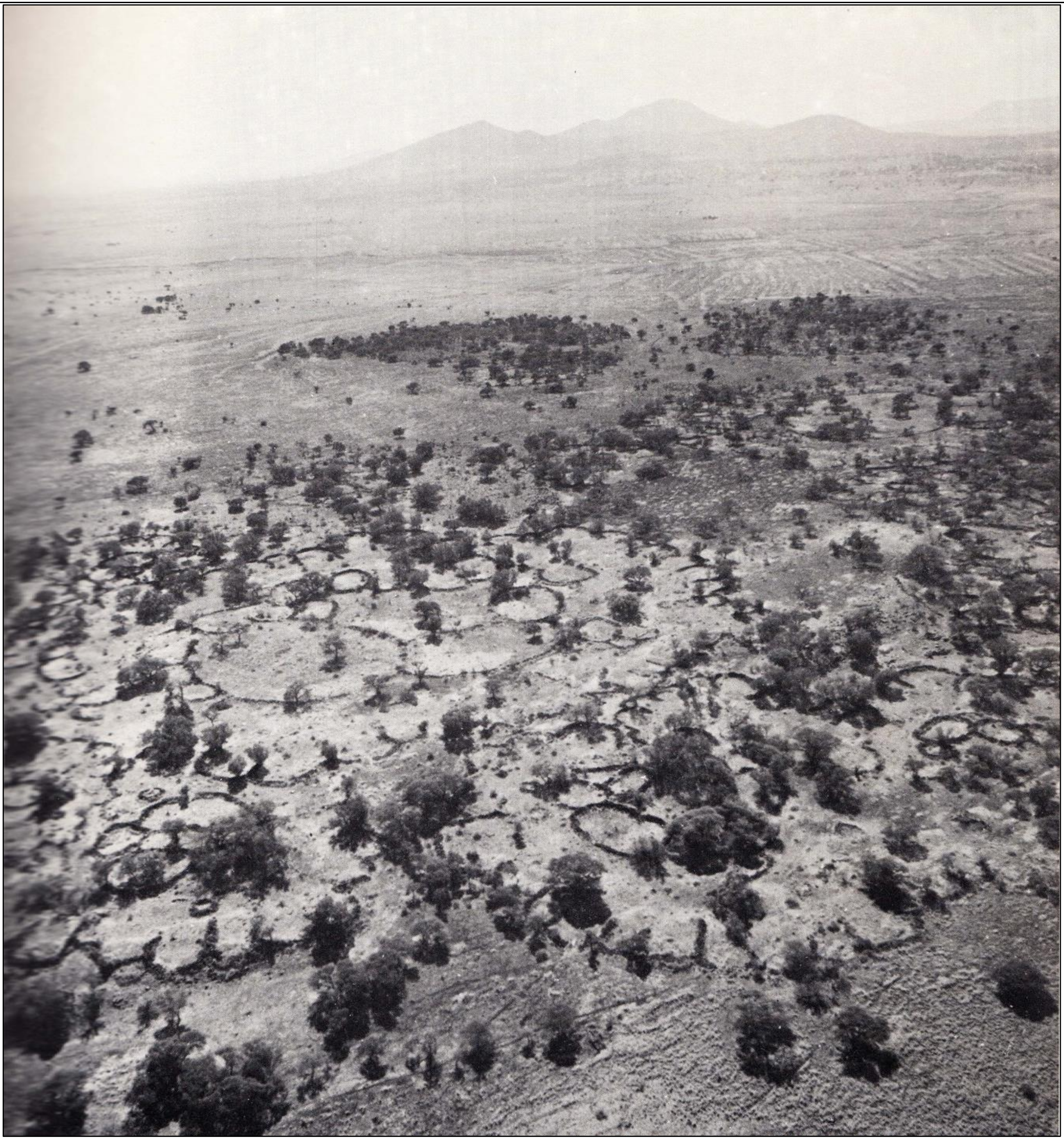

Figure 12 – This aerial view of Marothodi was taken by Professor Revil Mason (1986:3).

1815	Under its new leader Bogatsu, the Batlokwa chiefdom moved to Marothodi in 1815. Marothodi is located on the present day farms of Bultfontein 204 JP, Diamant 206 JP and Vlakfontein 207 JP. Of these, the latter farm is situated nearest to the present study area at a distance of 19.7 km to the north-west. While the chief moved to Marothodi, a section of the Batlokwa ba ga Sedumedi remained behind in the Pilwe Hills (Anderson, 2009). During the 1980s, the Eskom Land Survey Department identified a Late Iron Age stonewalled megasite at Vlakfontein, to the west of the Pilanesberg. Professor Revil Mason carried out an initial assessment of the site (Mason, 1986). Between 2002 and 2008, the site was excavated by Dr Mark Anderson for his Doctoral Thesis at the University of Cape Town (Anderson, 2009).

	Anderson (2009:326-327) states that the "…*excavation at Marothodi has confirmed that the dominant ceramic style associated with the Tlokwa in the early 19th century is representative of the Uitkomst facies, which is part of the Fokeng cluster. In the ceramic sequence…Uitkomst is derived from Nstuanatsatsi, demonstrating the link between the Marothodi Tlokwa and the first group of Bantu speakers to cross the Vaal River from KwaZulu-Natal in the south-east. These early Fokeng originated among Northern Nguni people (Huffman, 2007).* The presence of Nguni characteristics at Marothodi further underscores the association of the site with the Tlokwa. These characteristics include the central placement of the middens within the homestead as well as the intermittent capping of these middens using soil. Anderson (2009:327) adds that "*Marothodi must be understood against an historical backdrop somewhat different to those of the neighbouring aggregated towns inhabited by 'typical' western Tswana in the region, such as the Kwena at Molokwane and the Hurutshe at Kaditshwene. Instead, we glimpse a process of 'Tswana-isation' somewhere along their journey north-westward, possibly soon after their arrival in the Pilanesberg, which eventually resulted in the cultural expression we see at Marothodi in the early 19th century. While Uitkomst remains the dominant ceramic expression at Marothodi, a trajectory of increasing interaction with other regional communities is represented in elements of imported Buispoort pottery appearing in the assemblages, and in the adoption of a western Tswana worldview so vividly demonstrated in the culturally driven organisation of settlement space and commodity production*." The research at Marothodi also revealed a significant emphasis on metal production, and especially copper. With copper possibly valued high enough to be exchanged for cattle, the large cattle enclosures at Marothodi may have been the result of trade with other communities (Anderson, 2009).
c. 1820	During the reign of Bogatsu the Batlokwa became embroiled in another conflict with the Bafokeng. As a result, the Bafokeng, under its chief Moseletsane, marched on the Batlokwa at Pilwe and Marothodi. The Tlokwe met the Bafokeng on the plain to the west of the Pilwe Hills where the Bafokeng chief was eventually captured and executed by the Batlokwa (Anderson, 2009).
c. 1823	The Batlokwa ba ga Sedumedi remained at Marothodi until c. 1823 when they moved to present-day Botswana (Anderson, 2009).
1827 - 1832	The Khumalo Ndebele (Matabele) of Mzilikazi established themselves along the Magaliesberg Mountains, having moved here from the central Vaal River. In c. 1832 the Khumalo Ndebele moved to the Marico River (Bergh, 1999). Dr. J.CC Pistorius interpreted a number of settlement features that he identified some 19.9km south-east of the present study area, as a Matabele settlement (Pistorius, 1996a & 1996b).

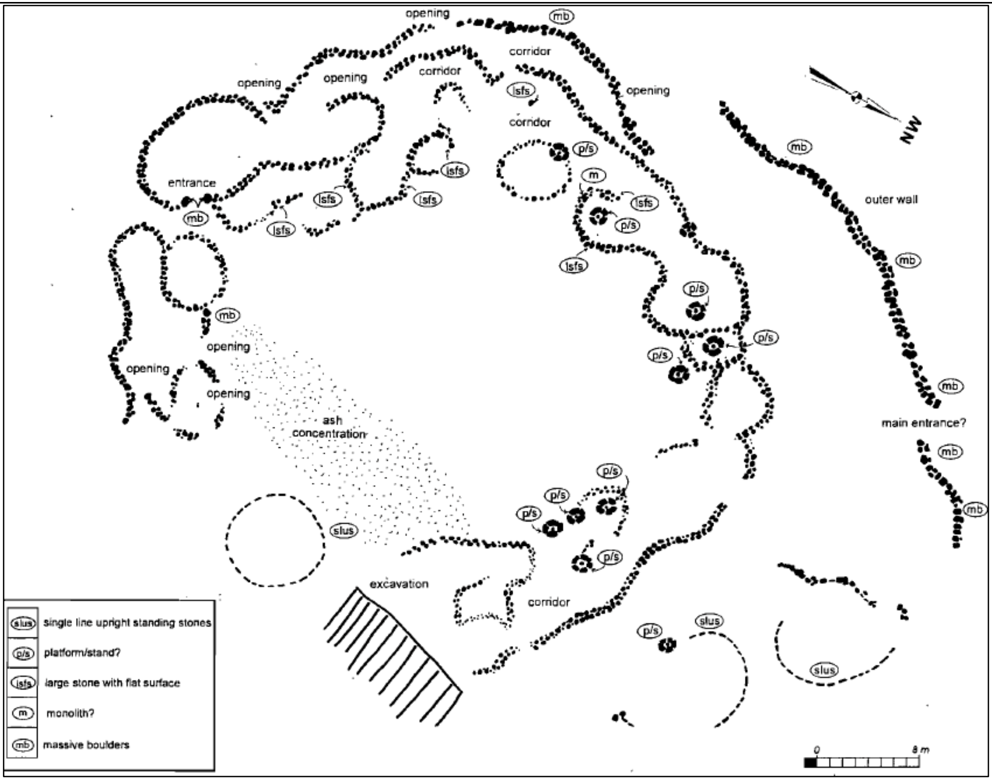

Figure 13 – One of the units from the Matabele settlement which Dr. Pistorius identified (1996b:51).

1829 - 1837	During this period, a number of expeditions led by explorers, missionaries, hunters and adventurers travelled through the general surroundings of the study area. These included the expeditions of Robert Schoon & William McLuckie (1829), Robert Moffat (1829), Andrew Smith (1835) and Cornwallis Harris (1836-1837) (Pistorius, 1996a).
1836	The first Voortrekker parties started crossing the Vaal River (Bergh, 1999).
Late 1830s – Early 1840s	These years saw the early establishment of farms by the Voortrekkers in the general vicinity of the study area (Bergh, 1999). One of these Voortrekkers was Stephanus Johannes Paulus (Paul) Kruger, who was President of the Zuid-Afrikaansche Republiek between 1883 and the end of the South African War in 1902. His family formed part of the Voortrekkers who settled in these parts during this time and, in 1841 at the age of 16, Kruger himself became an owner of a farm (Waterkloof) near Rustenburg. He would eventually own a large number of farms in the Rustenburg area, including Boekenhoutfontein 260 JQ (located roughly 2km south-east of the present study area). From the 1860s, President Paul Kruger used the farm Boekenhoutfontein as his home away from Pretoria. His house is still preserved on this farm, and is located 7km south-east of the present study area. During this period the first contacts between the black people residing in the Rustenburg area at the time (including the Bafokeng) and white people took place. According to Bergh (2005) these early contacts resulted in the setting aside of land by the Voortrekker leadership for the Bafokeng people. This land appears to have included the farms Boekenhoutfontein 260 IQ (located roughly 2km south-east of the present study area), Turffontein 262 IQ (located 6 km south-east of the present study area) and possibly Kookfontein 265 IQ (10.8km south-east of the study area) as well (Bergh, 2005). Mbenga (1997) indicates that the relationship between the Voortrekkers and the Bakgatla were initially also amicable. However, within a short period the

<table>
<tr><td></td><td>relationship between the Voortrekkers and the black groups living in the area around Rustenburg became increasingly strained. For example, Bergh (2005) states that the Bafokeng were eventually dispossessed of their farms. The system of unpaid labour enforced by the Voortrekkers on the local black groups would certainly have deteriorated the relationship further. See for example Morton (1992).</td></tr>
<tr><td colspan="2">

Figure 14 – President Paul Kruger, used to have a country residence at the nearby farm Boekenhoutfontein (Raath, 2007:338).</td></tr>
<tr><td>1851</td><td>Both the district and town of Rustenburg were established in this year (Bergh, 1999). The study area fell within the Rustenburg district at the time.</td></tr>
<tr><td>10 February 1859</td><td>The very first Reformed Church (Gereformeerde Kerk) was established in South Africa on this day. The church was established under a Syringa tree in Church Street, Rustenburg. The stump of this tree was proclaimed as a National Monument in 1951 (Bergh, 1999). This tree is located 24.2km south-east of the present study area. Incidentally, the Anglican Church of Rustenburg was proclaimed a National Monument in 1972 and the Dutch Reformed Church of Rustenburg was proclaimed a National Monument in 1979.</td></tr>
</table>

Early 1860s	After 1861, Tshomankane Pilane moved with a significant section of the Bakgatla ba ga Kgafela from Saulspoort (on the north-eastern end of what is today known as the Pilanesberg National Park) to establish himself at a place known as Bopitiko (Breutz, 1953). While some authors indicate that Bopitiko is located on the present day farm Doornhoek 91 JQ (Maree, 1966), others (Breutz, 1953) (Schapera, 1965) indicates that Bopitiko was located on the farm presently known as Ledig 90 JQ. These farms are both situated approximately 14km north of the study area.
1862	In 1862 Henry Gonin arrived in the Rustenburg District to establish a missionary station for the Dutch Reformed Church. His first mission station was established on the farm Welgeval 171 JQ (Morton, 1992), which is presently located within the Pilanesburg National Park and is located roughly 11.8k north-west of the present study area.
1867	Hermannsburg missionary Hermann Wenhold established the Kana mission station amongst the Bafokeng. At the time the mission station was established on the farm Tweedepoort 283 JQ (Bergh, 2005). This farm is situated roughly 20.7km east by south-east of the study area.
December 1869	The Kana mission station was moved from the farm Tweedepoort 283 JQ to the farm Reinkoyalskraal 278 JQ (Bergh, 2005). This new location for the Kana Mission Station is located 17.6km south-east of the study area.

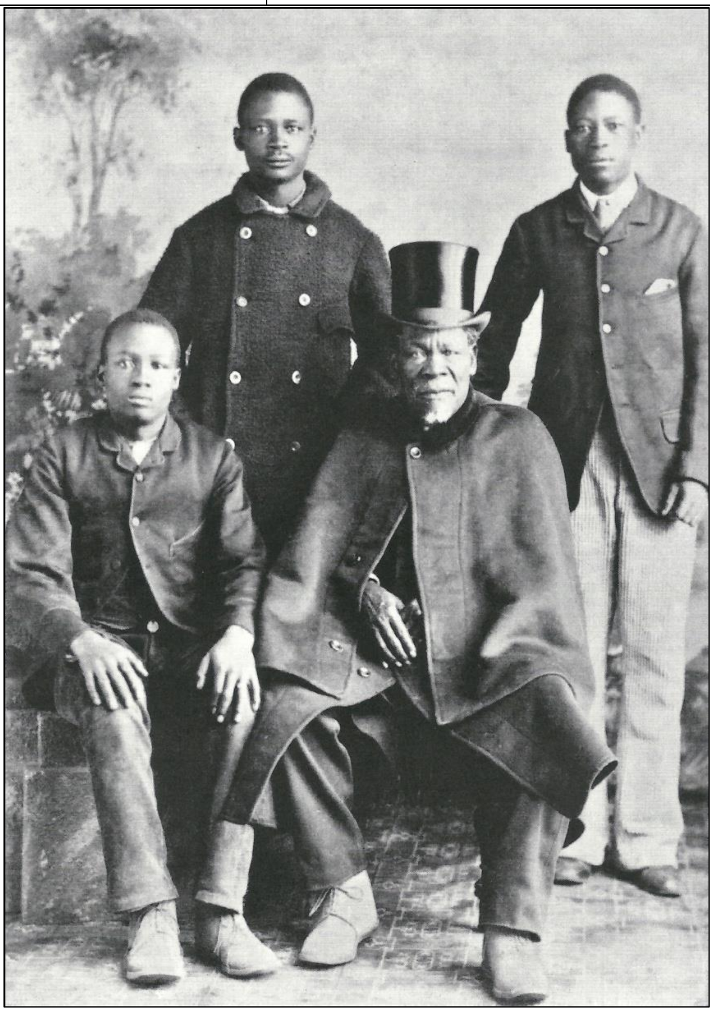

Figure 15 – Photograph taken in 1887 of Kgosi Mokgatle and his sons (Mbenga & Manson, 2010).

1860s – 1870s	With the assistance provided by German missionary Christoph Penzhorn of the Hermannsburg Missionary Society, Kgosi Mokgatle and the Bafokeng bought a number of farms in proximity to Rustenburg (Bergh, 2005). These

	acquisitions were an attempt by the Kgosi and the Bafokeng to procure land that had been theirs before the arrival of the first white people. Mbenga & Manson (2010) states that the Bafokeng acquired a total of 24 farms during the second half of the 19th century. Of these, the closest farms to the present study area are Turffontein 262 JQ (located 6 km south-east of the present study area), Doornspruit 106 JQ (located 6.5km east of the present study area) and Klein Doornspruit 108 JQ (roughly 7.9 km north-east of the present study area) and (Bergh, 2005).
1880-1881	The First Boer War (also known as the First War of Independence) took place during this time. The most significant aspect of the war for the town of Rustenburg would have been the besiegement of a company of 2nd Batallion Royal Scots Fusiliers by Boer forces. The siege lasted for 93 days (Wulfsohn, 1992). While the earthwork fort in which the British forces were besieged does not exist anymore, its present location would have been the corner of Kerk and Von Wielligh Streets. This position is some 34km south-east of the present study area (Wulfsohn, 1992).
1899 - 1902	The South African War took place during these years. While no skirmishes or battles are known from within the study area, a number of events and activities associated with the war from the surroundings of the study area are known. In early 1900 for example, a group of men from Rustenburg were called upon to establish a laager on the drift over the Elands River "…*on the present day main road to Sun City*…" (Wulfsohn, 1992:68). This was to prevent an invasion into Rustenburg by the Bakgatla from Saulspoort and Bechuanaland. The men holding the drift included W.T. Dawes, August Schoch, J.S. (Sammy) Mundel and Philip Brink (Wulfsohn, 1992). The position of this drift (if it still existed today) is roughly 11.7km north by north-west of the present study area. During the war years the Bakgatla from Saulspoort and Bechuanaland under Kgosi Linchwe I (the son of Kgamanyane Pilane) actively resisted and fought the Boer Commandos and also raided Boer farms across the present-day North West and Gauteng Provinces as far as south of Rustenburg (some sources even indicate that the Kgatla regiments raided farms in the Pretoria District as well). While no clear victors in the fight for the land north of the Elands River emerged, the Bakgatla succeeded in harassing and attacking the Boer forces to the extent that the far north-western areas of the Transvaal Republic were largely left unmanned and unoccupied by Boer forces during much of the war, and especially so as the war progressed. While numerous skirmishes would have taken place around the Pilanesberg as a result of the tug of war between the Boers and Baklgatla, two pitched battles did occur in this area namely at Janskop and Draaiberg (Morton, 1992). These battlefields are located on the northern and north-western ends of the Pilanesberg, and as a result some distance from the present study area. Apart from the drift over the Elands River, another highly strategic point from the surroundings of the study area during the war years was Boschoek Nek. Situated roughly 2.6km north-west of the present study area, this topographic feature represented one of only a few passes through the Magaliesberg Mountains. The strategic importance of the nek was not realised at first by the British authorities, with the Boer forces utilising it with impunity on numerous occasions to move men across the mountain range. Even as late as 21 May 1902, reports were received by the British Command in Rustenburg that a group of 30 Boers had crossed over the nek from the west to carry out raids on the Kana Mission Station and Magatostad (Wulfsohn, 1992).

	This said, Boschoek Nek was at least temporarily occupied by several British units during the guerrilla phase of the war. For example, on 9 June 1901,General Dixon occupied the nek with a force comprising three infrantry batallions, several batteries of artillery and numerous mounted horsemen. Boschoek Nek was again held by Colonel Allenby and his men during September 1901 (Wulfsohn, 1992). The Staff Diaries of the Rustenburg District provide further insight into war-time events which occurred in the surroundings of the study area. For example, on 6 February 1902 a patrol of Imperial Yeomanry commanded by Captain Johnstone and accompanied by a group of Burgher Scouts under a British Intelligence Officer left Rustenburg for the Pilanesberg. The Burgher Scouts were tasked with the construction of a line of blockhouses. Upon completing this task, the Imperial Yeomanry returned to Rustenburg, arriving safely on 16 February 1902 with valuable information on Saulspoort and the Pilanesberg. The Burgher Scouts remained behind on the farm Palmietfontein (Wulfsohn, 1992) Other recorded events include the returning to Rustenburg of a column under the command of Colonel Colenbrander on 10 March 1902 from a patrol of the Elands River beyond Boschhoek (Rustenburg Staff Diary, March 1902). While the details of this patrol are not known, it would have been carried out in the immediate surroundings of the study area. Also, on 21 March 1902, Captain Johnstone, in command of a patrol of Imperial Yeomanry, as well as Lieutenant Haigh of the Field Intelligence Department, returned to Rustenburg from the Pilanesberg (Rustenburg Staff Diary, March 1902). The reason for their visit to the Pilanesberg is not known, nor is the route that was followed by this column.

Figure 16 - Colonel Colenbrander, who led a British column on a patrol of the Elands River beyond Boschhoek (Creswicke, 1902: 76).

1902	At the end of the South African War the Rustenburg District was divided into three wards, namely Swartruggens, Hex River and Elands River. The study area now fell within the Elands River Ward of the Rustenburg District (Bergh, 1999). During this time, Ramono, the brother of Linchwe I, was installed as kgosi of the Bakgatla ba ga Kgafela living in the then Transvaal (Tlou & Campbell, 1997).
1914 -1915	In 1914 the South African government under General Louis Botha decided to assist Great Britain in its war with Germany. A number of Boer leaders were not happy about this turn of events, and when General Koos de la Rey was killed at a roadblock in Johannesburg emotions reached a boiling point and a Boer rebellion broke across the then Transvaal and Free State. This was also true for the wider surroundings of the study area. On 6 and 7 November 1914, for example, a force of 18 rebels attacked the Pilanesberg Police Station, which at the time was held by a single policeman, Constable Petrus Paulus Jacobus (Piet) Botha. The attack did not succeed (Wulfsohn, 1989). While the exact location of this police station is not presently known, Mr Wulfsohn indicates that it was near Sun City.

Figure 17 - Dr. Hans Merensky, the geologist who discovered the platinum reef at Rustenburg (Machens, 2009).	
1924	In this year the famous geologist Hans Merensky was shown a sample of platinum ore that a Mr. Andries Lombard had found near Lydenburg. Merensky managed to trace a platinum reef all along the outer edge of the Bushveld Complex from Lydenburg to Rustenburg. This reef was to be known as Merensky Reef (Carruthers, 2007). The discovery of the Bushveld Complex was of extensive economic significance for South Africa. As indicated by Wikipedia, the Bushveld Igneous Complex "…*contains the world's largest reserves of platinum-group-metals (PGMs) – platinum, palladium, osmium, iridium, rhodium, and ruthenium – along with vast quantities of iron, tin, chromium, titanium and vanadium*." The complex was traced along two zones or belts, known as the Western and Eastern Belt. The Western Belt is of significance for the present study. The relevant government survey reports and later studies all indicate that the Western Belt "…*extends for about 100 miles as follows: from Brits towards Rustenburg and then northwards, skirting the Pilanesberg on its western side and continuing almost as far as the Crocodile River*." See for example The Official Year Book of the Union (1938:862). The identification of the Bushveld Igneous Complex inter alia between Rustenburg and the west of the Pilanesberg, meant that the surroundings of the study area were increasingly prospected and mined in the years after 1924.

December 1924	A branch line was opened between Rustenburg and Boschhoek (Higginson, 2014). This development would have stimulated mining exploration and development in areas around Boschhoek. At the time, the Boschhoek railhead would have been located roughly 1.3 km east by north-east of the study area.
April 1929	In April 1929, E.R. Schoch published his "*Notes on the Nickel and Copper Deposits in the Norite Complex of the Pilansberg, District Rustenburg, Transvaal*" in the Journal of the South African Institute of Mining and Metallurgy. This, and other attempts at prospecting and exploring the mineral wealth of the areas to the west of the Pilanesberg, would have stimulated the mineral development of the wider surroundings of the study area.
August 1936	Palmiet Chrome (Pty) Ltd was established in August 1936. It owned 3,807 morgen of chrome rights on the farm Palmietfontein 208 JP (South African Mining Yearbook, 1941/2), situated some 18km north-west of the present study area.
15 January 1938	Rustenburg Chrome Mines (Pty) Ltd was established on this day and at the time held options on the farm Vogelstruisnek 173 JP (South African Mining Yearbook, 1941/2), situated roughly 27km north-west of the present study area.
1966	In 1966 the Apartheid government forcibly relocated the Bakubung ba Ratheo from Molotestad near Boons (roughly 54km south-east of the present study area) to the farms Wydhoek, Ledig and Koedoesfontein. When Bophutatswana was established a decade later, these farms were handed over to the Bantustan (www.wikipedia.org). See also Historia (2000) and De Satgé (2006). The nearest of these farms to the study area is Koedoesfontein, which is located approximately 12.6km north by north-west of the study area.
6 December 1977	The South African government granted independence to Bophutatswana on 6 December 1977 (www.wikipedia.org).
1977	The Pilanesberg National Park was established in 1977 and during its early years was managed by the then Agricultural Development Corporation of Bophutatswana (Carruthers, 2011).
7 December 1979	The Sun City resort was opened on this day and at the time fell within the Bantustan of Bophutatswana (www.wikipedia.org).

4.2.1 Archival and historical maps

The examination of historical data and cartographic resources represents a critical tool for locating and identifying heritage resources and determining the historical and cultural context of the study area. Relevant topographic maps and satellite imagery were studied to identify structures, possible burial grounds or archaeological sites in the footprint area.

Historical topographic maps (1:50 000) for various year (1963) were available for utilisation in the background study. These maps were assessed to observe the area's development and the location of possible historical structures and burial grounds. The study area was overlain on the map sheets to identify structures or graves situated within or immediately adjacent to the study area that could possibly be older than 60 years and thus protected under Section 34 and 36 of the NHRA. No potential heritage features are represented on the map.

This section deals with the First Editions of the 2527AC and 2527CA Topographical Sheets. The details of these two sheets are as follows:

- The 2527AC HEYSTEKRAND sheet was based on aerial photography undertaken in 1961, was surveyed in 1963 and drawn in 1964 by the Trigonometrical Survey Office; and
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- The 2526BD SNYMANSVLEI sheet was based on aerial photography undertaken in 1963, was surveyed in 1967 and drawn in 1968 by the Trigonometrical Survey Office.

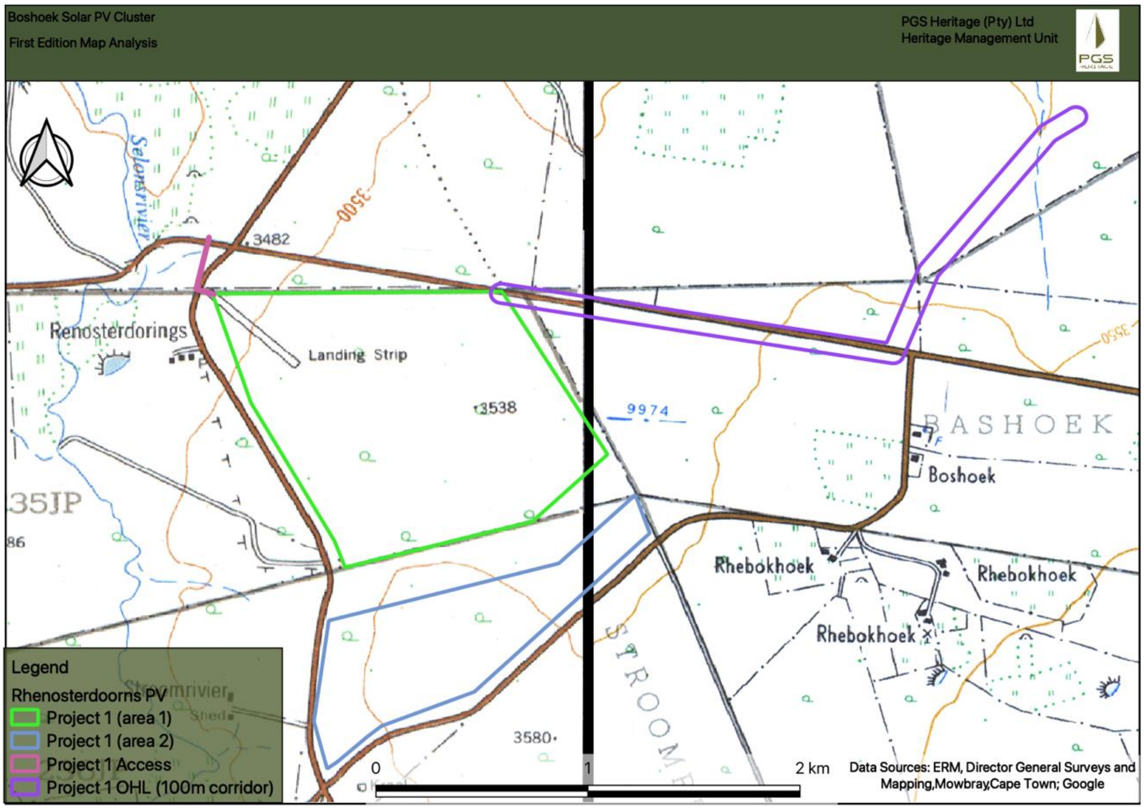

Figure 18 - Detail view of the depiction of the study area on the First Editions of the 2527AC (right) and 2526BD (left) Topographical Map Sheets

4.2.2 Previous heritage impact assessment reports from the study area and surroundings

A search of the South African Heritage Resources Information System (SAHRIS) database revealed that several previous archaeological and heritage impact assessments had been undertaken within the surroundings of the study area. In each case, the results of each study are shown in bold. These previous studies are listed below in ascending chronological order:

This assessment has revealed that one previous study was undertaken within the present study area, which identified one cemetery. Additionally, a number of studies have also been undertaken in the immediate surroundings of the study area, with various heritage and archaeological site types identified.

All these previous studies located on the SAHRIS system will be briefly discussed in chronological order below. The previous study that was undertaken within the present study area will be discussed first. In each case, the results of each study are shown in bold.

The following previous study was undertaken within the present study area:

- MNGOMEZULU, M. 2015. Phase 1 Heritage Impact Assessment for Section 24G Rectification Process and Water Use License Application for the Chrome Crushing, Screening and Washing plant on Portion 8 of the Farm Boshoek 103 JQ in Rustenburg, Bojanala Platinum District Municipality, North West Province. **One cemetery was identified during the fieldwork.** The cemetery that is included in this report as site BSCH 6 was also identified during this 2015 study. At the time, the cemetery also consisted of four graves. SAHRIS Case ID: 8140.

The following studies have been undertaken in the immediate surroundings of the present study area:

- PISTORIUS, J.C.C. 2003. A Heritage Impact Assessment (HIA) for SA Ferrochrome's New Proposed Expansion Operations in Boschhoek, North of Rustenburg in the North-West Province of South Africa. **The fieldwork resulted in the identification of a number of features and sites. However, only a grave and the remains of old mining activities were considered to be of any significance.** SAHRIS MAPID: 01069.

- PISTORIUS, J.C.C. 2014. Heritage Baseline Report for the Proposed Boshoek Smelter on Portions of the Farms Boschoek 103 JQ, Bultfontein 259 JQ, Boekenhoutfontein 260 JQ and Stellite 255 JQ. **Two graveyards and three single graves were identified during the study.** The nearest of these sites to the present study area is the graveyard GY01 which is located approximately 1km east by north-east of the present study area. SAHRIS CaseID: 5526.

- COETZEE, F. 2015. Cultural Heritage Assessment for the Amendment to the Environmental Management Programme for the Proposed Tailings Storage Facility (TSF) and Associated Infrastructure at Royal Bafokeng Platinum Styldrift Mine Complex, Rustenburg Local Municipality, Bojanala District Municipality, North West Province. **No historical or archaeological resources or graves were uncovered during this assessment.** SAHRIS CaseID: 7030

4.2.3 Heritage screening

A heritage screening report was compiled by the Department of Environmental Affairs National Web-based Environmental Screening Tool as required by Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended. The heritage screening report shows the project area has a Low Heritage Sensitivity (**Figure 19**). The fieldwork undertaken supports this sensitivity rating, as no heritage features were located.

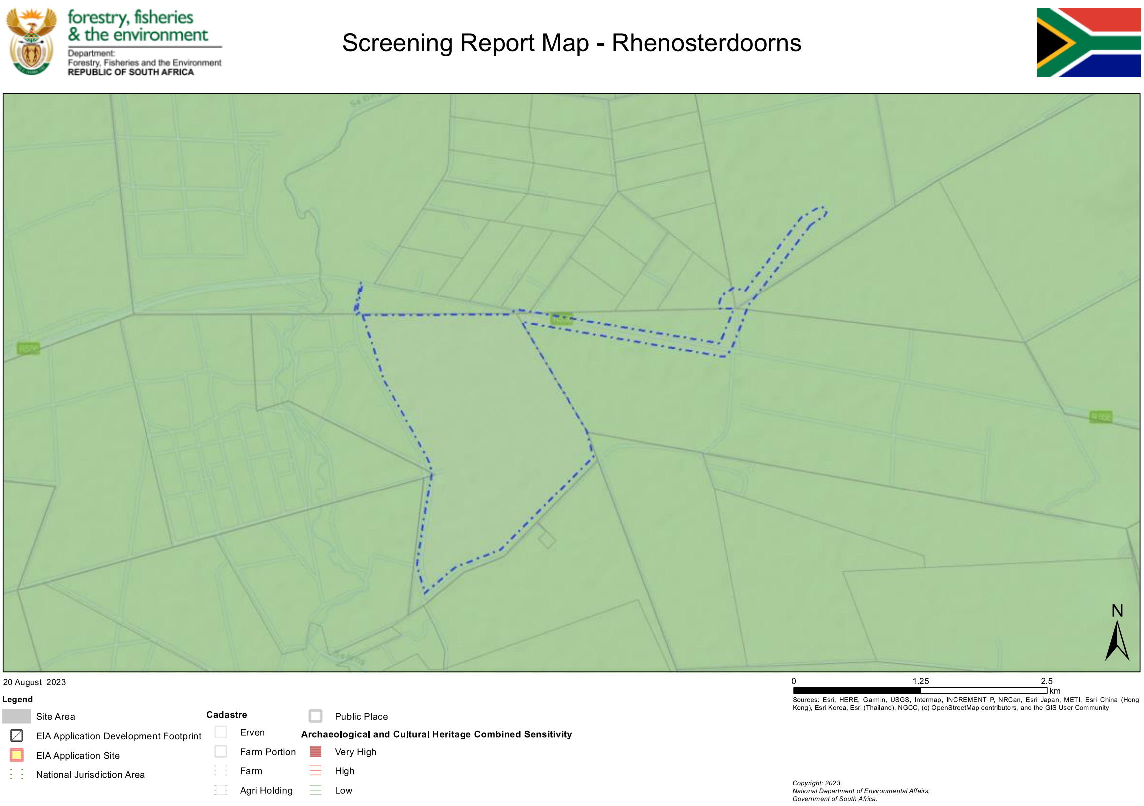

Figure 19 - Screening tool map indicating a low sensitivity rating for archaeology and heritage

4.2.4 Palaeontological screening

The National Environmental Web-bases Screening Tool indicates a High Sensitivity while areas with a moderate Sensitivity is also crossed.

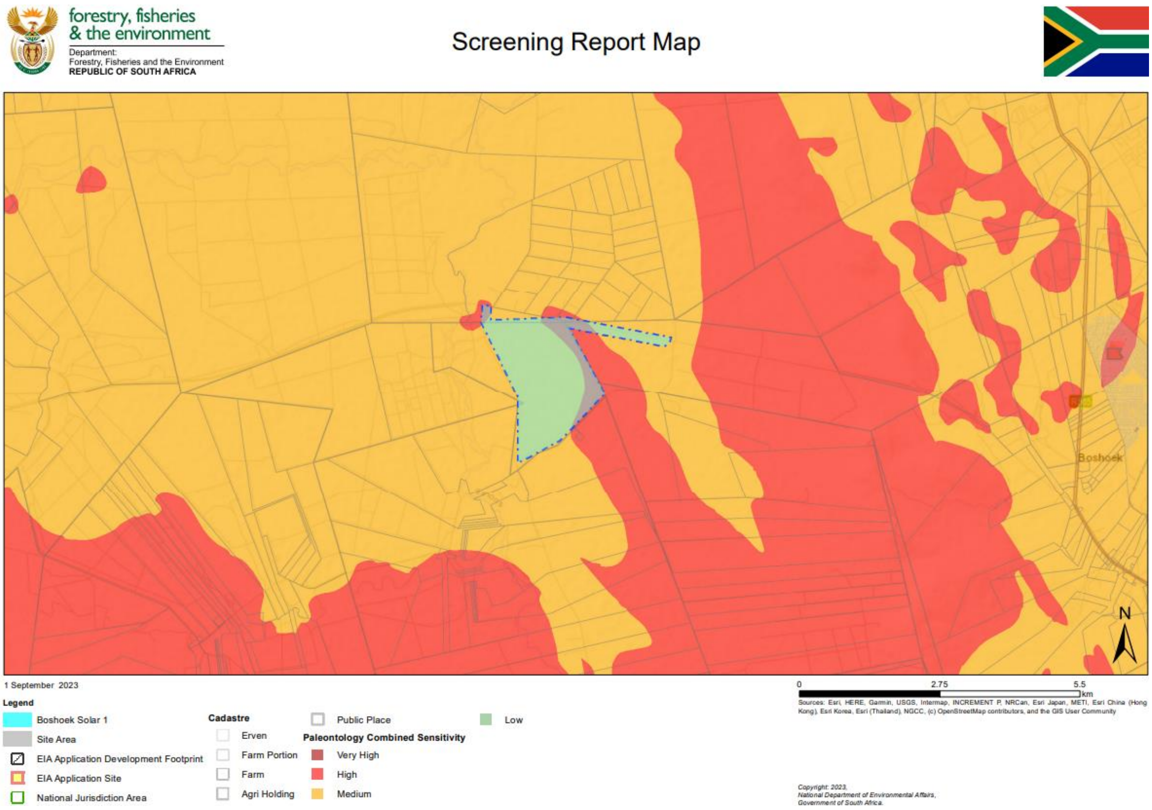

Figure 20 - Palaeontological Sensitivity of the Boshoek Solar 1 by the National Environmental Web-bases Screening Tool indicates a High (red) Sensitivity while areas with a moderate (yellow) Sensitivity is also crossed

4.2.5 Heritage sensitivity

Analysis of maps and satellite imagery enabled the identification of possible heritage sensitive areas. By superimposition and analysis, it was possible to rate these structures according to age and thus their level of protection under NHRA. **Table 4** lists the possible tangible heritage sites identified in the vicinity of the study area and the relevant legislative protection.

Table 4: Tangible heritage site in the study area.

Name	Description	Legislative protection
Archaeology	Older than 100 years	NHRA Sections 3 and 35
Structures	Possibly older than 60 years	NHRA Sections 3 and 34
Burial grounds	Graves	NHRA Sections 3 and 36 and MP Graves Act

Additionally, evaluation of satellite imagery has indicated the following areas that may be sensitive from a heritage perspective. The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix (**Table 5**).

Table 5: Landform type to heritage find matrix

LANDFORM TYPE	HERITAGE TYPE
Crest and foot hill	LSA and MSA scatters, LIA settlements
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Water holes/pans/rivers	MSA and LSA sites, LIA settlements
Farmsteads	Historical archaeological material
Ridges and drainage lines	LSA sites, LIA settlements
Clearings	LIA settlements

4.3 Fieldwork findings[1]

The fieldwork was conducted from the 21st to the 25th of August 2023 by a field team of PGS heritage. Their movement on site was tracked by GPS and a tracklog map can be seen in **Figure 21**.

During the fieldwork no heritage features were identified.

[1] *Site in this context refers to a place where a heritage resource is located and not a proclaimed heritage site as contemplated under s27 of the NHRA.*

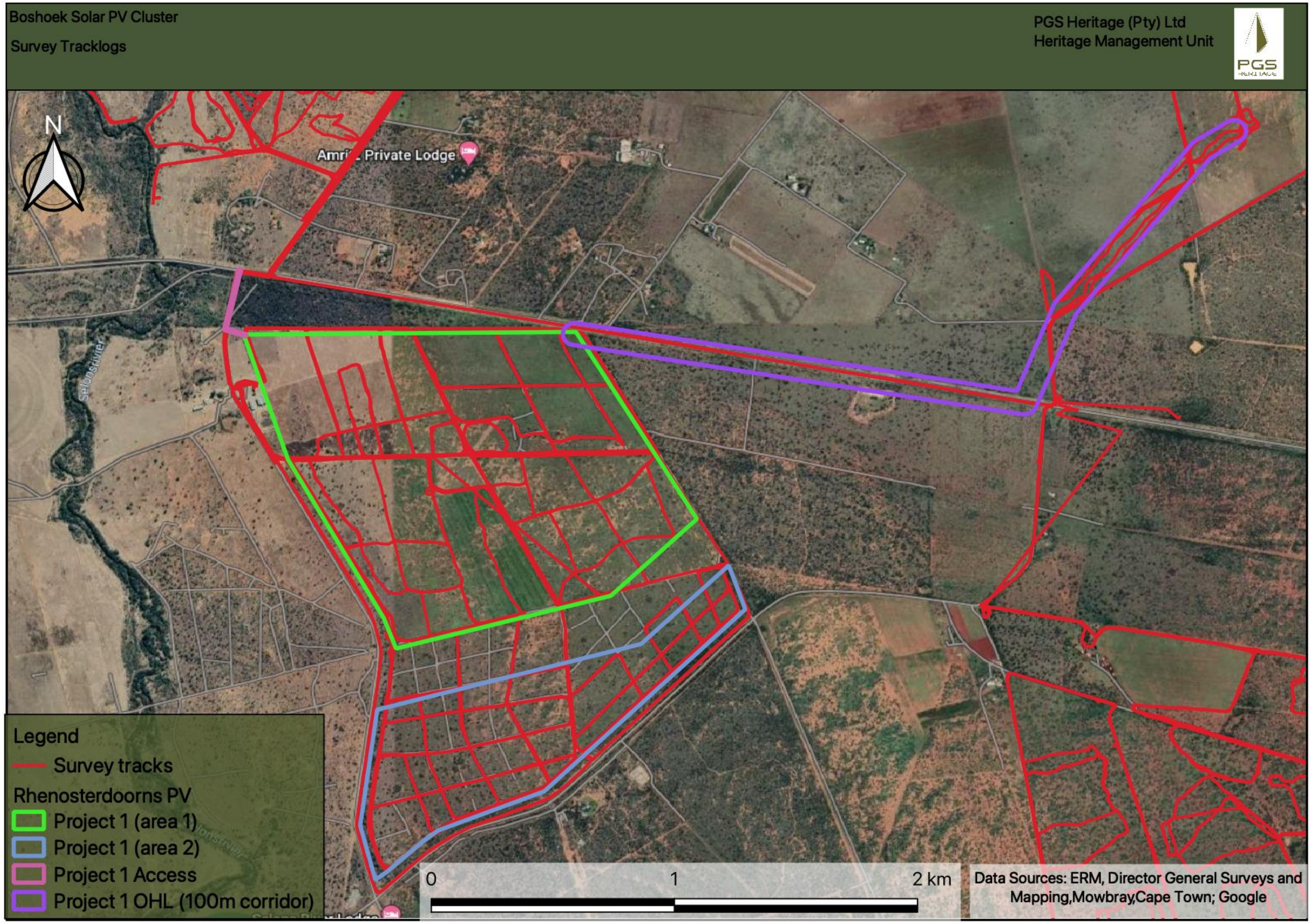

Figure 21 - Fieldwork tracklogs (track in red, study area in green and blue, grid in purple)

4.4 Palaeontology

PGS appointed Banzai Environmental to conduct the Palaeontological Desktop Assessment (PDA) to assess the Palaeontology of the Proposed Boshoek Solar PV Cluster near Boshoek in North West Province. The proposed Cluster comprises of Boshoek Solar 1, Boshoek Solar 2 and Boshoek Solar 3. Under the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PDA is necessary to confirm if fossil material could potentially be present in the approved development area and to evaluate the potential impact of the proposed changes to the development on the Palaeontological Heritage.

The proposed Boshoek Solar Cluster is underlain by Quaternary superficial deposits as well as the Silverton Formation (Pretoria Group, Transvaal Supergroup). The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the study area is underlain by sediments with a High (Silverton Formation) and Moderate (Quaternary deposits) Palaeontological Sensitivity (Almond et al, 2013; SAHRIS website). Updated geology produced by the Council for Geosciences in Pretoria indicates that the development is underlain by the alluvium, colluvium, eluvium, and gravel as well as the Silverton Formation of the Pretoria Group (Transvaal Supergroup). The National Environmental Web-bases Screening Tool indicates a High Sensitivity while areas with a moderate Sensitivity is also crossed.

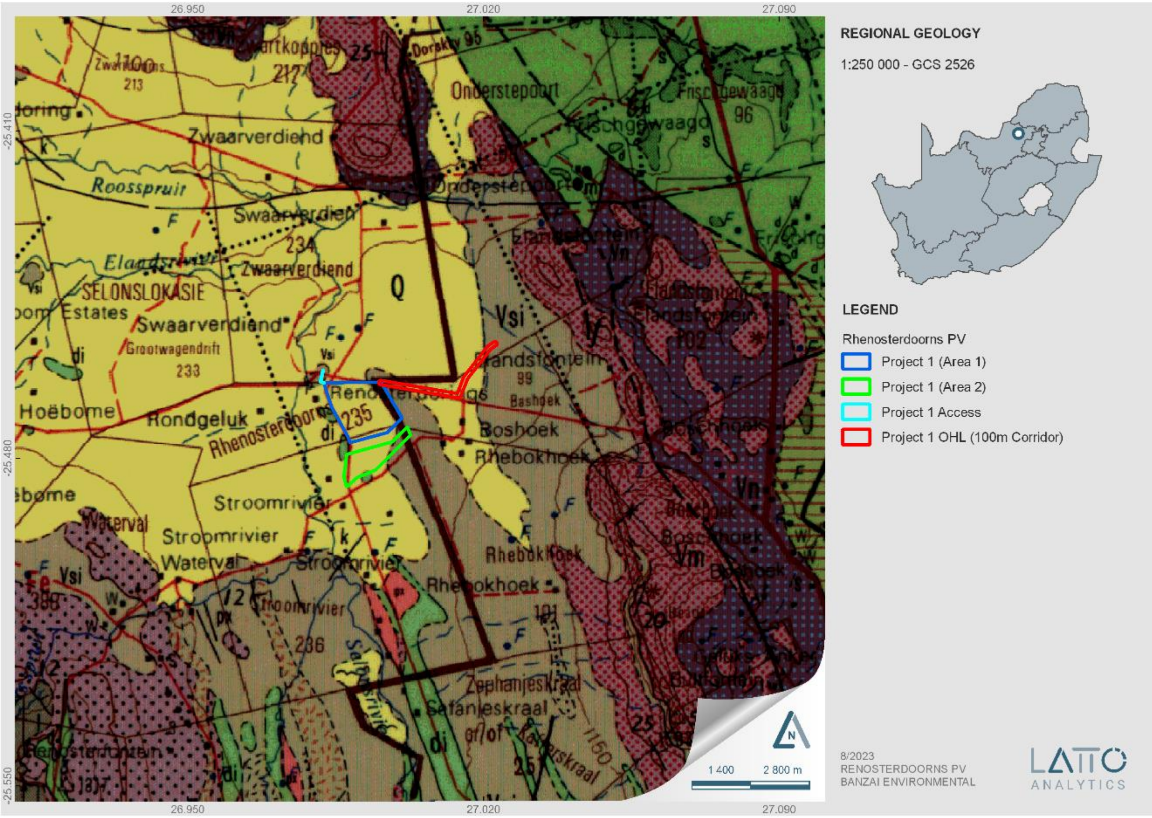

Figure 22 - Extract of the 1:250 000 Rustenburg 2526 (1981) Geological Map (Council for Geosciences, Pretoria) indicating that the Boshoek Solar 1 is mostly underlain by Quaternary Superficial Sediments (Q, yellow) while a eastern portion of the study area and grid infrastructure is underlain by the Silverton Formation (Vsi, khaki; Pretoria Group, Transvaal Supergroup)

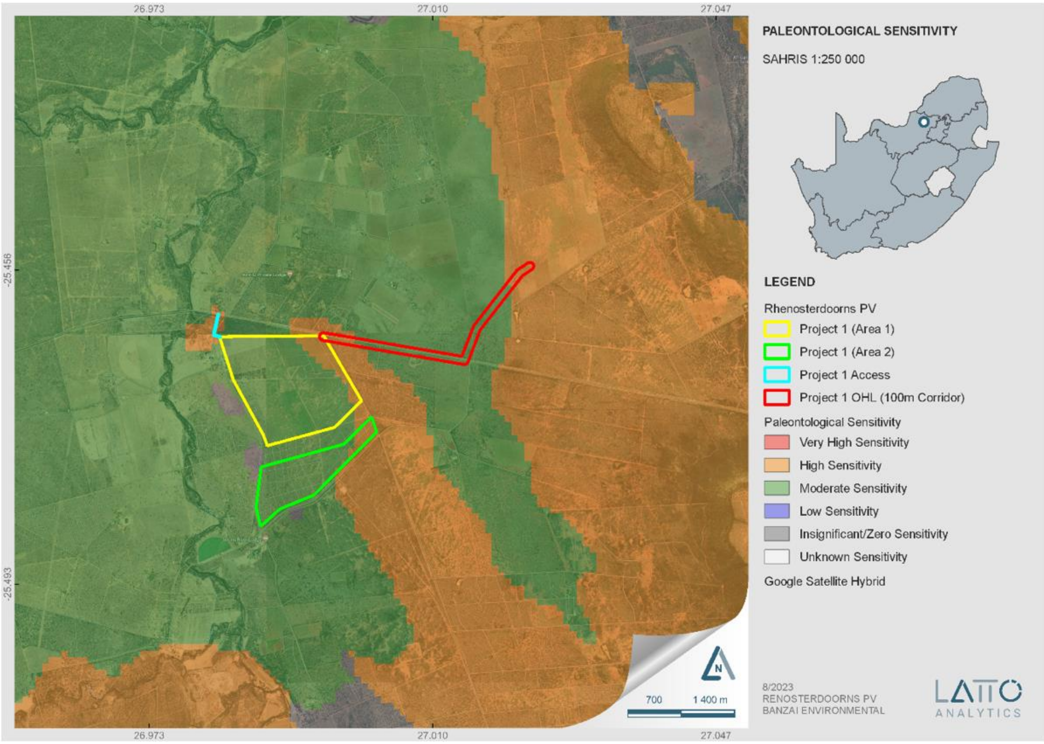

Figure 23 - The SAHRIS PalaeoMap map (Council of Geosciences) indicates that the Boshoek Solar 1 near Boshoek in North West is underlain with sediments with a High (orange, Silverton Formation) and Moderate (green, Quaternary deposits) Palaeontological Sensitivity.

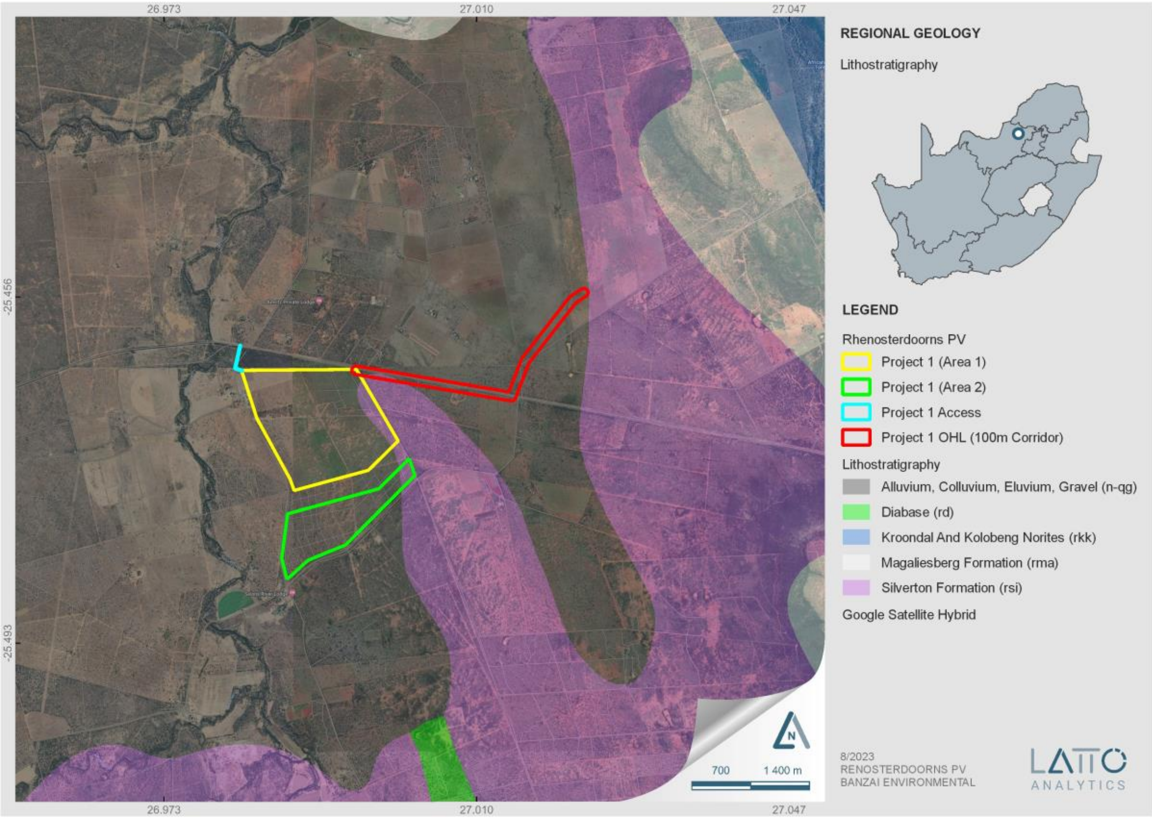

Figure 24 - Updated Geology compiled by the Council of Geosciences indicates that the proposed Boshoek Solar 1 is underlain by alluvium, colluvium, eluvium and gravel as well as the Silverton Formation (Pretoria Group-, Transvaal Supergroup).

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5 IMPACT ASSESSMENT

The impact assessment rating is based on the rating scale as contained in **Appendix B**.

The following section provides an analysis of the impacts of the proposed project on heritage resources within the study area.

5.1 Details of all alternatives considered.

This section describes alternative means of carrying out the operation and the consequences of not proceeding with the proposed project.

The “no-go” alternative refers to the option of not going ahead with the proposed project. This will entail maintaining the current status quo with no impact from the project.

5.1.1 Heritage

As no heritage features were located, the impact significance during the construction phase is rated as LOW before and after mitigation.

5.1.2 Palaeontology

A Medium impact significance has been allocated for the construction phase of the solar PV development pre-mitigation and a Low significance post mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage and **no significant impacts are expected to impact the Operational and Decommissioning phases**.

5.2 Cumulative Impact

There are currently two (in process / approved) Renewable Energy Facilities within 50 km of the Boshoek solar PV cluster based on the data using the REEA_OR_2022_Q4. The cumulative impacts on archaeological heritage are considered MEDIUM before mitigation and LOW after mitigation and, therefore, fall within the acceptable limits for the project.

5.3 Impact Assessment summary tables

Implementing the impact assessment methodology as supplied by ERM, the following tables provide provides a quantitative assessment of the impacts of the proposed Boshoek Solar Cluster.

The impact analysis of the project has shown no potential archaeological and/or other cultural heritage features identified during the fieldwork .

Table 6: Heritage Impact Assessment

Impact Phase: Construction/ Operation/Decommissioning							
Potential impact description: Damage/destruction to archaeological heritage Detailed description of impact : No heritage resources were located, therefore the only potential Impact, are to chance finds.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	L	L	L	Neutral	L	L	H
With Mitigation	L	L	L	Neutral	L	L	H
Can the impact be reversed?			NO. Destruction to heritage sites is permeant.				
Will impact cause irreplaceable loss or resources?			YES. Heritage sites are unique and irreplicable.				
Can impact be avoided, managed or mitigated?			YES. Follow mitigation measures as described by SAHRA				
Mitigation measures to reduce residual risk or enhance opportunities: • Chance find protocol must be implemented							
Residual impact	*Yes, but acceptable as of low negative significance*						

Table 7: Palaeontological Impact Assessment

Impact Phase: Construction/ Operation/Decommissioning
Potential impact description: Impact on Fossil Heritage Detailed description of impact Boshoek Solar 1 The excavations and clearing of vegetation during the construction phase of the PV Facility and associated infrastructure areas will consist of digging into the superficial sediment cover as well as underlying deeper bedrock. These excavations will change the existing topography and may possibly destroy or even permanently close-in fossils at or below the ground surface. These fossils will then be lost for research. Impacts on Palaeontological Heritage are only likely to happen within **the construction phase**. No impacts are expected to occur during the operation phase or decommissioning phase....

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	M	L	H	Negative	H	L	H
With Mitigation	M	L	H	Neutral	L	L	H
Can the impact be reversed?			NO. Destroyed fossils cannot be replaced.				
Will impact cause irreplaceable loss or resources?			YES. Fossils cannot be replaced				
Can impact be avoided, managed or mitigated?			YES. The impact can be mitigated by the Chance find protocol.				
Mitigation measures to reduce residual risk or enhance opportunities: • If a chance find is made the person responsible for the find must immediately **stop working** and all work that could impact that finding must cease in the immediate vicinity of the find. • The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates. • A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates. • Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found. • Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary. • The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find. • If the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO. Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site. • Once the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.							
Residual impact	*Loss of Fossil Heritage*						

Table 8: Cumulative Impacts

Impact Phase: Construction/ Operation/Decommissioning							
Potential impact description: Damage/destruction to archaeological heritage Detailed description of impact: No heritage resources were located, therefore the only potential Impact, are to chance finds.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	L	L	L	Neutral	L	L	H
With Mitigation	L	L	L	Neutral	L	L	H
Can the impact be reversed?			NO. Destruction to heritage sites is permeant.				
Will impact cause irreplaceable loss or resources?			YES. Heritage sites are unique and irreplicable.				
Can impact be avoided, managed or mitigated?			YES. Follow mitigation measures as described by SAHRA				
Mitigation measures to reduce residual risk or enhance opportunities: • Chance find protocol must be implemented							
Residual impact	*Yes, but acceptable as of low negative significance*						

Impact Phase: Cumulative							
Potential impact description: Impact on Fossil Heritage Detailed description of impact Boshoek Solar 1: Loss of fossil heritage. As the development footprint is not considered sensitive in terms of palaeontological resources, the only impacts could be on chance finds							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation / Enhancement	L	L	L	Negative	L	L	H
With Mitigation / Enhancement	L	L	L	Neutral	L	L	H
Can the impact be reversed?			NO. Destroyed fossils cannot be replaced.				
Will impact cause irreplaceable loss or resources?			YES. Fossils cannot be replaced.				

Can impact be avoided, managed or mitigated?	YES. The impact can be mitigated by the Chance find protocol.
Mitigation measures to reduce residual risk or enhance opportunities: • If all the facilities apply the Chance find Protocol the risk will be low	
Residual impact	*Loss of Fossil Heritage. During construction phases, it is possible fossil rich deposits could be uncovered.*

6 MANAGEMENT RECOMMENDATIONS AND GUIDELINES

The following section must be read in conjunction with **Table 10** of this report.

6.1 Construction and operational phases

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camp areas and small-scale infrastructure development associated with the project.

It is possible that cultural material will be exposed during construction and may be recoverable, keeping in mind delays can be costly during construction, and as such must be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, however foundation holes do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project, and these must be catered for. Temporary infrastructure developments, such as construction camps and laydown areas, are often changed or added to the project as required. In general, these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the construction phase, it is important to recognize any significant material being unearthed, making the correct judgment on which actions should be taken. It is recommended that the following chance find procedure should be implemented.

6.2 Chance finds procedure

- A heritage practitioner / archaeologist should be appointed to develop a heritage induction program and conduct training for the ECO as well as team leaders in the identification of heritage resources and artefacts **during the implementation of the EMPr**.
- An appropriately qualified heritage practitioner / archaeologist must be identified to be called upon in the event that any possible heritage resources or artefacts are identified.
- Should an archaeological site or cultural material be discovered during construction (or operation), the area should be demarcated, and construction activities halted.
- The qualified heritage practitioner / archaeologist will then need to come out to the site and evaluate the extent and importance of the heritage resources and make the necessary recommendations for mitigating the find and the impact on the heritage resource.
- The contractor therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the materials and data are recovered.
- Construction can commence as soon as the site has been cleared and signed off by the heritage practitioner / archaeologist.

6.3 Possible finds during construction

The study area occurs within a greater historical and archaeological site as identified during the desktop and fieldwork phase. Soil clearance for infrastructure as well as the proposed reclamation activities, could uncover the following:

- Historical structures and foundations
- unmarked burial grounds and graves

6.4 Timeframes

It must be kept in mind that mitigation and monitoring of heritage resources discovered during construction activity will require permitting for collection or excavation of heritage resources and lead times must be worked into the construction time frames. **Table 9** gives guidelines for lead times on permitting.

Table 9: Lead times for permitting and mobilisation

Action	Responsibility	Timeframe
Preparation for field monitoring and finalisation of contracts	The contractor and service provider	1 month
Application for permits to do necessary mitigation work	Service provider – Archaeologist and SAHRA	3 months
Documentation, excavation and archaeological report on the relevant site	Service provider – Archaeologist	3 months
Handling of chance finds – Graves/Human Remains	Service provider – Archaeologist and SAHRA	2 weeks
Relocation of burial grounds or graves in the way of the development	Service provider – Archaeologist, SAHRA, local government and provincial government	6 months

6.5 Heritage Management Plan for EMPr implementation

Table 10: Heritage Management Plan for EMPr implementation

Area and site no.	Mitigation measures	Phase	Timeframe	The responsible party for implementation	Monitoring Party (frequency)	Target	Performance indicators (monitoring tool)
General project area	Implement a chance to find procedures in case where possible heritage finds are uncovered.	Construction	During construction	Applicant ECO Heritage Specialist	ECO (monthly / as or when required)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 34-36 and 38 of NHRA	ECO Monthly Checklist/Report
Palaeontological resources	Implement a chance to find protocol. If fossil remains or trace fossils are discovered during any phase of construction, either on the surface or exposed by excavations the Environmental Control Officer (ECO) in charge of these developments must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation can be carry out by a palaeontologist	Construction	During Construction	Applicant Environmental Control Officer (ECO)	Monthly	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 36 and 38 of NHRA	ECO Monthly Checklist/Report

7 CONCLUSIONS AND RECOMMENDATIONS

PGS Heritage (Pty) Ltd was appointed by ERM Southern Africa (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) process for the proposed Boshoek Solar PV Cluster - Boshoek Solar 1 on Portion 0 of the farm Rhenosterdoorns 531, portion 1 and 18 of the farm Zwaarverdiend 234, portion 1 of the farm Elandsfontein 102, Paul Bodenstein Landgoed 571 JG and the farm Onderstepoort 98, within the Rustenburg Local Municipality and the Bojanala District Municipality in the North West Province

A further standalone Palaeontological Desktop Assessment (PDA) was completed for PGS by Dr Elize Butler of Banzai Environmental.

During the fieldwork no heritage resources were identified.

7.1 Mitigation considerations and buffers to consider from the EIA phase are:

- No heritage resources were located, however, not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and existing vegetation cover. It should be noted most of the study area was accessible for the fieldwork survey, but the vegetation is thick bush and visibility of sites such as Stone Age or Iron Age are difficult to locate.
- During the construction phase, it is important to recognize any significant material being unearthed, making the correct judgment on which actions should be taken. It is recommended that the following chance find procedure should be implemented.
    - A heritage practitioner / archaeologist should be appointed to develop a heritage induction program and conduct training for the ECO as well as team leaders in the identification of heritage resources and artefacts **during the implementation of the EMPr**.
    - An appropriately qualified heritage practitioner / archaeologist must be identified to be called upon in the event that any possible heritage resources or artefacts are identified.
    - Should an archaeological site or cultural material be discovered during construction (or operation), the area should be demarcated, and construction activities halted.
    - The qualified heritage practitioner / archaeologist will then need to come out to the site and evaluate the extent and importance of the heritage resources and make

the necessary recommendations for mitigating the find and the impact on the heritage resource.

- The contractor therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the materials and data are recovered.

7.2 Mitigation measures

Mitigation measures are described in **Table 10** of this report.

7.3 General

It is the combined considered opinion of the heritage specialists that the proposed project will not have a direct impact on heritage resources.

With the implementation of recommended mitigation measures the overall impact on heritage resources will be at an acceptable level during the activities of the project.

8 REFERENCES

8.1 Published References

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8.3 Historical Topographic Maps

All the historic topographical maps used in this report were obtained from the Directorate: National Geo-spatial Information of the Department of Rural Development and Land Reform in Cape Town.

8.4 Internet

www.angloboerwar.com

www.sahistory.org.za

www.sanbi.org

www.wikipedia.org

8.5 Google Earth

All the aerial depictions and overlays used in this report are from Google Earth.

APPENDIX A

ENVIRONMENTAL IMPACT METHODOLOGY

ERM: IMPACT ASSESSMENT METHODOLOGY

INTRODUCTION

Owing to the complexity of many of the systems that need to be considered when undertaking an Environmental Impact Assessment (EIA), it is not always possible to obtain quantitative data on which to base the impact assessment. Therefore, it is often necessary to use qualitative or semi-quantitative methods to determine the significance of environmental impacts.

The significance ranking approach presented in this paper is intended as a tool for use together with the general framework presented in Part 1 and is the final step in completing the structured and systematic approach. In Part 1 it was shown how environmental impacts can be linked to the project activities via the responsible "mechanisms", which are defined as *environmental aspects* in the ISO 14 000 series of standards. It was explained that significant impacts would only be present if significant aspects are present. Hence, a method for ranking the significance of aspects is required. Once the significance aspects have been identified, it is necessary to rank the significance of the impacts that could result form them.

SIGNIFICANCE OF ENVIRONMENTAL ASPECTS

The significance of environmental aspects can be determined and ranked by considering the criteria presented in **Table 1**. In some cases it may be necessary to undertake the impact assessment to determine whether a particular aspect is significant. Therefore, a fair degree of iteration is unavoidable during the assessment process.

Table 1 – Criteria used to determine the significance of environmental aspects

Significance Ranking	Negative Aspects	Positive Aspects
H (High)	Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.	Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.
M (Moderate)	Has characteristics that could cause negative impacts.	Has characteristics that could cause positive impacts.
L (Low)	Will never exceed legislation or standards. Unlikely to cause significant negative impacts.	Will always comply with all legislation and standards. Unlikely to cause significant positive impacts.

The aspect identification and ranking process is largely a screening exercise whereby the aspects that do not have the potential to cause significant impacts are eliminated. Aspects ranked "high" and "moderate" are significant and the possible impacts associated with their presence will need to be determined. Aspects ranked “low” do not warrant further attention.

The significance of the aspects should be ranked on the assumption that the management recommended in the EIA will be in place i.e. *with management*. This represents the scenario that the proponent wishes to have considered for approval. The environmental aspects associated with the proposed project activities during the construction, operational, closure phases (where appropriate) need to be identified. The influence of various project alternatives on the significance of the aspects must also be considered.

It may be desirable to also undertake a *without management* aspect ranking, since this highlights the sensitivity of the key risk areas to management and, hence, the management priorities. However, the dilemma in such an exercise is deciding on how much management to include. In the case of a mining project, for example, does one assume that the tailings dam will be completely absent or merely operated poorly? A useful rule of thumb is to assume that all the management required for operational reasons will be in place, but that any management specifically for environmental control will be absent. The danger in presenting *without management* ranking scenario in an EIA report is that it does not represent the scenario that the proponent wishes to have approved.

SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Where significant environmental aspects are present (“high” or “moderate”), significant environmental impacts ***may*** result. The significance of the impacts associated with the significant aspects can be determined by considering the risk:

Significance of Environmental Impact (Risk) = Probability x Consequence

The consequence of impacts can be described by considering the severity, spatial extent and duration of the impact.

Severity of Impacts

Table 2 presents the ranking criteria that can used to determine the severity of impacts on the bio- physical and socio-economic environment. Table 3 provides additional ranking criteria for determining the severity of negative impacts on the bio-physical environment.

Table 2 – Criteria for ranking the Severity of environmental impacts

Type of Criteria	Negative			Positive		
	H-	M-	L-	L+	M+	H+
Qualitative	Substantial deterioration. Death, illness or injury.	Moderate deterioration. Discomfort.	Minor deterioration. Nuisance or minor irritation.	Minor improvement.	Moderate improvement.	Substantial improvement .
Quantitative	Measurable deterioration.		Change not measurable i.e. will remain within current range.		Measurable improvement.	
	Recommended level will often be violated.	Recommended level will occasionally be violated.	Recommended level will never be violated.		Will be within or better than recommended level.	
Community Response	Vigorous community action.	Widespread complaints.	Sporadic complaints.		No observed reaction.	Favourable publicity

Table 3 – Criteria for ranking the Severity of negative impacts on the bio-physical environment

Environment	Ranking Criteria		
	Low (L-)	**Medium (M-)**	**High (H-)**
Soils and land capability	Minor deterioration in land capability. Soil alteration resulting in a low negative impact on one of the other environments (e.g. ecology).	Partial loss of land capability. Soil alteration resulting in a moderate negative impact on one of the other environments (e.g. ecology).	Complete loss of land capability. Soil alteration resulting in a high negative impact on one of the other environments (e.g. ecology).
Ecology (Plant and animal life)	Disturbance of areas that are degraded, have little conservation value or are unimportant to humans as a resource. Minor change in species variety or prevalence.	Disturbance of areas that have some conservation value or are of some potential use to humans. Complete change in species variety or prevalence.	Disturbance of areas that are pristine, have conservation value or are an important resource to humans. Destruction of rare or endangered species.
Surface and Groundwater	Quality deterioration resulting in a low negative impact on one of the other environments (ecology, community health etc.)	Quality deterioration resulting in a moderate negative impact on one of the other environments (ecology, community health etc.).	Quality deterioration resulting in a high negative impact on one of the other environments (ecology, community health etc.).

Spatial Extent and Duration of Impacts

The duration and spatial scale of impacts can be ranked using the following criteria:

Table 4 – Ranking the Duration and Spatial Scale of impacts

	Ranking Criteria		
	L	**M**	**H**
Duration	Quickly reversible Less than the project life Short-term	Reversible over time Life of the project Medium-term	Permanent Beyond closure Long-term
Spatial Scale	Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national

Where the severity of an impact varies with distance, the severity should be determined at the point of compliance or the point at which sensitive receptors will be encountered. This position corresponds to the spatial extent of the impact.

Consequence of Impacts

Having ranked the severity, duration and spatial extent, the overall consequence of impacts can be determined using the following qualitative guidelines:

Table 5 – Ranking the Consequence of an impact

SEVERITY = L

DURATION	**Long-term**	**H**			
	Medium-term	**M**			**MEDIUM**
	Short-term	**L**	**LOW**		

SEVERITY = M

DURATION	**Long-term**	**H**			**HIGH**
	Medium-term	**M**		**MEDIUM**	
	Short-term	**L**	**LOW**		

SEVERITY = H

DURATION	**Long-term**	**H**			
	Medium-term	**M**			HIGH
	Short-term	**L**	MEDIUM		
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national
			SPATIAL SCALE		

To use Table 5, firstly go to one of the three "layers" based on the severity ranking obtained from Table 2 and/ or Table 3. Thereafter determine the consequence ranking by locating the intersection of the appropriate duration and spatial scale rankings.

Overall Significance of Impacts

Combining the consequence of the impact and the probability of occurrence, as shown by Table 6, provides the overall significance (risk) of impacts.

Table 6 – Ranking the Overall Significance of impacts

	Definite Continuous	**H**	MEDIUM		HIGH

PROBABILITY	Possible Frequent	**M**		MEDIUM	
	Unlikely Seldom	**L**	LOW		MEDIUM
			L	M	H
			CONSEQUENCE (from Table 5)		

The overall significance ranking of the negative environmental impacts provides the following guidelines for decision making:

Table 7 – Guidelines for decision-making

Overall Significance Ranking	Nature of Impact	Decision Guideline
High	Unacceptable impacts.	Likely to be a fatal flaw.
Moderate	Noticeable impact.	These are unavoidable consequence, which will need to be accepted if the project is allowed to proceed.
Low	Minor impacts.	These impacts are not likely to affect the project decision.

Priority of Primary Impacts

In some cases environmental aspects could result in impacts on a number of environments. For example, the release of contaminated runoff could pollute surface water, which in turn could adversely impact on the ecology. In such cases the impact on the environment in which the first or primary impact occurs should be considered first. In the example "surface water" is the environment on which the primary impact occurs. If it can be shown that the impact on the primary environment will be insignificant, then secondary impacts need not be considered.

CONCLUSIONS

While the significance ranking methodology presented in above is not a substitute for more sophisticated qualitative methods, it is a step forward from the arbitrary methods that are often used to determine the significance of environmental impacts. In many instances it is impractical or prohibitively costly to source the data required to undertake a fully quantitative assessment and, hence, a qualitative or semi-quantities approach is the best option available. If used in conjunction with the general framework outlined in Part 1, it provides a systematic and structured approach to undertaking an EIA.

APPENDIX B

SITE DESCRIPTION FORMS

NO SITES WERE LOCATED

APPENDIX C

PGS TEAM CVS

JESSICA ANGEL

Professional Heritage Practitioner

PROFILE

Senior Heritage Specialist with an MSc degree in Archaeology and Geography. I am accredited as a Professional Archaeologist by the Association of Southern African Professional Archaeologists and as a Field Supervisor for Colonial Period, Iron Age, and Stone Age archaeology. My primary focus is on heritage management, which includes conducting Heritage Impact Assessments, managing heritage mitigation, and overseeing lab operations.

I have successfully managed various aspects of large-scale mitigation projects in South Africa and Lesotho. My responsibilities included conducting archaeological research, documentation, GIS, artefact photography, and archaeological illustration. I also managed archaeological assemblage storage and curation, as well as specialist analysis.

CONTACT

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PGS HERITAGE

EDUCATION

University of the Witwatersrand
2003-2005
BA Degree - Majors in Archaeology and Geography

University of the Witwatersrand
2006
BSc Hon Geography, with further specialisation in Environmental Management, Advanced GIS, Palaeogeomorphology and Globalisation and Agro Food restructuring.

University of the Witwatersrand
2010 - 2013
MSc Archaeology and Geography

WORK EXPERIENCE

PGS Heritage – Heritage Specialist/Senior Archaeologist
2023- present
Working in the Heritage Unit, managing Heritage Impact Assessments. Training of interns and Junior archaeologists

PGS Heritage, Lesotho– Senior Archaeologist
2018-2023
Laboratory and collections manager for the Heritage Mitigation of Polihali Dam Project. The Polihali Dam Project was a 2nd Phase CRM operation to mitigate the total inundation of various cultural sites.

PGS Heritage – Junior Archaeologist
2015-2018
Heritage Impact Assessments, Second Phase Heritage Mitigation on the Raising of the Clanwilliam Dam Wall.

PGS Heritage – Internship
2012 – 2014
My duties included gaining familiarity with gathering relevant background data, field surveys, exhumations, and report writing.

NGT Projects and Heritage Consultants
2013
Heritage Impact Assessments - Background research, report writing and ground surveys

Department of Geography, Archaeology and Environmental Science (University of the Witwatersrand)
2011
Research Assistant

PROFESSIONAL AFFILIATION

Accredited Professional Archaeologist
Association of Southern African Professional Archaeologists (ASAPA)– Since 2015

WOUTER FOURIE

Professional Heritage Practitioner

PROFILE

Project Manager and Principal Heritage Specialist holds a post-graduate degree in Archaeology and is registered with the Association of Southern African Professional Archaeologists as a Professional Archaeologist and is accredited as a Principal Investigator; he is further an Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners in South Africa.

My work focuses on heritage management through Heritage Impact Assessments, implementation of recommendations and large-scale heritage mitigation projects. I have worked, completed and implemented heritage projects in South Africa, Botswana, Mozambique, Mauritius, Zambia, Lesotho, and the Democratic Republic of the Congo.

CONTACT

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PGS HERITAGE

EDUCATION

University of Pretoria
1993-1996
BA Degree - Majors in Archaeology, Anthropology and Geography

University of Pretoria
1997
BA Hon Archaeology, with further specialisation in environmental management.

University of Cape Town
2016 – present
MPhil Conservation of the Built Environment

WORK EXPERIENCE

PGS Heritage Group of Companies
(*South Africa, Lesotho, Mozambique, and Portugal*)
Director – Heritage Specialist
2003- present
I am actively involved in the management of the business and focus on marketing and new business for PGS, specifically the broader SADC region. Acting as heritage specialist in multidisciplinary teams

The University of the Witwatersrand - Project Manager – Archaeological Contracts Unit
2007-2008
Responsible for conducting heritage and archaeological impact studies, archaeological excavations and general management of the unit

Matakoma Consultants – Director – Heritage Specialist
2000 – 2008
Heritage specialist and Director responsible for heritage and archaeological impact studies

Randfontein Estate Gold Mine – Environmental Coordinator
Oct 1998- Feb 2000
Coordinating all environmental Rehabilitation work

Department of Minerals and Energy Environmental Officer
Oct 1997– Sept 1998

PROFESSIONAL AFFILIATION

Accredited Professional Heritage Practitioner
Association of Professional Heritage Practitioners
Since 2014

Accredited Professional Archaeologist
Association of Southern African Professional Archaeologists – Since 2001

<<archaeologists

THE ASSOCIATION OF SOUTHERN AFRICAN PROFESSIONAL ARCHAEOLOGISTS

CERTIFICATE OF MEMBERSHIP

HEREBY CONFIRMS THAT

JESSICA ANGEL

Is a Professional Member (No 0423) of
the Association of Southern African Professional
Archaeologists and is in good standing
with the organisation

Valid April 2024 - March 2025

2024

ALBINO JOPELA
CHAIRPERSON

SHAHZAADEE KHAN
TREASURER

SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE
Proposed Boshoek Solar PV Cluster

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Heritage Assessment
Specialist Company Name	PGS Heritage (Pty) Ltd
Specialist Name	Jessica Angel
Specialist Identity Number	8312250052082
Specialist Qualifications:	MSc Archaeology
Professional affiliation/registration:	ASAPA 423
Physical address:	906 Bergarend Street, Waverly, Pretoria
Postal address:	PO Box 32542
Postal address	Totiusdal, 0134
Telephone	(012)3325305
Cell phone	0847981914
E-mail	jessica@pgsheritage.co.za

•

2. DECLARATION BY THE SPECIALIST

I, Jessica Angel declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Angel

Signature of the Specialist

PGS Heritage (Pty) Ltd

Name of Company:

08 Aug 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Jessica Angel_________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Angel

Signature of the Specialist

PGS Heritage (Pty) Ltd

Name of Company

08 August 2024

Date

Signature of the Commissioner of Oaths

08 Aug 2024

Date

TIRELO YA MAPODISI A AFRIKA BORWA
VISPOL COMMANDER
2024 -08- 08
HARTBEESPOORTDAM
SUID-AFRIKAANSE POLISIEDIENS
SOUTH AFRICAN POLICE SERVICE

JA

PALAEONTOLOGICAL DESKTOP ASSESSMENT

PROPOSED BOSHOEK SOLAR PV CLUSTER NEAR BOSHOEK, NORTH WEST PROVINCE

August 2023

COMPILED FOR: PGS HERITAGE

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological 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 favorable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, 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;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations.

<u>PALAEONTOLOGICAL CONSULTANT:</u> Banzai Environmental (Pty) Ltd

<u>CONTACT PERSON:</u> Elize Butler

Tel: +27 844478759

Email: info@banzai-group.com

Butler.

<u>SIGNATURE:</u>

This Palaeontological Desktop Assessment report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 2 – refer to **Appendix A**	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – Methods and TOR	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Desktop Assessment	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 4 Approach and Methodology	-

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
(f) details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1 & 9	
(g) An identification of any areas to be avoided, including buffers	Section 1 & 9	
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 9	
(k) Any mitigation measures for inclusion in the EMPr	Section 10	
(l) Any conditions for inclusion in the environmental authorisation	Section 1 and 9	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 1 and 9	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 9	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance,	Section 1 and 9	-

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan		
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process was handled as part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) process.
(p) A summary and copies of any comments that were received during any consultation process	N/A	Not applicable. To date, no comments regarding heritage resources that require input from a specialist have been raised.
(q) Any other information requested by the competent authority.	N/A	Not applicable.

Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by PGS Heritage to conduct the **Palaeontological Desktop Assessment** (PDA) to assess the Palaeontology of the Proposed Boshoek Solar PV Cluster near Boshoek in North West Province. The proposed Cluster comprises of Boshoek Solar 1, Boshoek Solar 2 and Boshoek Solar 3. Under the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PDA is necessary to confirm if fossil material could potentially be present in the approved development area and to evaluate the potential impact of the proposed changes to the development on the Palaeontological Heritage.

The proposed Boshoek Solar Cluster is underlain by Quaternary superficial deposits as well as the Silverton Formation (Pretoria Group, Transvaal Supergroup). The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the study area is underlain by sediments with a High (Silverton Formation) and Moderate (Quaternary deposits) Palaeontological Sensitivity (Almond *et al*, 2013; SAHRIS website). Updated geology produced by the Council for Geosciences in Pretoria indicates that the development is underlain by the alluvium, colluvium, eluvium and gravel as well as the Silwerton Formation of the Pretoria Group (Transvaal Supergroup). The National Environmental Web-bases Screening Tool indicates a High Sensitivity while areas with a moderate Sensitivityl is also crossed.

Based on the site investigation as well as desktop research it is concluded that fossil heritage of scientific and conservational interest in the overall development footprint for the solar facilities is rare. This is in contrast with the High Sensitivity allocated to the development area by the SAHRIS Palaeosensitivity Map and DFFE Screening Tool. **A Medium Palaeontological Significance has been allocated for the construction phase of the solar PV development pre-mitigation and a Low significance post mitigation**. The construction phase will be the only development phase impacting Palaeontological Heritage and **no significant impacts are expected to impact the Operational and Decommissioning phases**. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The **cumulative impacts of the development near Boshoek are medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project**. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. **The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.** It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

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1 INTRODUCTION

Boshoek Solar 1 (Pty) Ltd, Boshoek Solar 2 (Pty) Ltd, and Boshoek Solar 3 (Pty) Ltd, propose the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province.

Since the projects trigger activities in all three listing notices, a full scoping and EIA application process will be followed. Each facility within the cluster will have its own application and associated reporting and public participation process, i.e., 3 Applications and 3 S&EIA Reports will be compiled for the cluster.

Table 2: Technical Details of the Boshoek solar PV facility			
Development	**Boshoek Solar 1**	**Boshoek Solar 2**	**Boshoek Solar 3**
Developer / Applicant	Boshoek Solar 1 (Pty) Ltd	Boshoek Solar 2 (Pty) Ltd	Boshoek Solar 3 (Pty) Ltd
DFFE Reference	To be confirmed	To be confirmed	To be confirmed
Solar Facility			
Capacity of Solar Facility	Up to 150 MW	Up to 150 MW	Up to 50 MW
Assessment Area, including the associated grid connection	~ 290 ha	~285 ha	~202 ha
Roads			
Description of roads	The majority of the access road will follow existing, gravel farm roads that may require widening up to 10 m (inclusive of storm water infrastructure). Where new sections of road need to be constructed (/lengthened), this will be gravel/hard surfaced access road and only tarred if necessary. A network of gravel internal access roads and a perimeter road (cumulatively up to 33 km in length), each with a width of up to ± 6 m, will be constructed to provide access to the various components of the PV development.	The majority of the access road will follow existing, gravel farm roads that may require widening up to 10 m (inclusive of storm water infrastructure). Where new sections of road need to be constructed (/lengthened), this will be gravel/hard surfaced access road and only tarred if necessary. A network of gravel internal access roads and a perimeter road (cumulatively up to 33 km in length), each with a width of up to ± 6 m, will be constructed to provide access to the various components of the PV development.	The majority of the access road will follow existing, gravel farm roads that may require widening up to 10 m (inclusive of storm water infrastructure). Where new sections of road need to be constructed (/lengthened), this will be gravel/hard surfaced access road and only tarred if necessary. A network of gravel internal access roads and a perimeter road (cumulatively up to 33 km in length), each with a width of up to ± 6 m, will be constructed to provide access to the various components of the PV development.

Site Access	Site access is proposed directly off an unnamed gravel road surrounding the site; however, this will be confirmed based on the outcome of the traffic impact assessment.	Site access is proposed directly off an unnamed gravel road surrounding the site; however, this will be confirmed based on the outcome of the traffic impact assessment.	Site access is proposed directly off an unnamed gravel road surrounding the site; however, this will be confirmed based on the outcome of the traffic impact assessment.
Length of site access road	To be confirmed based on the outcome of the traffic impact assessment.	To be confirmed based on the outcome of the traffic impact assessment.	To be confirmed based on the outcome of the traffic impact assessment.
Width of site access road	up to 10 m (inclusive of storm water infrastructure)	up to 10 m (inclusive of storm water infrastructure)	up to 10 m (inclusive of storm water infrastructure)
Length of internal roads	up to 33 km	up to 33 km	up to 33 km
Width of internal roads	up to 6 m	up to 6 m	up to 6 m
Facility Auxiliary Infrastructure			
Operations and maintenance buildings (O&M building) with parking area	An area of up to 1 ha will be occupied by buildings which will include (but not limited to) a 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre.	An area of up to 1 ha will be occupied by buildings which will include (but not limited to) a 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre.	An area of up to 1 ha will be occupied by buildings which will include (but not limited to) a 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre.
On-site substation capacity	Up to 132 kV	Up to 132 kV	Up to 132 kV
On-site switching station capacity	Up to 132 kV	Up to 132 kV	Up to 132 kV
Grid Connection Capacity	Up to 132 kV	Up to 132 kV	Up to 400 kV

Overhead Powerline	A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.	A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3 km north of the site.	A single or double circuit 132 kV power line from the switching station to the proposed Boshoek Main Transmission Station ~1 km north of the site.
Main Transmission Substation (MTS)	-	-	A new 132 /400 kV MTS ("Boshoek MTS").
Connection to National Grid	The future planned Eskom collector switching station will facilitate the connection of the facility substation to the Ngwedi 400/132kV MTS via a single or double circuit 132 kV overhead powerline. The connection infrastructure associated with this grid solution (i.e. between the collector switching station and the MTS) falls outside of the scope of this EIA and will be assessed as part of a separate Environmental Application.	The future planned Eskom collector switching station will facilitate the connection of the facility substation to the Ngwedi 400/132kV MTS via a single or double circuit 132 kV overhead powerline. The connection infrastructure associated with this grid solution (i.e. between the collector switching station and the MTS) falls outside of the scope of this EIA and will be assessed as part of a separate Environmental Application.	A ~2km 400 kV LILO powerline from the existing Eskom Powerline (Midas/Ngwedi 2 400 kV) to the proposed Boshoek MTS.
Cabling network	Medium voltage cables (up to 33 kV)	Medium voltage cables (up to 33 kV)	Medium voltage cables (up to 33 kV)
BESS Area	up to 5 ha	up to 5 ha	up to 5 ha
Height of fencing	up to 3.5 ha	up to 3.5 ha	up to 3.5 ha
Type of fencing	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.	Where site offices are required, temporary screen fencing used to screen offices from the wider landscape.

1.1 Boshoek Solar 1

Boshoek Solar 1 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province.

The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW. The development area is situated approximately 33 km north west of Rustenburg within the Rustenburg Local Municipality and the Bojanala District Municipality, in the North West Province.

The development area for the PV facility and associated infrastructure will be located on the following properties.

Farm Name	Farm No.	Portion No.
Boshoek Solar 1 PV Facility		
Farm Rhenosterdoorns	531	0
Farm Zwaarverdiend	234	1
Boshoek Solar 1 PV Grid Connection		
Zwaarverdiend 234 JP	234	18
Paul Bodenstein Landgoed 571 JG	571	RE
Elandsfontein 102 JG	102	1
Onderstepoort 98 JG	98	RE

The project is planned as part of a larger cluster, which includes two additional PV facilities (Boshoek Solar 2 and Boshoek Solar 3) up to 150 MW and 50 MW respectively.

An assessment area of approximately 290 ha is being assessed as part of this EIA process and the infrastructure associated with the 150 MW facility includes:

- PV modules (mono- or bifacial) and mounting structures;
- Inverters and transformers;
- Battery Energy Storage System (BESS);
- Site access road;
- Internal access roads;
- Auxiliary buildings (switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Temporary and permanent laydown area; and
- Grid connection infrastructure, including:
    - Underground medium-voltage cabling between the project components and the facility substation;
    - Up to 132kV facility substation;
    - Switching station;

- A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.

1.2 Boshoek Solar 2

Boshoek Solar 2 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province.

The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW. The development area is situated approximately 30 km north west of Rustenburg within the Rustenburg Local Municipality and the Bojanala District Municipality, in the North West Province.

The development area for the PV facility and associated infrastructure will be located on the following properties:

Farm Name	Farm No.	Portion No.
Boshoek Solar 2 PV Facility		
Farm Paul Bodenstein Landgoed	571	RE
Farm Rhebokhoek	101	2
Farm Rhebokhoek	101	12
Boshoek Solar 2 PV Grid Connection		
Farm Rhebokhoek	101	2
Rhebokhoek 101 JQ	101	11
Paul Bodenstein Landgoed 571 JQ	571	RE
Elandsfontein 102 JQ	102	1
Zwaarverdiend 234 JP	234	18
Onderstepoort 98 JQ	98	RE

The project is planned as part of a larger cluster, which includes two additional PV facilities (Boshoek Solar 1 and Boshoek Solar 3) up to 150 MW and 50 MW respectively.

An assessment area of approximately 285 ha is being assessed as part of this EIA process and the infrastructure associated with the 150 MW facility includes:

- PV modules (mono- or bifacial) and mounting structures;
- Inverters and transformers;
- Battery Energy Storage System (BESS);
- Site access road;
- Internal access roads;

- Auxiliary buildings (switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Temporary and permanent laydown area; and
- Grid connection infrastructure, including:
    - Underground medium-voltage cabling between the project components and the facility substation;
    - Up to 132kV facility substation;
    - Switching station;
    - A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3 km north of the site.

1.3 Boshoek Solar 3

Boshoek Solar 3 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province.

The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 50 MW. The development area is situated approximately 33 km north west of Rustenburg within the Rustenburg Local Municipality and the Bojanala District Municipality, in the North West Province.

The development area for the PV facility and associated infrastructure will be located on the following properties:

Farm Name	Farm No.	Portion No.
Boshoek Solar 3 PV Facility		
Farm Zwaarverdiend	234	1
Boshoek Solar 3 PV Grid Connection		
Farm Zwaarverdiend	234	1
Farm Zwaarverdiend	234	2
Farm Zwaarverdiend	234	4

The project is planned as part of a larger cluster, which includes two additional PV facilities (Boshoek Solar 1 and Boshoek Solar 2) up to 150 MW each respectively.

An assessment area of approximately 202 ha is being assessed as part of this EIA process and the infrastructure associated with the 50 MW facility includes:

- PV modules (mono- or bifacial) and mounting structures;
- Inverters and transformers;
- Battery Energy Storage System (BESS);
- Site access road;
- Internal access roads;
- Auxiliary buildings (switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Temporary and permanent laydown area; and
- Grid connection infrastructure, including:
    - Underground medium-voltage cabling between the project components and the facility substation;
    - Up to 132kV facility substation;
    - Switching station;
    - A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station 1 km north of the site;
    - A new 132 / 400 kV MTS ("Boshoek MTS").

1.4 Plan of Study

A site sensitivity verification report is required to be undertaken to comply with "Part A - General Protocol for the Site Sensitivity Verification and Minimum Report Content Requirements where a Specialist Assessment is required but no specific Environmental Theme Protocol has been prescribed" (GG 43110 / GNR 320, 20 March 2020).

A desktop study of the proposed development was conducted to verify the site sensitivity assigned to the Boshoek Solar Cluster and to validate the sensitivity and land use as prescribed by the DFFE Screening Tool. The Screening Tool indicates that the proposed development has a High Palaeontological Sensitivity. According to the National Palaeontological Databases no fossil Heritage has been found close to the development area. Based on desktop research it is concluded that fossil heritage of scientific and conservational interest in the overall development footprint for the solar facilities is rare. If Palaeontological Heritage is uncovered during surface clearing and excavations, the Chance find Protocol attached should be implemented immediately. These recommendations should be incorporated into the EMPr and fully implemented during the construction phase of the development. The construction of the development may thus be permitted in its whole extent, and no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

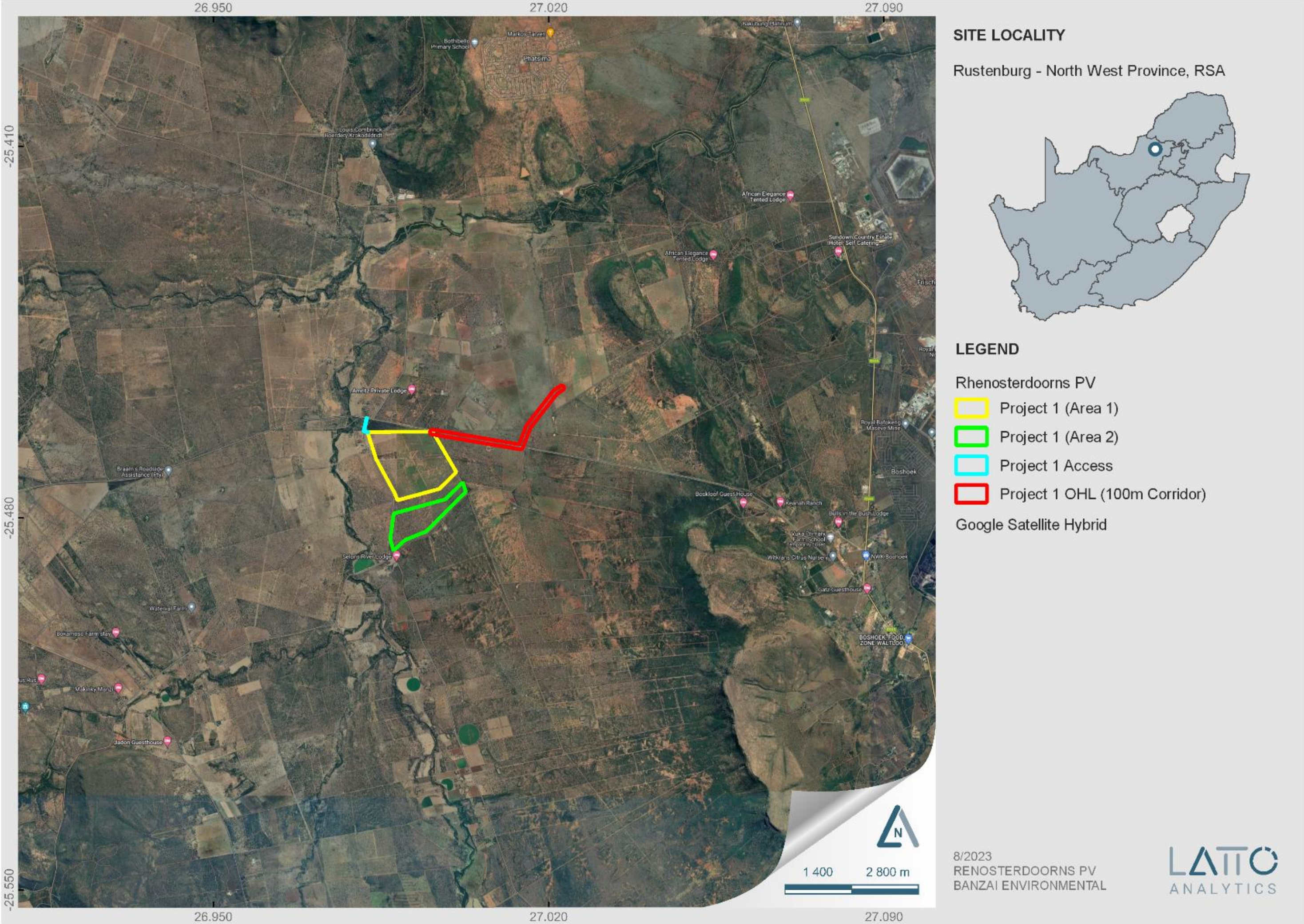

Figure 1:*Google Earth Image (2023) indicating the regional locality of the proposed Boshoek Solar 1 near Boshoek in North West.*

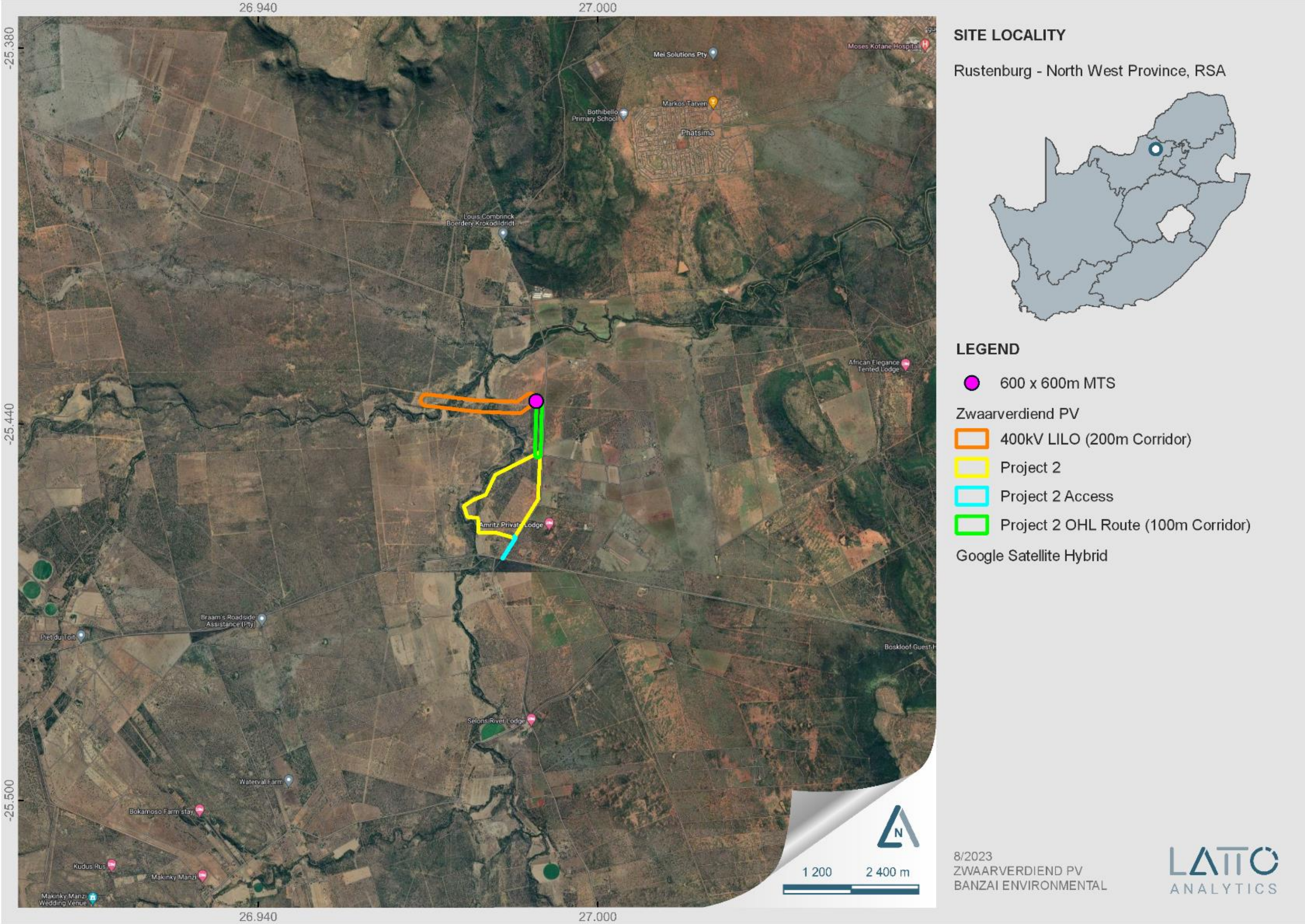

Figure 2: *Google Earth Image (2023) indicating the regional locality of the proposed Boshoek Solar 2 near Boshoek in North West.*

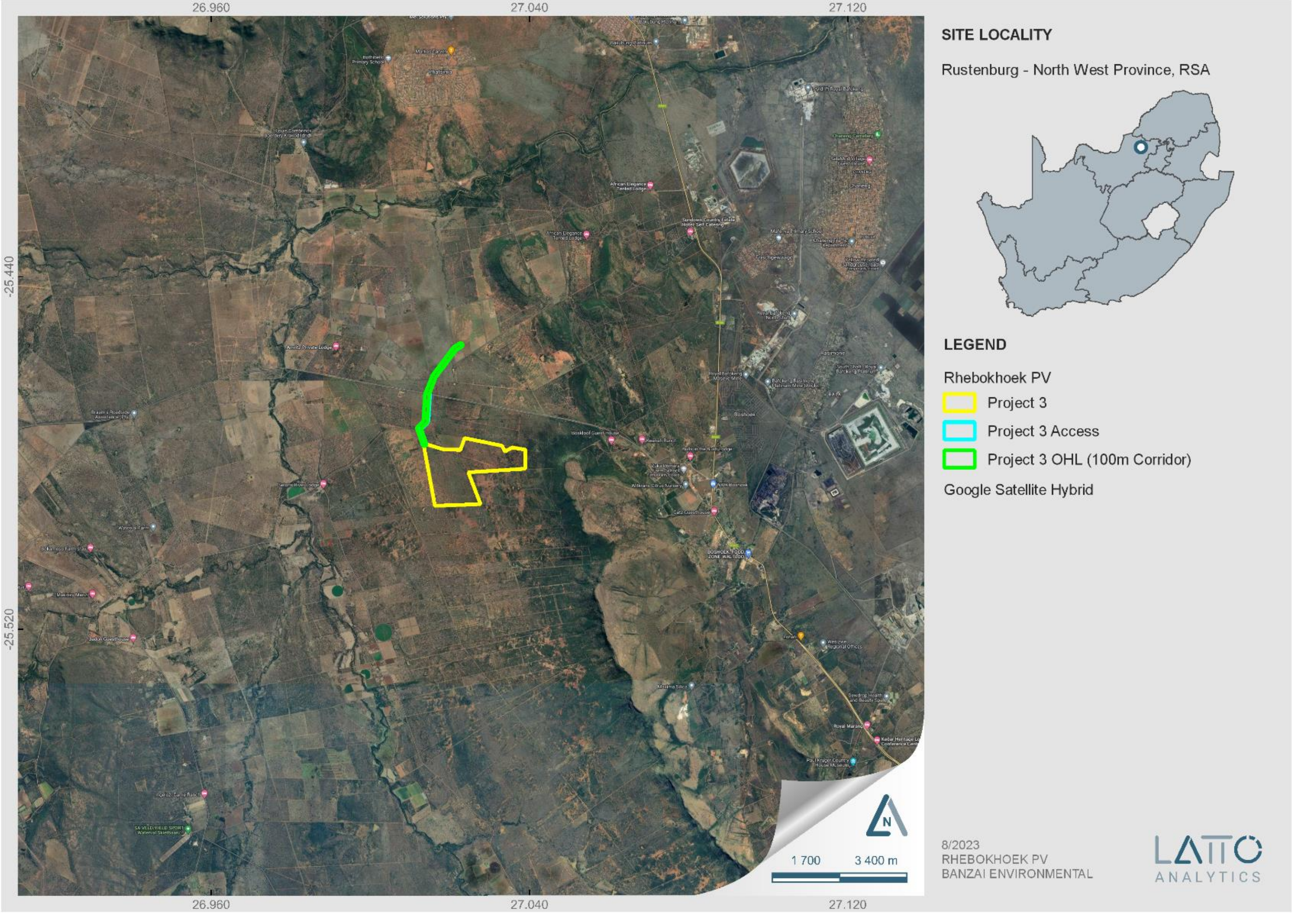

Figure 3:*Google Earth Image (2023) indicating the regional locality of the proposed Boshoek Solar 3 near Boshoek in North West.*

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This study has been conducted by Mrs Elize Butler, palaeontologist of Banzai Environmental (Pty) Ltd. She has conducted approximately 400 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than twenty-eight years. She has experience in locating, collecting, and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

A curriculum vitae is included in Appendix 1 of this specialist input report

3 LEGISLATION

National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

The identification, evaluation and assessment of any cultural heritage site, artefact or finds in the South African context is required and governed by the following legislation:

- National Environmental Management Act (NEMA) Act 107 of 1998
- National Heritage Resources Act (NHRA) Act 25 of 1999
- Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified.

The next section in each Act is directly applicable to the identification, assessment, and evaluation of cultural heritage resources.

GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Assessment Report (BAR) – Regulations 19 and 23
- Environmental Impacts Assessment (EIA) – Regulation 23
- Environmental Scoping Report (ESR) – Regulation 21
- Environmental Management Programme (EMPr) – Regulations 19 and 23

National Heritage Resources Act (NHRA) Act 25 of 1999

- Protection of Heritage Resources – Sections 34 to 36
- Heritage Resources Management – Section 38

The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) "…*identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage*".

In agreement with legislative requirements, EIA rating standards as well as SAHRA policies the following comprehensive and legally compatible PIA report have been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This Palaeontological Impact assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length.
- the construction of a bridge or similar structure exceeding 50 m in length.
- any development or other activity which will change the character of a site—
- (Exceeding 5 000 m^2 in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m^2 in extent.
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4. METHODS AND TERMS OF REFERENCE

This study forms part of the Heritage Impact Assessment Report. According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the purpose of the PIA is: 1) to identify the palaeontological importance of the rock formations in the footprint; 2) to evaluate the palaeontological magnitude of the formations; 3) to clarify the **impact** on fossil heritage; and 4) to suggest how the developer might protect and lessen possible damage to fossil heritage.

The palaeontological status of each rock section is calculated as well as the possible impact of the development on fossil heritage by a) the palaeontological importance of the rocks, b) the type of development and c) the quantity of bedrock removed.

All possible information is consulted to compile a scoping report, and this includes the following: Provisional DFFE Screening Tool, SAHRIS Palaeosensitivity map, all Palaeontological Impact Assessment reports in the same area; aerial photos and Google Earth images, topographical and geological maps as well as scientific articles of specimens from the development area and Assemblage Zones.

When the development footprint has a moderate to high palaeontological sensitivity a field-based assessment is necessary. The desktop and the field survey of the exposed rock determine the impact significance of the planned development and recommendations for further studies or mitigation are made. Destructive impacts on palaeontological heritage usually only occur during the construction phase while the excavations will change the current topography and destruct or permanently seal-in fossils at or below the ground surface. Fossil Heritage will then no longer be accessible for scientific research.

During a site investigation the palaeontologist does not only survey the development but also tries to determine the density and diversity of fossils in the development area. This is confirmed by examining representative exposures of fossiliferous rocks (sedimentary rocks contain fossil heritage whereas igneous and metamorphic rocks are mostly unfossiliferous). Rock exposures that are investigated usually contains a large portion of the stratigraphic unit, can be accessed easily and comprise of unweathered (fresh) exposed rock. These exposures may be natural (rocky outcrops in stream or river banks, cliffs, dongas) but could also be artificial (quarries, open building excavations and even railway and road cuttings). It is common practice for palaeontologist to log well-preserved fossils (GPS, and stratigraphic data) during field assessment studies.

Mitigation usually precedes construction or may occur during construction when potentially fossiliferous bedrock is exposed. Mitigation comprises the collection and recording of fossils. Preceding excavation of any fossils, a permit from SAHRA must be obtained and the material will have to be housed in a permitted institution. When mitigation is applied correctly, a positive impact is possible as knowledge of local palaeontological heritage may be increased.

The terms of reference of a PIA are as follows:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;
- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study,
- Description and location of the proposed development and provide geological and topographical maps

- Provide palaeontological and geological history of the affected area.
- Identification of sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
    a. **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
    b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
    c. **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
- Fair assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (such as permits, licenses etc).

4.1 Assumptions and Limitations

The focal point of geological maps is the geology of the area and the sheet explanations of the Geological Maps were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have never been reviewed by palaeontologists and data is generally based on aerial photographs alone. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is also used to provide information on the existence of fossils in an area which has not documented in the past. When using similar Assemblage Zones and geological formations for Desktop studies it is generally **assumed** that exposed fossil heritage is present within the footprint. A field-assessment will thus improve the accuracy of the desktop assessment.

5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The geology of the proposed Boshoek Solar PV Cluster near Boshoek in North West Province is indicated on the 1: 250 000 Rustenburg 2526 (1981) Geological Map (Council for Geosciences, Pretoria) (**Figure 4-6, Table 3**). The proposed development is underlain by Quaternary alluvium (Q, yellow), as well as the Silverton Formation (Vsi, khaki; Pretoria Group, Transvaal Supergroup). The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the study area is underlain by sediments with a High (orange, Silverton Formation) and Moderate (green, Quaternary superficial deposits) Palaeontological Sensitivity (**Figure 7-9, Table 4**) (Almond *et al*, 2013; SAHRIS website). Uploaded Geology of the geological Map is indicated in **Figures 10-12**. The DFFE screening tool for the study areas indicates that the proposed development has a High Palaeontological Sensitivity (**Figure 13-15**).

The Quaternary surface deposits are the most recent geological deposits generated (from approximately 2.6 million years ago to the present). The majority of the surface deposits are unconsolidated sediments made up of clay, gravel, sand, and silt that create thin, discontinuous patches of sediment or broader stretches onshore. Beach sand, channel, floodplain, and stream deposits, talus gravels, and glacial drift sediments are among the sediments found here.

Because palaeoclimatic variations are reflected in diverse geological formations, Quaternary deposits are particularly important (Hunter et al., 2006). Most geomorphologic characteristics in southern Africa were generated by climate changes during the Cenozoic Era (Maud, 2012). According to Barnosky (2005), multiple warming and cooling events occurred during the Cenozoic, but climatic changes during the Quaternary Period, notably the last 1.8 Ma, were the most dramatic climate shifts relative to all previous climate fluctuations. Climate changes during the Quaternary Period were both drier and wetter than today, resulting in changes in river flow patterns, sedimentation processes, and vegetation variety (Tooth et al., 2004).

Quaternary fossil assemblages are often scarce and low in diversity, and they occur throughout a large geographic range. In some situations, these fossil assemblages may be found in vast alluvial and colluvial deposits cut by dongas. Palaeontologists have traditionally ignored Caenozoic surface deposits, despite the fact that they can contain large fossil deposits. These fossil assemblages resemble extant animals and may include mammalian teeth, bones, and horn corns, reptile skeletons, and ostrich egg pieces. Microfossils and non-marine mollusc shells have also been discovered in Quaternary strata. Plant elements, such as leaves, wood, pollens, and peats, as well as trace fossils such as vertebrate tracks, burrows, termitaria (termite heaps/ mounds), and rhizoliths (root casts), are recovered.

About 2060 million years ago, the Bushveld Complex encroached on rocks of the Transvaal Supergroup in the Transvaal Basin (Walraven and Martini, 1995). The Transvaal Supergroup is underlain by the Archaean basement, Witwatersrand Supergroup, and Ventersdorp Supergroup. The Transvaal Supergroup is additionally overlain by rocks from the Gaborone Granite Suite and Kanye Formation in the far western and Kanye Basins.

The Precambrian Transvaal Supergroup is approximately 2550-2050 Ma old (Late Archaean to Early Proterozoic) and 15 km thick (Catuneanu et al. 1999). Sedimentary, volcanic, and unmetamorphosed clastic rocks make up this Supergroup. The mudrocks of the Silverton Formation overlie the sandstone-dominated Magaliesberg Formation, which in turn overlies the sandstone-dominated Daspoort Formation. The Silverton Formation is a lithologically diverse, mudrock-dominated sequence that was formed on an offshore shelf along the Kaapvaal Craton's boundaries (Eriksson et al. 1995; 1998; 2006, 2012). Volcanic ash-rich strata are widespread, as are small carbonate and chert levels. In the top half of the sequence, sandstones become more regular and were deposited in shallower circumstances. The Machadodorp Member, which sits in the centre of the Silverton Formation in the eastern Pretoria Basin, is distinguished by a prominent layer of volcanic rocks (including agglomerates, basaltic lavas, and tuffs). The existence of volcanic pillow lavas and water-lain tuffs indicates that they developed below the sea. The deep-water Silverton mudrocks were deposited at high sea levels and were followed by shallowing fluvial and deltaic sandstones of the overlying Magaliesberg Formation at low sea levels. Basaltic andesite and pyroclastic rocks make up the Hekpoort formation and is volcanic in origin.

The Transvaal Basin's Pretoria Group is made up of a variety of stromatolites (microbial laminates), ranging from supratidal mats to intertidal columns and huge subtidal domes (Eriksson et al. 2006). Stromatolites are sedimentary rocks that consist of layered mounds, columns, and sheet-like structures (Figure 5). Layer upon layer of cyanobacteria, a single-celled photosynthesizing microorganism, grew to build these formations. Cyanobacteria are prokaryotic cells, which are the most basic form of modern carbon-based life. Stromatolites are the earliest known fossils and were discovered in Precambrian strata. During the Archaean and Proterozoic eras, countless cyanobacteria photosynthesized, producing the oxygen atmosphere we have today.

Several writers have reported the stromatolites and oolites from the Transvaal Supergroup (Eriksson and Altermann, 1998). In the literature, there are thorough accounts of South African Archaean stromatolites (Altermann, 1995, 2001; Buick, 2001; and Schopf, 2006). The Silverton Formation, which is 1 to 3 km thick and composed of recessive weathering that created a landscape of rolling hills and valleys, is located in the eastern Transvaal Basin (Visser 1989). At the very top of the Silverton Formation are carbonate rocks. According to research, organic carbon in the shales is produced by bacteria in low oxygen environments (Eriksson et al. 1989). The carbon-rich Silverton Formation may contain organic-walled microfossils, whereas the chert layers may have different microbial assemblages. However, macrofossils are not known to be present in the Silverton Formation. Microbial mats are seen in the Daspoort and Magaliesberg Formations.

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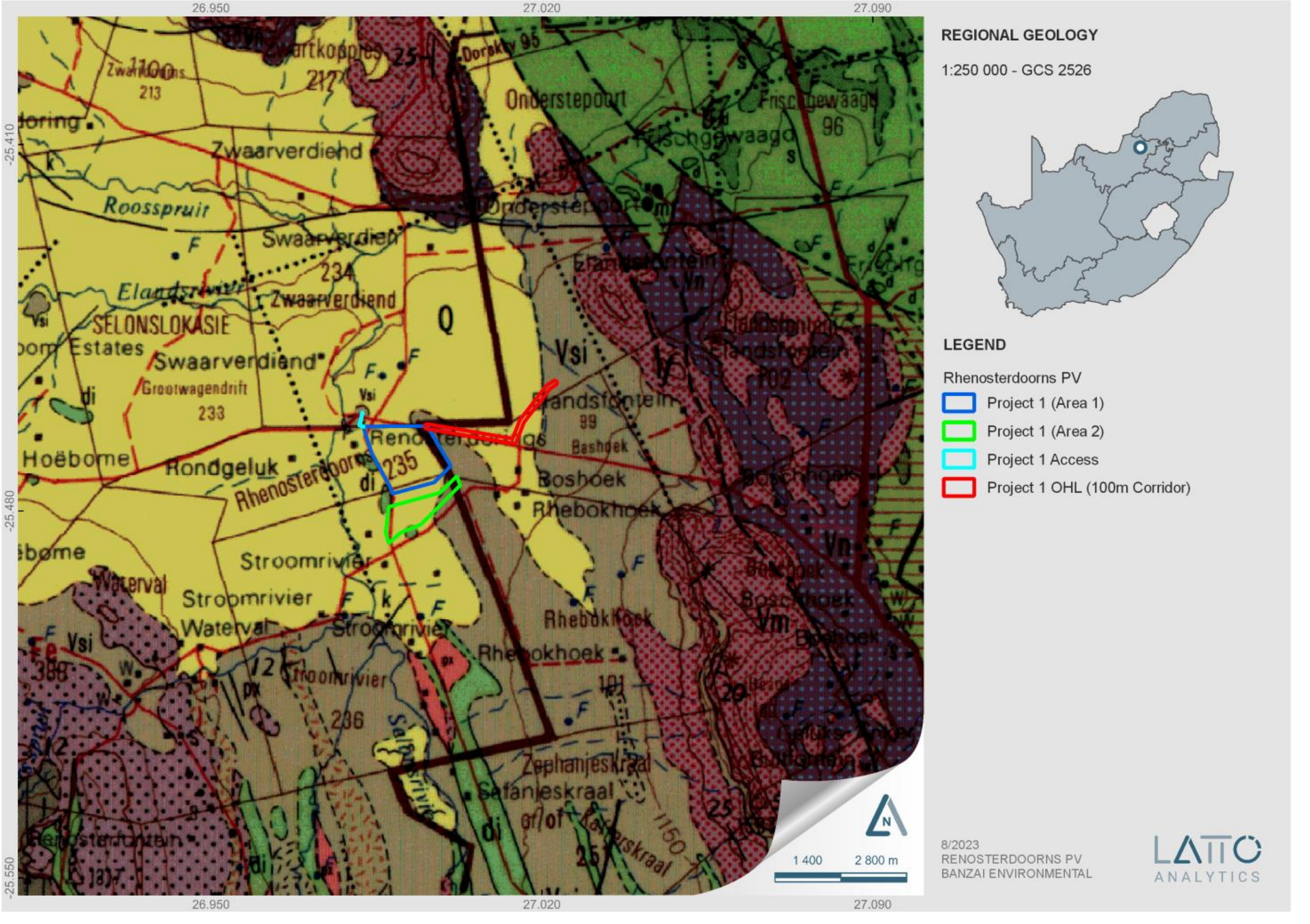


Figure 4*: Extract of the 1:250 000 Rustenburg 2526 (1981) Geological Map (Council for Geosciences, Pretoria) indicating that the Boshoek Solar 1 is mostly underlain by Quaternary Superficial Sediments (Q, yellow) while a eastern portion of the study area and grid infrastructure is underlain by the Silverton Formation (Vsi, khaki; Pretoria Group, Transvaal Supergroup).*

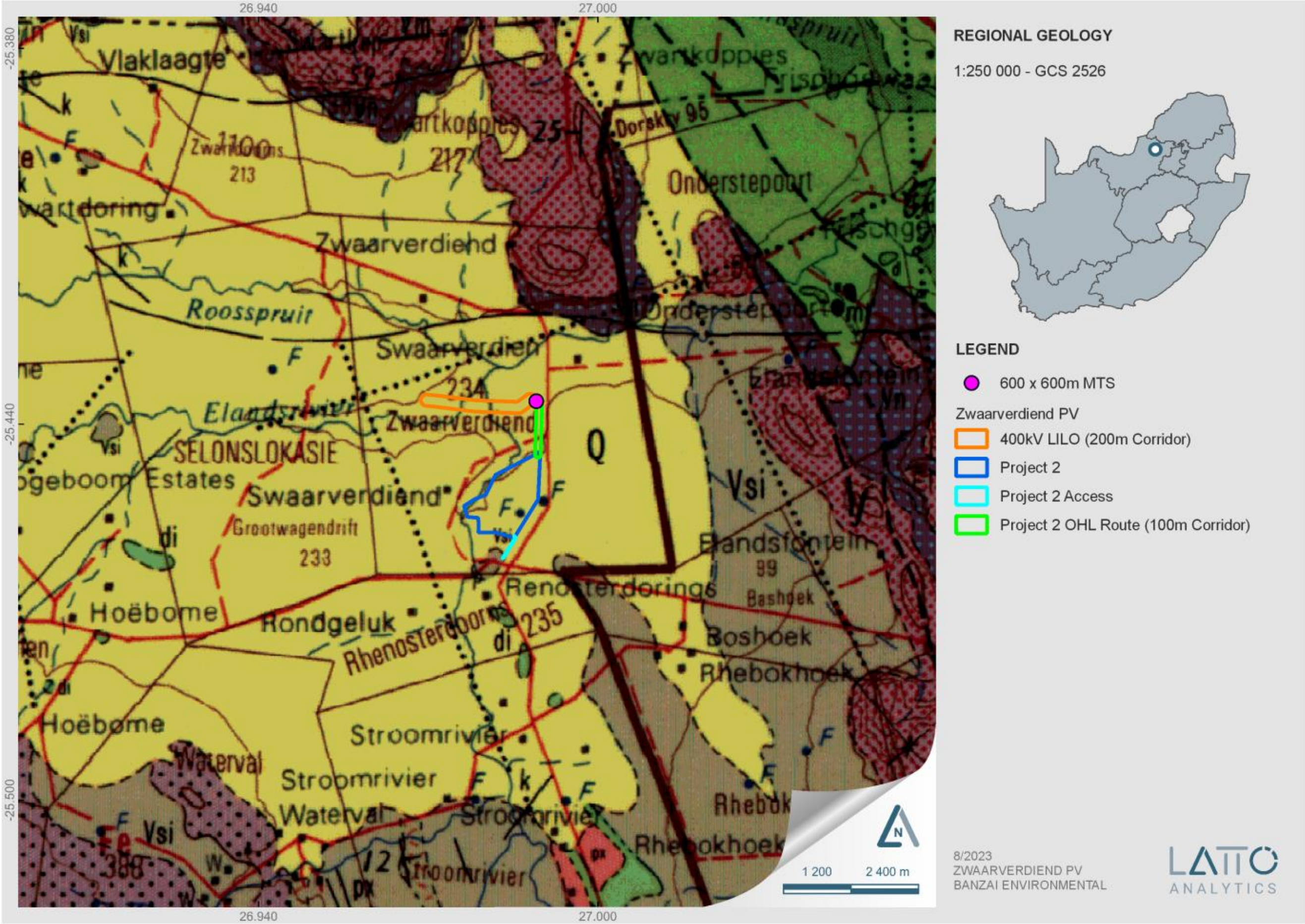


Figure 5*: Extract of the 1:250 000 Rustenburg 2526 (1981) Geological Map (Council for Geosciences, Pretoria) indicating that the Boshoek Solar 2 is mostly underlain by Quaternary Superficial Sediments (Q, yellow) while the most southern portion of the access route is underlain by the Silverton Formation (Vsi, khaki; Pretoria Group, Transvaal Supergroup).*

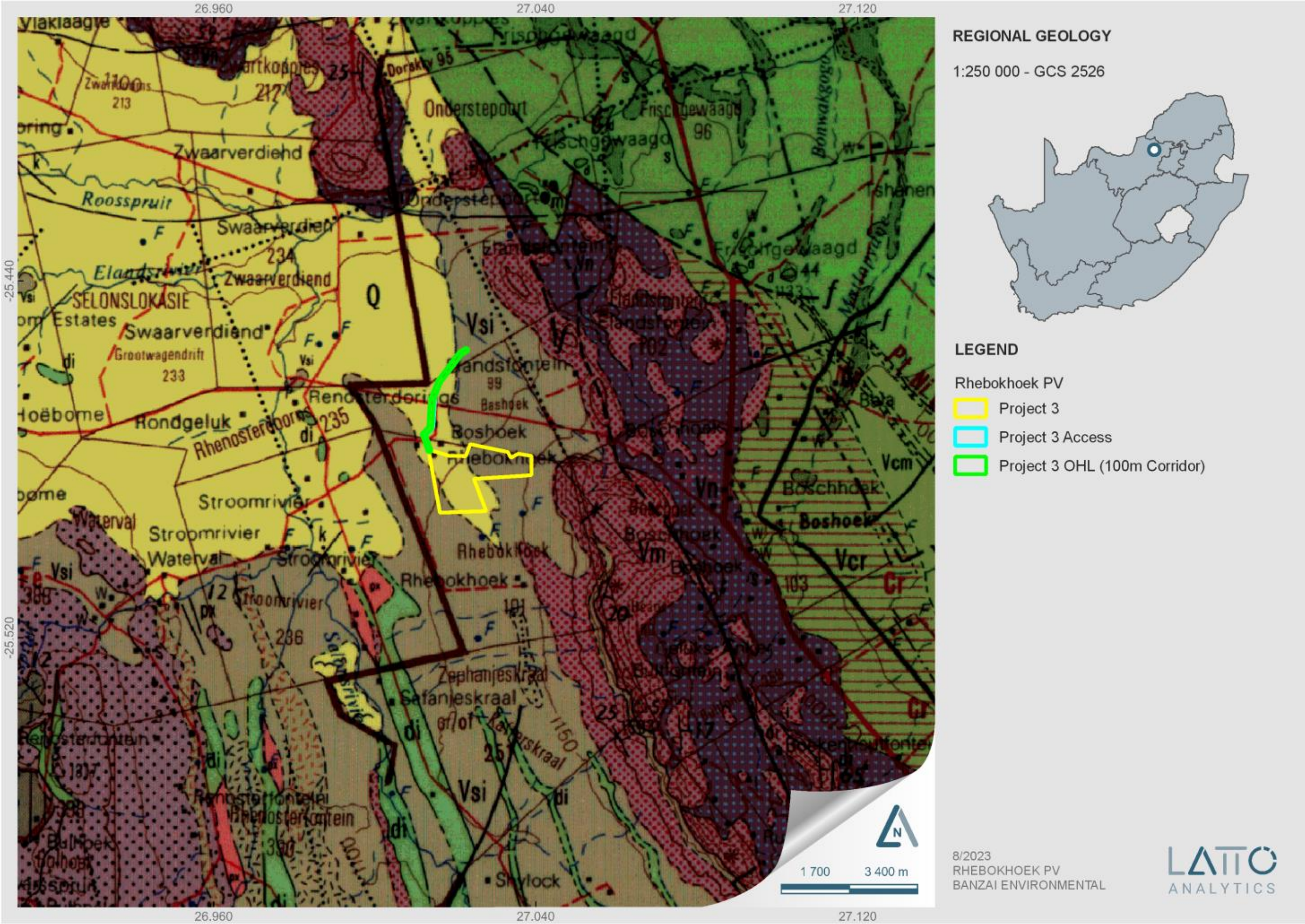
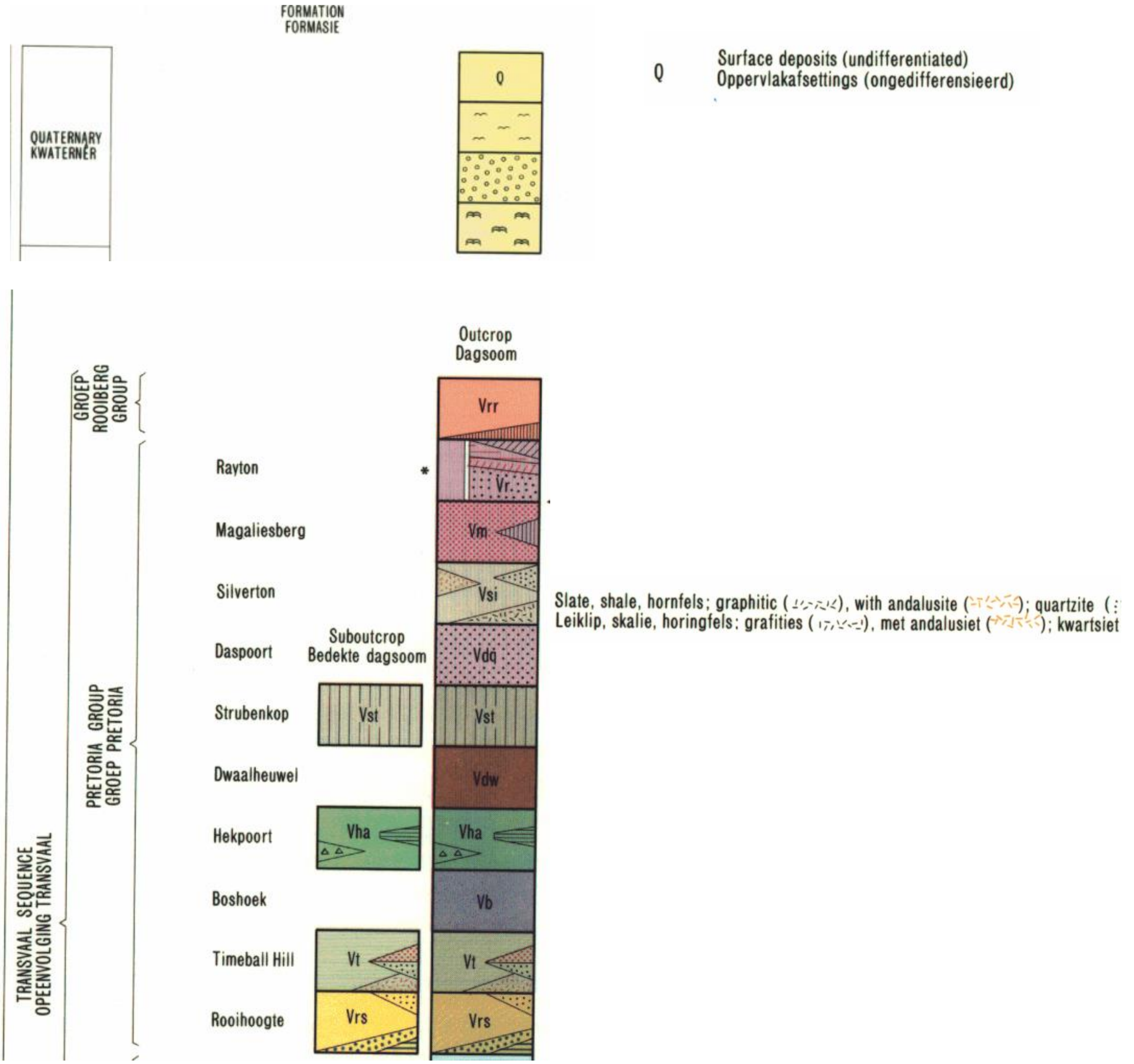


Figure 6*: Extract of the 1:250 000 Rustenburg 2526 (1981) Geological Map (Council for Geosciences, Pretoria) indicating that the Boshoek Solar 3 is underlain by Quaternary Superficial Sediments (Q, yellow) and Silverton Formation (Vsi, khaki; Pretoria Group, Transvaal Supergroup).*

Table 3:Legend of the1:250 000 Rustenburg 2526 (1981) Geological Map (Council for Geosciences, Pretoria)



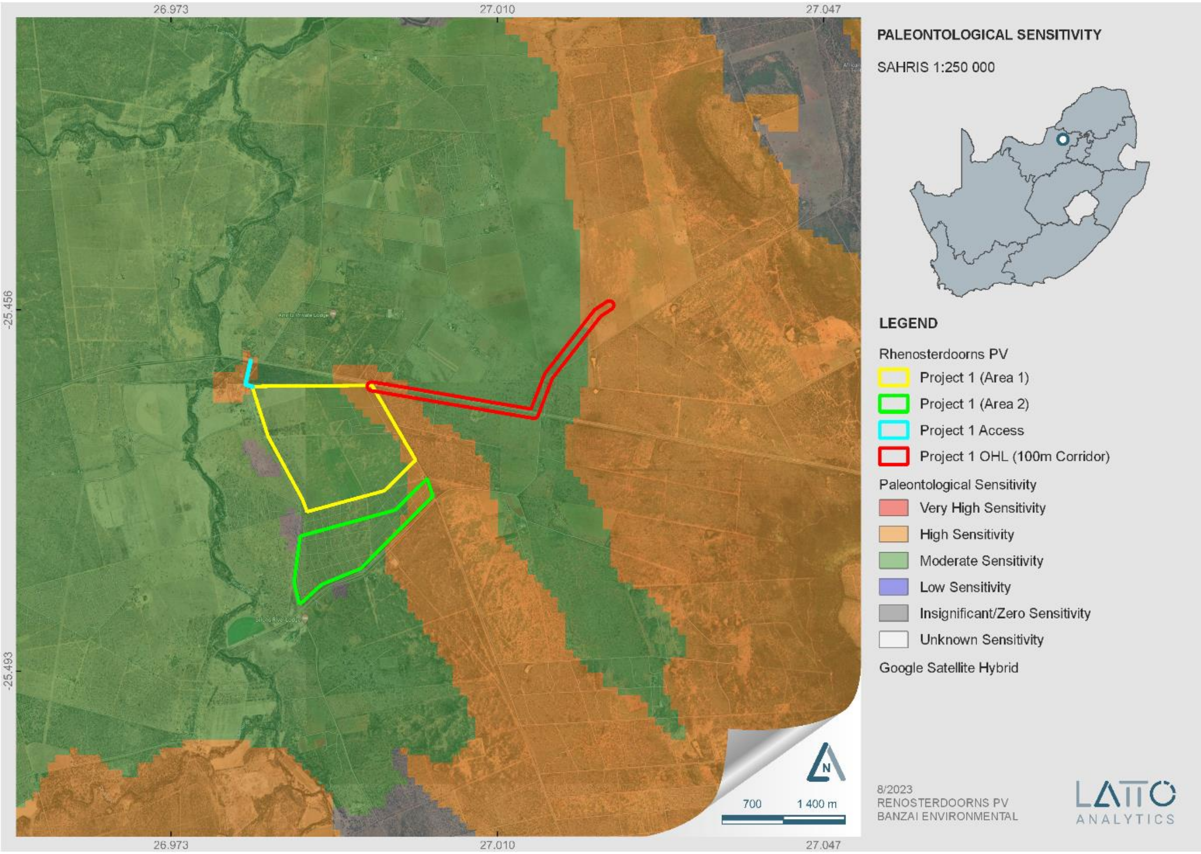


***Figure 7**: The SAHRIS PalaeoMap map (Council of Geosciences) indicates that the Boshoek Solar 1 near Boshoek in North West is underlain with sediments with a High (orange, Silverton Formation) and Moderate (green, Quaternary deposits) Palaeontological Sensitivity.*

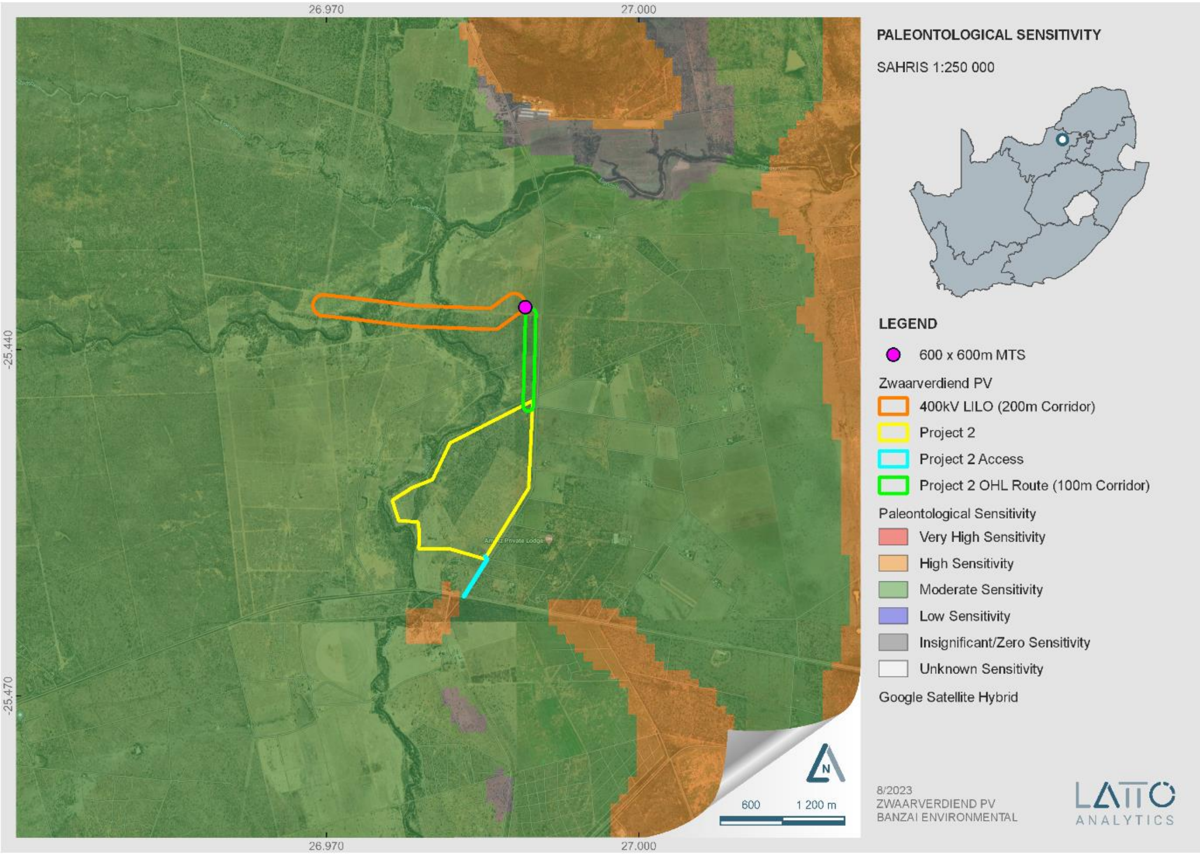


Figure 8: *The SAHRIS PalaeoMap map (Council of Geosciences) indicates that the Boshoek Solar 2 near Boshoek in North West is mostly underlain by sediments with a Moderate (green, Quaternary deposits) Palaeontological Sensitivity while a portion of the access road is underlain by sediments with a High (orange, Silverton Formation) Palaeontological Sensitivity.*

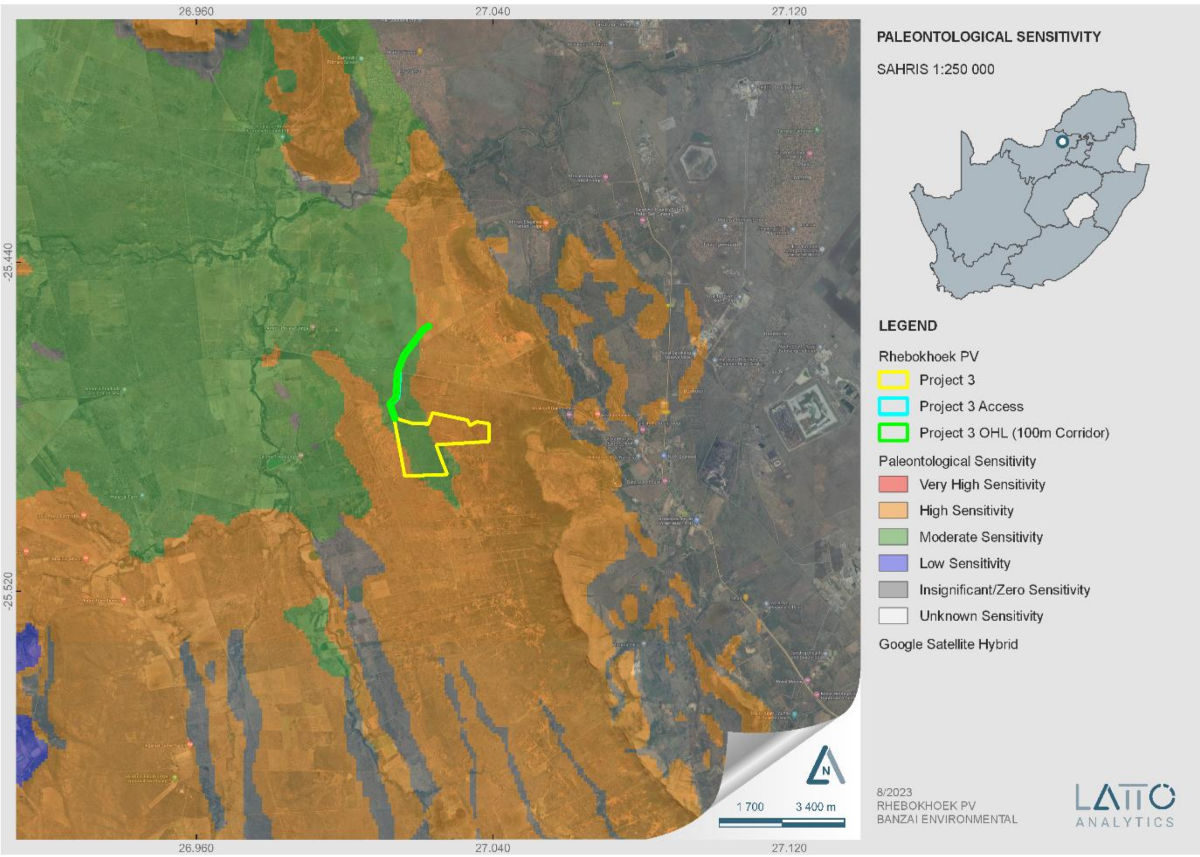


***Figure 9**: The SAHRIS PalaeoMap map (Council of Geosciences) indicates that the Boshoek Solar 3 near Boshoek in North West is underlain with sediments with a High (orange, Silverton Formation) and Moderate (green, Quaternary deposits) Palaeontological Sensitivity.*

Table 4: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website.

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	**HIGH**	**Desktop study is required and based on the outcome of the desktop study; a field assessment is likely**
GREEN	**MODERATE**	**Desktop study is required**
BLUE	**LOW**	**No palaeontological studies are required however a protocol for finds is required**
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

The SAHRIS Palaeosensitivity map (**Figure 7- 9**) indicates that the proposed development is underlain by sediments with a High (orange) and Moderate (green) Palaeontological Sensitivity.

The National Palaeontological databases indicate all the fossils collected by the different institutions in the country. This database does not identify any fossils collected in a 30 km radius of the development footprint.

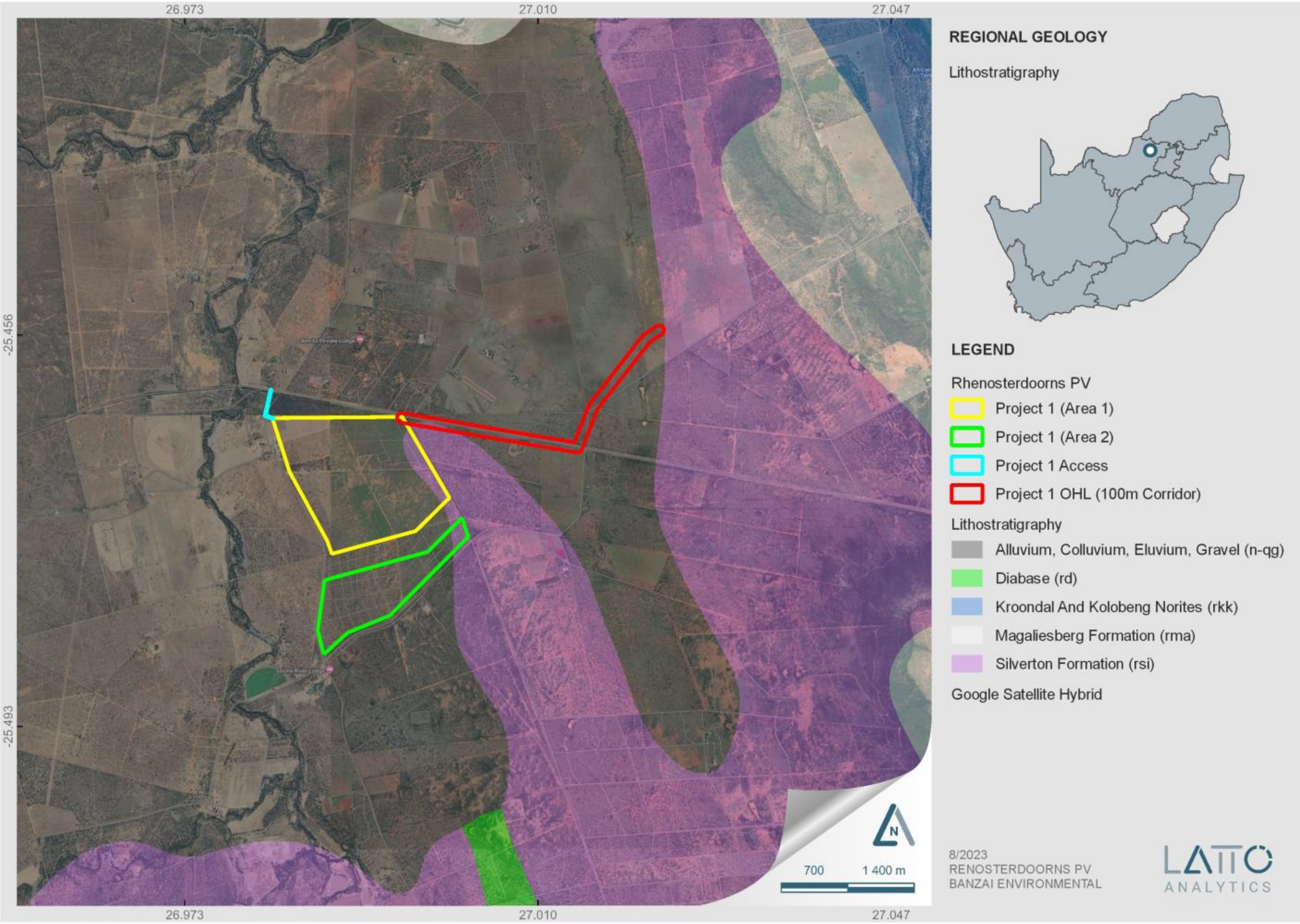


***Figure 10**: Updated Geology compiled by the Council of Geosciences indicates that the proposed Boshoek Solar 1 is underlain by alluvium, colluvium, eluvium and gravel as well as the Silverton Formation (Pretoria Group-, Transvaal Supergroup).*

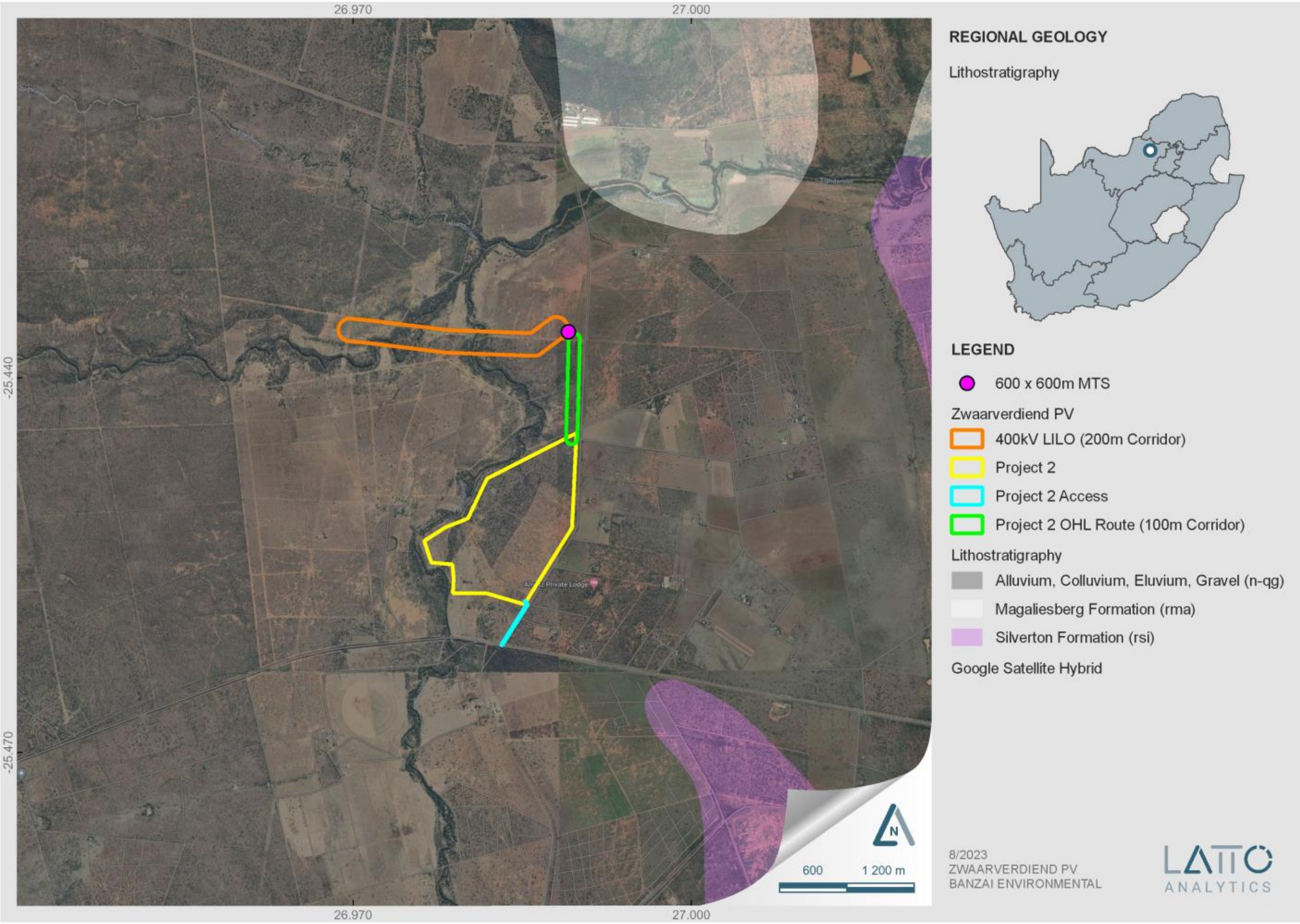


Figure 11: *Updated Geology compiled by the Council of Geosciences indicates that the proposed Boshoek Solar 2 is entirely underlain by alluvium, colluvium, eluvium and gravel.*

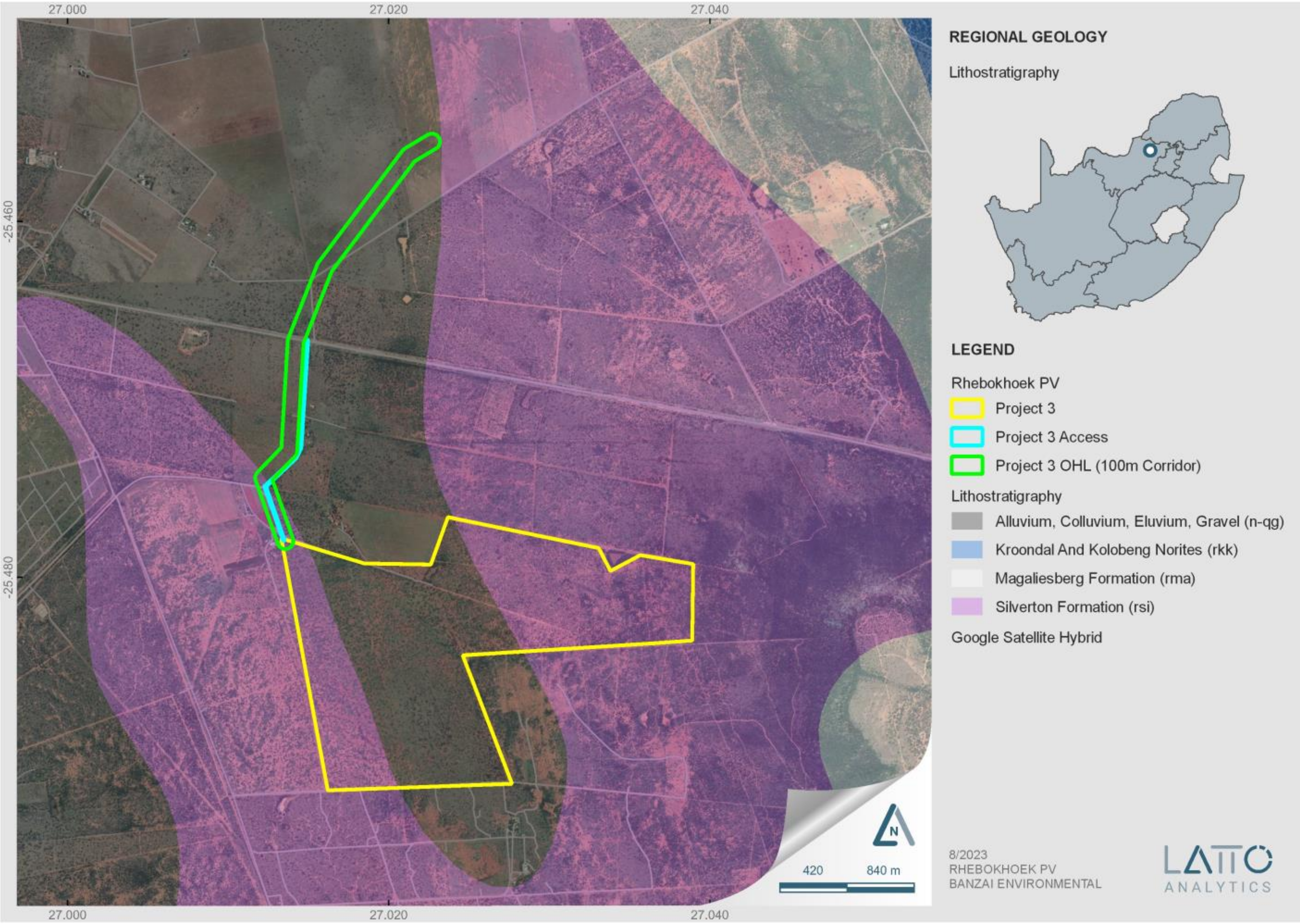


Figure 12*: Updated Geology compiled by the Council of Geosciences indicates that the proposed Boshoek Solar 3 is underlain by alluvium, colluvium, eluvium and gravel as well as the Silverton Formation (Pretoria Group-, Transvaal Supergroup).*

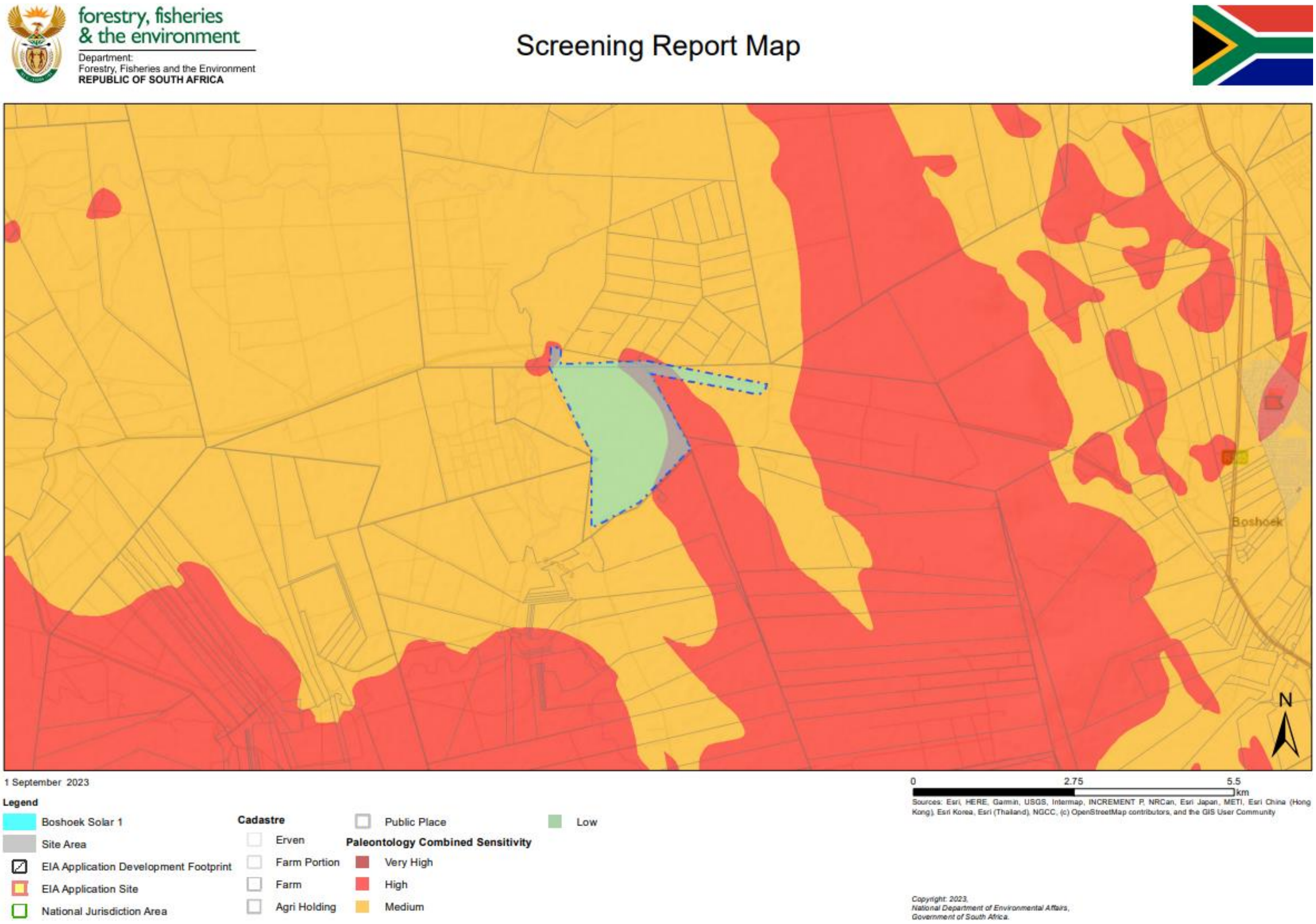


***Figure 13**: Palaeontological Sensitivity of the Boshoek Solar 1 by the National Environmental Web-bases Screening Too indicates a High (red) Sensitivity while areas with a moderate (yellow) Sensitivity is also crossed.*

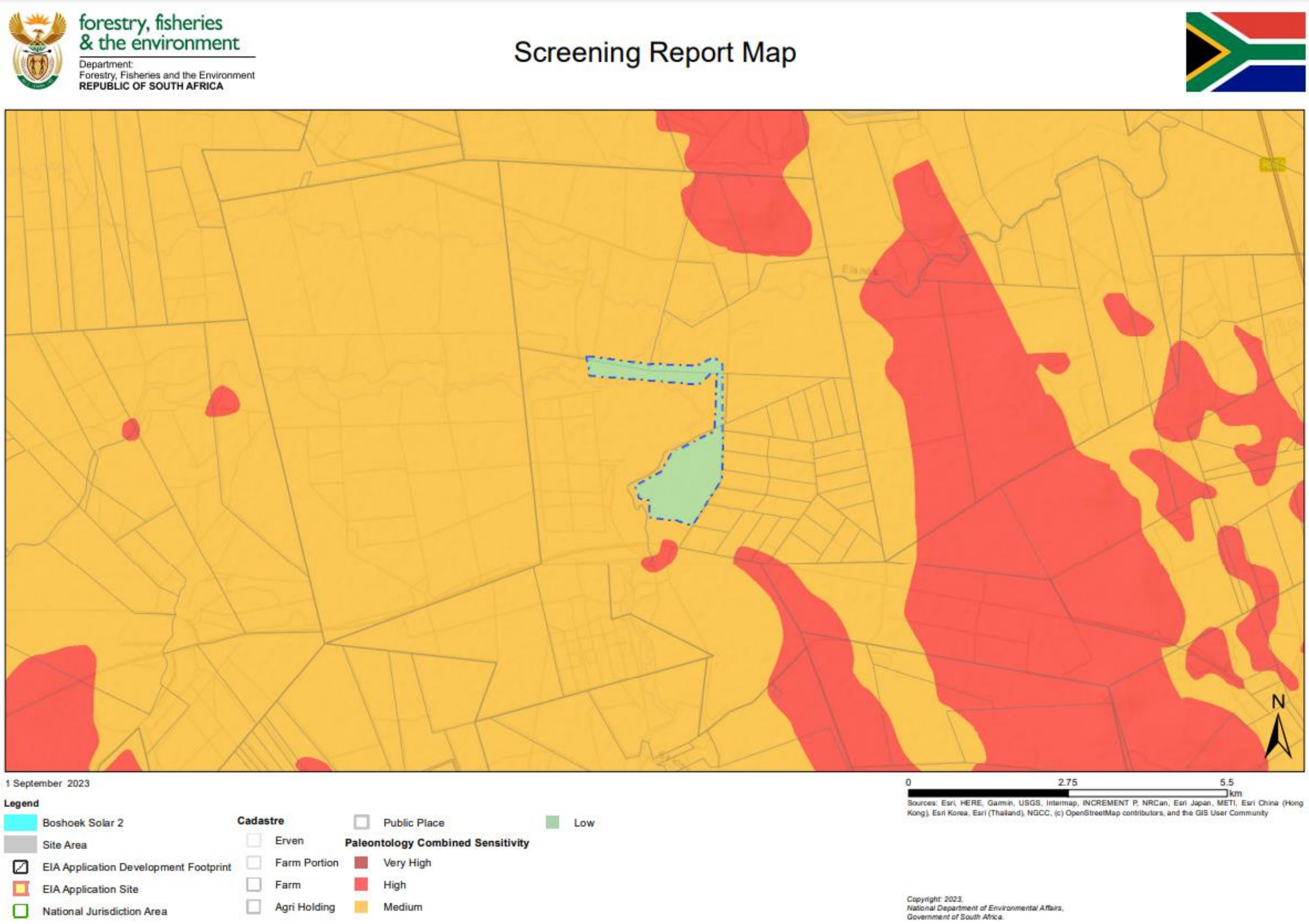


***Figure 14**: Palaeontological Sensitivity of the Boshoek Solar 2 by the National Environmental Web-bases Screening Tool indicates a Moderate (yellow) Palaeontological Sensitivity.*

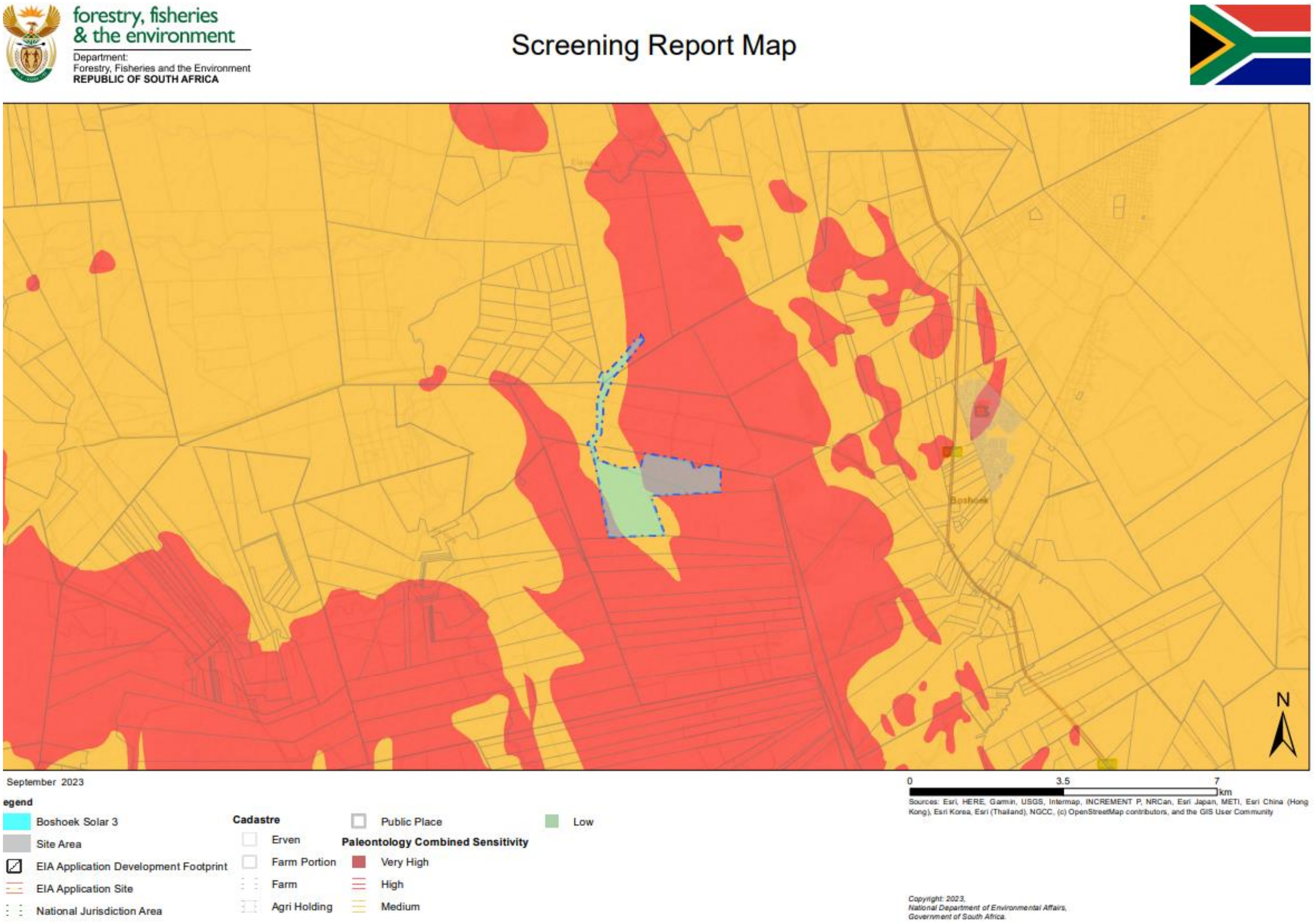


Figure 15*: Palaeontological Sensitivity of the Boshoek Solar 3 by the National Environmental Web-bases Screening Tool indicates a High (red) Sensitivity while areas with a moderate (yellow) Sensitivity is also crossed.*

6 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984)
- A Google Earth map with polygons of the proposed development was obtained from PGS
- 1:250 000 Rustenburg 2526 (1981) Geological Map (Council for Geosciences, Pretoria)
- Updated geology of the proposed development (Council for Geosciences, Pretoria).

7. GEOGRAPHICAL LOCATION OF THE SITE

The Boshoek solar PV cluster is located approximately 30 - 33 km north west of Rustenburg within the Rustenburg Local Municipality and the Bojanala District Municipality, in the North West Province (**Figure 1-3).**

8. IMPACT ASSESSMENT METHODOLOGY

Significance of Environmental Aspects

The significance of environmental aspects can be determined and ranked by considering the criteria presented in Table 1. In some cases, it may be necessary to undertake the impact assessment to determine whether a particular aspect is significant. Therefore, a fair degree of iteration is unavoidable during the assessment process.

Table 5: Criteria used to determine the significance of environmental aspects

Significance Ranking	Negative Aspects	Positive Aspects
H (High)	Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.	Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.
M (Moderate)	Has characteristics that could cause negative impacts.	Has characteristics that could cause positive impacts.
L (Low)	Will never exceed legislation or standards. Unlikely to cause significant negative impacts.	Will always comply with all legislation and standards. Unlikely to cause significant positive impacts.

The aspect identification and ranking process is largely a screening exercise whereby the aspects that do not have the potential to cause significant impacts are eliminated. Aspects ranked "high" and "moderate" are significant and the possible impacts associated with their presence will need to be determined. Aspects ranked "low" do not warrant further attention.

The significance of the aspects should be ranked on the assumption that the management recommended in the EIA will be in place i.e. *with management*. This represents the scenario that the proponent wishes to have considered for approval. The environmental aspects associated with the proposed project activities during the construction, operational, closure phases (where appropriate) need to be identified. The influence of various project alternatives on the significance of the aspects must also be considered.

It may be desirable to also undertake a *without management* aspect ranking, since this highlights the sensitivity of the key risk areas to management and, hence, the management priorities. However, the dilemma in such an exercise is deciding on how much management to include. In the case of a mining project, for example, does one assume that the tailings dam will be completely absent or merely operated poorly? A useful rule of thumb is to assume that all the management required for operational reasons will be in place, but that any management specifically for environmental control will be absent. The danger in presenting *without management* ranking scenario in an EIA report is that it does not represent the scenario that the proponent wishes to have approved.

Significance Of Environmental Impacts

Where significant environmental aspects are present ("high" or "moderate"), significant environmental impacts ***may*** result. The significance of the impacts associated with the significant aspects can be determined by considering the risk:

Significance of Environmental Impact (Risk) = Probability x Consequence

The consequence of impacts can be described by considering the severity, spatial extent and duration of the impact.

Severity of Impacts

Table 6 presents the ranking criteria that can used to determine the severity of impacts on the bio- physical and socio-economic environment. Table 3 provides additional ranking criteria for determining the severity of negative impacts on the bio-physical environment.

Table 6: Criteria for ranking the Severity of environmental impacts

Type of Criteria	**Negative**			**Positive**		
	H-	**M-**	**L-**	**L+**	**M+**	**H+**
Qualitative	Substantial deterioration. Death, illness or injury.	Moderate deterioration. Discomfort.	Minor deteriorati on. Nuisance or minor	Minor improvement.	Moderate improvement.	Substantial improvement .
Quantitative	Measurable deterioration.		Change not measurable i.e. will remain within current		Measurable improvement.	
	Recommended level will often be violated.	Recommended level will occasionally be violated.	Recommended level will never be violated.		Will be within or better than recommended level.	
Community Response	Vigorous community action.	Widespread complaints.	Sporadic complaints.		No observed reaction.	Favourable publicity

Table 7:Criteria for ranking the Severity of negative impacts on the bio-physical environment

Environment	**Ranking Criteria**		
	Low (L-)	**Medium (M-)**	**High (H-)**
Soils and land capability	Minor deterioration in land capability. Soil alteration resulting in a low negative impact on one of the other environments (e.g. ecology).	Partial loss of land capability. Soil alteration resulting in a moderate negative impact on one of the other environments (e.g. ecology).	Complete loss of land capability. Soil alteration resulting in a high negative impact on one of the other environments (e.g. ecology).
Ecology (Plant and animal life)	Disturbance of areas that are degraded, have little conservation value or are unimportant to humans as a resource. Minor change in species variety or prevalence.	Disturbance of areas that have some conservation value or are of some potential use to humans. Complete change in species variety or prevalence.	Disturbance of areas that are pristine, have conservation value or are an important resource to humans. Destruction of rare or endangered species.
Surface and Groundwater	Quality deterioration resulting in a low negative impact on one of the other environments (ecology, community health etc.)	Quality deterioration resulting in a moderate negative impact on one of the other environments (ecology, community health etc.).	Quality deterioration resulting in a high negative impact on one of the other environments (ecology, community health etc.).

Spatial Extent and Duration of Impacts

The duration and spatial scale of impacts can be ranked using the following criteria:

Table 8: Ranking the Duration and Spatial Scale of impacts

	Ranking Criteria		
	L	**M**	**H**
Duration	Quickly reversible Less than the project life Short-term	Reversible over time Life of the project Medium-term	Permanent Beyond closure Long-termterm
Spatial Scale	Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national

Where the severity of an impact varies with distance, the severity should be determined at the point of compliance or the point at which sensitive receptors will be encountered. This position corresponds to the spatial extent of the impact.

Consequence of Impacts

Having ranked the severity, duration and spatial extent, the overall consequence of impacts can be determined using the following qualitative guidelines:

Table 9:Ranking the Consequence of an impact

SEVERITY = L

DURATION	Long-term	**H**			High
	Medium-term	**M**			
	Short-term	**L**			

SEVERITY = M

DURATION	Long-term	**H**			**HIGH**
	Medium-term	**M**			
	Short-term	**L**	**LOW**		

SEVERITY = H

DURATION	Long-term	**H**			
	Medium-term	**M**			**HIGH**
	Short-term	**L**	**MEDIUM**		
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national
			SPATIAL SCALE		

To use Table 5, firstly go to one of the three "layers" based on the severity ranking obtained from Table 2 and/ or Table 3. Thereafter determine the consequence ranking by locating the intersection of the appropriate duration and spatial scale rankings.

Overall Significance of Impacts

Combining the consequence of the impact and the probability of occurrence, as shown by Table 10, provides the overall significance (risk) of impacts.

Table 10: Ranking the Overall Significance of impacts

PROBABILITY	Definite Continuous	**H**	**MEDIUM**		**HIGH**
	Possible Frequent	**M**		**MEDIUM**	
	Unlikely Seldom	**L**	**LOW**		**MEDIUM**
			L	**M**	**H**
			CONSEQUENCE (from Table 5)		

The overall significance ranking of the negative environmental impacts provides the following guidelines for decision making:

Table 11: Guidelines for decision-making

Overall Significance Ranking	Nature of Impact	Decision Guideline
High	Unacceptable impacts.	Likely to be a fatal flaw.
Moderate	Noticeable impact.	These are unavoidable consequence, which will need to be accepted if the project is allowed to proceed.
Low	Minor impacts.	These impacts are not likely to affect the project decision.

9. FINDINGS AND RECOMMENDATIONS

The proposed Boshoek Solar Cluster is underlain by Quaternary superficial deposits as well as the Silverton Formation (Pretoria Group, Transvaal Supergroup). The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the study area is underlain by sediments with a High (Silverton Formation) and Moderate (Quaternary deposits) Palaeontological Sensitivity (Almond *et al*, 2013; SAHRIS website). Updated geology produced by the Council for Geosciences in Pretoria indicates that the development is underlain by the alluvium, colluvium, eluvium and gravel as well as the Silverton Formation of the Pretoria Group (Transvaal Supergroup). The National Environmental Web-bases Screening Tool indicates a High Sensitivity while areas with a moderate Sensitivity is also crossed.

Based on the site investigation as well as desktop research it is concluded that fossil heritage of scientific and conservational interest in the overall development footprint for the solar facilities is rare. This is in contrast with the High Sensitivity allocated to the development area by the SAHRIS Palaeosensitivity Map and DFFE Screening Tool. **A Medium Palaeontological Significance has been allocated for the construction phase of the solar PV development pre-mitigation and a Low significance post mitigation**. The construction phase will be the only development phase impacting Palaeontological Heritage and **no significant impacts are expected to impact the Operational and Decommissioning phases**. As the No-Go Alternative considers the option of ‘do nothing’ and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The **cumulative impacts of the development near Boshoek are medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project**. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. **The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.** It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

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10. CHANCE FINDS PROTOCOL

The following procedure will only be followed if fossils are uncovered during the excavation phase of the development.

Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act No 25 of 1999) (NHRA).** According to Section 3 of the Act, all Heritage resources include **“all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**”.

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

A fossil is the naturally preserved remains (or traces thereof) of plants or animals embedded in rock. These organisms lived millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Site Officer (ESO) or site manager of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ESO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

10.1 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately **stop working** and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.
- Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.
- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- If the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO. Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

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Appendix A

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	30 years in Palaeontology
EDUCATION:	B.Sc Botany and Zoology, 1988 University of the Orange Free State
	B. Sc (Hons) Zoology, 1991 University of the Orange Free State
	Management Course, 1991 University of the Orange Free State
	M. Sc. *Cum laude* (Zoology), 2009 University of the Free State

Dissertation title: The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

Part time Laboratory assistant	Department of Zoology & Entomology University of the Free State Zoology 1989-1992
Part time laboratory assistant	Department of Virology University of the Free State Zoology 1992
Research Assistant	National Museum, Bloemfontein 1993 – 1997

Principal Research Assistant	National Museum, Bloemfontein
and Collection Manager	1998–2022

TECHNICAL REPORTS

Butler, E. 2014. Palaeontological Impact Assessment of the proposed development of private dwellings on portion 5 of farm 304 Matjesfontein Keurboomstrand, Knysna District, Western Cape Province. Bloemfontein.

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Butler, E. 2015. Palaeontological impact assessment of the proposed consolidation, re-division, and development of 250 serviced erven in Nieu-Bethesda, Camdeboo local municipality, Eastern Cape. Bloemfontein.

Butler, E. 2015. Palaeontological impact assessment of the proposed mixed land developments at Rooikraal 454, Vrede, Free State. Bloemfontein.

Butler, E. 2015. Palaeontological exemption report of the proposed truck stop development at Palmiet 585, Vrede, Free State. Bloemfontein.

Butler, E. 2015. Palaeontological impact assessment of the proposed Orange Grove 3500 residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape. Bloemfontein.

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Butler, E. 2015. Palaeontological Impact Assessment of the proposed Ficksburg raw water pipeline. Bloemfontein.

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Butler, E. 2015. Palaeontological Impact Assessment of the proposed township establishment on the remainder of portion 6 and 7 of the farm Sunnyside 2620, Bloemfontein, Mangaung metropolitan municipality, Free State, Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 1 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse729, near Vryburg, North West Province. Bloemfontein.

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Butler, E. 2015. Palaeontological Impact Assessment of the proposed Spectra foods broiler houses and abattoir on the farm Maiden Manor 170 and Ashby Manor 171, Lukhanji Municipality, Queenstown, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoort concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoort, Northern Cape. Prepared for Savannah Environmental. Bloemfontein.

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PROPOSED BOSHOEK 1 SOLAR ENERGY FACILITY

North West Province, South Africa

Social Impact Assessment Report

March 2024

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REPORT DETAILS

Title	:	Social Impact Assessment Report: Boshoek 1 Solar Photovoltaic (PV) Energy Facility
Author	:	Cornelius Holtzhausen Savannah Environmental (Pty) Ltd
Client	:	Boshoek Solar 1 (Pty) Ltd
Report Revision	:	Revision 0
Date	:	March 2024

When used as a reference this report should be cited as: Savannah Environmental (2023) Social Impact Assessment for the Boshoek Solar 1 PV Energy Facility, North West Province.

SPECIALIST DECLARATION OF INTEREST

I, Cornelius Holtzhausen, 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 Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I have no, 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.
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the Act.

Cornelius Holtzhausen
Name


Signature

March 2024
Date

EXECUTIVE SUMMARY

1. Background

Boshoek Solar 1 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province.

The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW. The development area is situated approximately 33 km north west of Rustenburg within the Kgetlengrivier Local Municipality and the Bojanala District Municipality, in the North West Province.

2. Identified Impacts and Mitigation Measures

Construction phase

The majority of social impacts associated with the project are anticipated to occur during the construction phase of the development and are typical of the type of social impacts generally associated with construction activities. These impacts will be temporary and short-term (~9 - 12 months) but could have long-term effects on the surrounding social environment if not planned or managed appropriately. It is therefore necessary that the detailed design phase be conducted in such a manner so as not to result in permanent social impacts associated with the ill-placement of project components or associated infrastructure or result in the mismanagement of the construction phase activities.

The positive and negative social impacts identified that will be assessed for the **construction phase** include:

» Direct employment opportunities
» Multiplier Effects on the Local Economy
» Safety and Security
» Local Services/Resources
» Nuisance Impacts

Operation phase

It is anticipated that the Boshoek Solar 1 will operate for up to 25 years (which is equivalent to the operational lifespan of the project). The majority of positive outcomes are associated with the operational phase of the project. If managed appropriately, the positive impact can be effectively enhanced, and the negative impacts mitigated.

The potential positive and negative social impacts that could arise as a result of the operation of the proposed project include the following:

» Direct employment and skills development opportunities
» Development of clean, renewable energy infrastructure
» Visual impact and impact on sense of place

Cumulative impacts

Cumulative impacts have been considered as this energy facility has the potential to result in significant positive cumulative impacts; specifically, since the establishment of a number of Solar energy facilities in the vicinity of the LM will create a number of socio-economic opportunities for the area, which in turn, will result in a positive social benefit. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. Benefits to the local, regional, and national economy through employment and procurement of services could be substantial should many renewable energy facilities proceed. This benefit will increase significantly should critical mass be reached that allows local companies to develop the necessary skills to support construction and maintenance activities and that allows for components of the renewable energy facilities to be manufactured in South Africa. Furthermore, at municipal level, the cumulative impact could be positive and could incentivize operation and maintenance companies to centralize and expand their activities towards education and training.

No-development Alternative.

Should the project not continue, the negative impacts associated with the project's construction and operation phases will not occur and the status quo will continue. The area will likely remain undeveloped, and the visual impacts associated with the solar facility will not occur. Further, the potential safety and security issues associated with projects and developments will not occur, the same for the influx of job seekers to the area.

The region will however likewise not benefit from the construction of the project. The area will miss the opportunities for jobs that the project will create, as well as the indirect economic benefits associated with the construction and operation of the facility. Further, the use of green renewable energy will serve to provide alternative clean energy in the face of the realities of climate change. The project will also serve to stabilise and bolster the struggling power supply in South Africa, which has done untold damage to the economy and society of the region and country.

Conclusions and Recommendations

The proposed Boshoek Solar 1 is unlikely to result in permanent damaging social impacts. Boshoek Solar 1 has the potential to result in significant positive cumulative impacts, specifically as the Boshoek Cluster will create socio-economic opportunities for the region, which in turn, can result in positive social benefits. The positive cumulative impacts include the creation of employment, skills development and training opportunities, and downstream business opportunities. The cumulative benefits to the local and regional economy through employment and procurement of services are more considerable than that of the Boshoek Solar 1 alone. From a social perspective, it is concluded that the proposed project and associated infrastructure are acceptable and should be developed subject to the implementation of the recommended mitigation measures and management actions contained in this report.

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ACRONYMS

BPDM	Bojanala Platinum District Municipality
DOE	Department of Energy
DM	District Municipality
EMPr	Environmental Management Programme
EPC	Engineering, Procurement and Construction
GVA	Gross Value Add
HD	Historically Disadvantage
HRD	Human Resource Development
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Plan
Km	Kilometre
KRLM	Kgetlengrivier Local Municipality
kV	Kilovolt
LED	Local Economic Development
LM	Local Municipality
NEMA	National Environmental Management Act (No. 107 of 1998)
NDP	National Development Plan
PV	Photovoltaic
RE	Renewable Energy
SDF	Spatial Development Framework
SMME	Small and Medium-Sized Enterprises

1. INTRODUCTION AND PROJECT DESCRIPTION

Boshoek Solar 1 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province.

The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW. The development area is situated approximately 33 km north west of Rustenburg within the Kgetlengrivier Local Municipality and the Bojanala District Municipality, in the North West Province.

1.1. Project Overview

The Boshoek Cluster PV and associated Grid Connections is situated in the eastern part of the North West Province. The site is located south west of the popular Sun City Resort and Entrainment Destination (See Error! Reference source not found.).The area is also known for the Pilanesberg National Park (to the north) and several mines (to the east, see: **Error! Reference source not found.**) The site is accessible via the tarred national R556 Lindleyspoort road, and unnamed gravel farm roads. The closest town to the development area is small town of Boshoek to the east, which consist of a few residents and a number of businesses serving traffic passing in the area (see Error! Reference source not found.).

The development area for the PV facility and associated infrastructure will be located on the following properties:

Table 1-1: Farm Portions for Boshoek Solar 1 PV Facility and the Associated Grid Connection.

Farm Name	Farm No.	Portion No.
Boshoek Solar 1 PV Facility		
Farm Rhenosterdoorns	531	0
Farm Zwaarverdiend	234	1
Boshoek Solar 1 PV Grid Connection		
Zwaarverdiend 234 JP	234	18
Paul Bodenstein Landgoed 571 JG	571	RE
Elandsfontein 102 JG	102	1
Onderstepoort 98 JG	98	RE

The project is planned as part of a larger cluster, which includes two additional PV facilities (Boshoek Solar 2 and Boshoek Solar 3) up to 150 MW and 50 MW, respectively.

An assessment area of approximately 290 ha is being assessed as part of this Environmental Impact Assessment (EIA) process and the infrastructure associated with the 150 MW facility includes:

» PV modules (mono- or bifacial) and mounting structures.
» Inverters and transformers.
» Battery Energy Storage System (BESS).
» Site access road.
» Internal access roads.

- » Auxiliary buildings (switch room, gatehouse and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.).
- » Temporary and permanent laydown area, and
- » Grid connection infrastructure, including:
  - Underground medium-voltage cabling between the project components and the facility substation.
  - Up to 132kV facility substation.
  - Switching station.
  - A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.

The majority of the access road will follow existing, gravel farm roads that may require widening up to 10 m (inclusive of storm water infrastructure). Where new sections of road need to be constructed (lengthened), this will be gravel/hard surfaced access road and only tarred if necessary. A network of gravel internal access roads and a perimeter road (cumulatively up to 33 km in length), each with a width of up to ± 6 m, will be constructed to provide access to the various components of the PV development. Where site offices are required temporary screen fencing used to screen offices from the wider landscape.

An area of up to 1 ha will be occupied by buildings which will include (but not limited to) a 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre. The future planned Eskom collector switching station will facilitate the connection of the facility substation to the Ngwedi 400/132kV Main Transmission Substation (MTS) via a single or double circuit 132 kV overhead power line. The connection infrastructure associated with this grid solution (i.e. between the collector switching station and the MTS) falls outside of the scope of this EIA and will be assessed as part of a separate Environmental Application.

The PV facility has an approximate construction timeline of up to 24 months and is due to operate for a period of 25 years. Should it be decided not to extend the operational lifespan of the project beyond 25 years, the project will be decommissioned. Decommissioning involves removing the solar panels and associated infrastructures and covering the concrete footings with soil to a depth sufficient for the re-growth of natural vegetation.

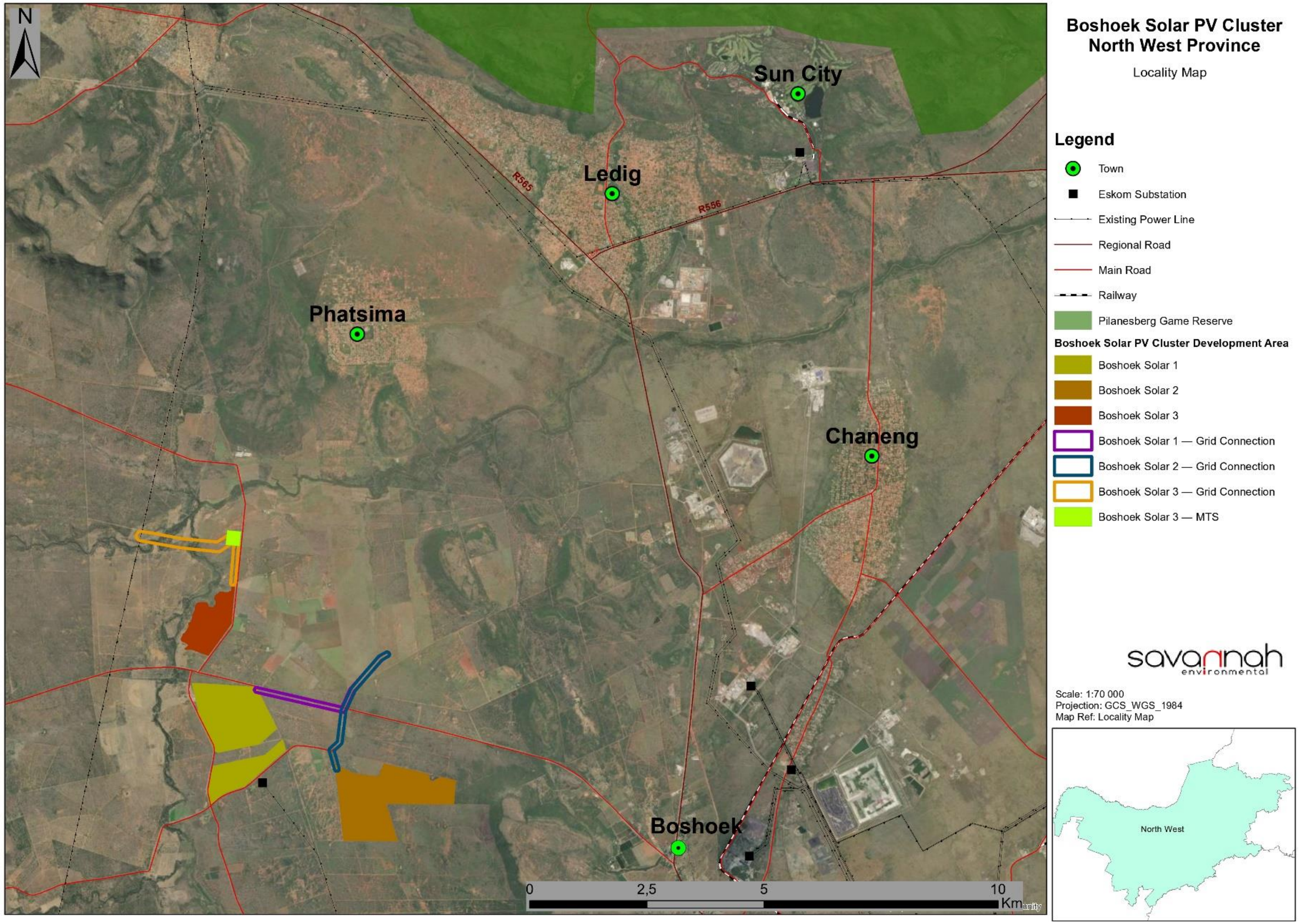

Figure 1-1 Boshoek PV Cluster Locality Map

1.2. Objective of the Environmental Impact Assessment Process

This Social Impact Assessment (SIA) has been prepared as part of the Scoping phase and now EIA phase of an EIA Process being undertaken for the Boshoek Solar 1 PV Facility (hereafter referred to as Boshoek Solar 1) and associated infrastructure. The purpose of this SIA is to provide details on the nature and extent of the proposed Boshoek Solar 1, and the potential social impacts associated with the construction and operation of the project. The inputs contained within this SIA are intended to provide an overview of the social environment within which the project is proposed and set the scene for issues which have been addressed in detail as part of the process specialist investigations.

The objective of this SIA is therefore to:

- » Identify and review policies and legislation which may have relevance to the activity from a social perspective.
- » Provide comment on the need and desirability of the proposed activity from a social perspective.
- » Identify and assess potential impacts and risks associated with the preferred activity and technology alternatives.
- » Identify suitable measures to avoid, manage or mitigate identified social impacts and determine the extent of residual risks that need to be managed and monitored.

1.3. Details of the Independent Specialist

This SIA has been undertaken by Cornelius Holtzhausen of Savannah Environmental.

Cornelius Holtzhausen - is registered with the International Association for Public Participation, South Africa and holds an MSocSci in Cultural Anthropology as well as a postgraduate degree in Social Impact Assessment and Public Participation. He has been producing social impact reports for two years, with the majority of projects focusing on Renewable Energy Facilities.

1.4. Structure of the SIA Report

This SIA has been structured as follows:

- » **Chapter 1** provides the introduction to the proposed project and the project description.
- » **Chapter 2** provides an overview of the methodology and approach utilised in preparing this SIA.
- » **Chapter 3** provides an overview of the legislative and policy environmental within which Boshoek Solar 1 is proposed.
- » **Chapter 4** provides the socio-economic profile of the Rustenburg Local Municipality, Kgetlengrivier Local Municipality, Bojanala District Municipality, and South Africa as a whole.
- » **Chapter 5** describes and assesses the potential social impacts which have been identified for the project.
- » **Chapter 6** provides the conclusion of the SIA and recommendations.

This SIA Report has been prepared in accordance with the requirements of Appendix 6 of the 2014 EIA Regulations, as amended. An overview of the contents of this SIA Report, as prescribed by Appendix 6 of the 2014 EIA Regulations (GNR 326), and where the corresponding information can be found within the report is provided in **Table 1-2**.

Table 1-2: Specialist report requirements

	Requirement	Location in Report
(a)	Details of – (i) The specialist who prepared the report. (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae.	Chapter 1
(b)	A declaration that the specialist is independent in a form as may be specified by the competent authority.	Page ii: Specialist Declaration of Interest
(c)	An indication of the scope of, and the purpose for which, the report was prepared.	Chapter 1
(cA)	An indication of the quality and age of base data used for the specialist report.	Chapter 4
(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change.	Chapter 5
(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment.	N/A
(e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used.	Chapter 2
(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative.	Chapter 4
(g)	An identification of any areas to be avoided, including buffers.	Chapter 4
(h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Chapter 4
(i)	A description of any assumptions made and any uncertainties or gaps in knowledge.	Chapter 2
(j)	A description of the findings and potential implications of such findings on the impact of the proposed activity or activities.	Chapter 6
(k)	Any mitigation measures for inclusion in the Environmental Management Programme (EMPr).	Chapter 5
(l)	A description of any consultation process that was undertaken during the course of preparing the specialist report.	Chapter 2
(m)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto.	To be included in the Final Report
(n)	Any other information requested by the competent authority.	N/A
2.	Where a government notice gazetted by the Minister provides for any protocol or minimum information	N/A

Requirement	Location in Report
requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	

2. METHODOLOGY AND APPROACH

2.1. Purpose of the Study

The International Principles for Social Impact Assessment defined SIA as:

"*The processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions*."

The International Principles for SIA define social impacts as changes to one or more of the following:

- People's way of life – that is, how they live, work, play and interact with one another on a day-to-day basis.
- Their culture – that is, their shared beliefs, customs, values and language or dialect.
- Their community – its cohesion, stability, character, services, and facilities.
- Their political systems – the extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place, and the resources provided for this purpose.
- Their environment – the quality of the air and water people use, the availability and quality of the food they eat, the level of hazard or risk, dust, and noise they are exposed to, the adequacy of sanitation, their physical safety, and their access to and control over resources.
- Their health and wellbeing – health is a state of complete physical, mental, social, and spiritual well-being and not merely the absence of disease or infirmity.
- Their personal and property rights – particularly whether people are economically affected or experience personal disadvantage which may include a violation of their civil liberties.
- Their fears and aspirations – their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

The purpose of this SIA is therefore to:

- Provide context describing the social environment within which the project is proposed, and which may be impacted (both positively and negatively) as a result of the proposed development.
- Identify, describe, and assess possible social risks / fatal flaws and social impacts that may arise as a result of the proposed development (in terms of the detailed design and construction and operation phases of the project).
- Recommend ways in which negative impacts can be avoided, minimised, or their significance reduced, and positive impacts maximised or enhanced.

2.2. Approach to the Study

This SIA Report provides a snapshot of the current social setting within which Boshoek Solar 1 is proposed. It provides an overview of the manner and degree to which the current status quo is likely to change or be impacted by the construction and operation of the project, as well as the way the social environment is likely to impact the development itself.

The process of undertaking the social impact assessment for this project comprised the following:

- Collection and review of existing information, including national, provincial, district, and local plans, policies, programmes, census data, and available literature from previous studies conducted within the area. Project specific information was obtained from the project proponent.
- Collection of Primary data through site visits and interviews with local interested and affected parties (I&APs).

  Identification and assessment of potential direct, indirect, and cumulative impacts likely to be associated with the construction and operation of the proposed project. Impacts associated with construction can also be expected to be associated with the decommissioning phase (however, to a lesser extent as the project site would have previously undergone transformation and disturbance during construction).

2.2.1. Collection and Review of Existing Information

Existing desktop information that has relevance to the proposed project, project area and / or surrounds was collected and reviewed. The following information was examined as part of this process:

- Project maps and layouts.
- Google Earth imagery.
- A description of the project (as provided by the project proponent).
- Responses to questions posed to the project proponent regarding employment and social upliftment and local economic development opportunities (as provided by the project proponent).
- Census Data (2011), and the Community Survey (2016).
- Planning documentation such as Provincial Growth and Development Strategies (PGDSs), Local and District Municipality Integrated Development Plans (IDPs), Spatial Development Frameworks (SDFs), and development goals and objectives.
- Relevant legislation, guidelines, policies, plans, and frameworks.
- Available literature pertaining to social issues associated with the development and operation of solar PV power plants and associated infrastructure.

2.2.2. Collection of Primary Data

Primary data was collected through in-person interviews and a site visit from 11th to 12th March 2024. Landowners were approached regarding the project, requesting comments and more information about the area and the potential social impact the project could have. Comments from I&APs from interviews were summarised and included in **Appendix 8**

2.2.3. Assessment of Impacts

Impacts likely to be induced by the proposed development have been identified taking into consideration other specialists findings undertaken as part of the EIA process, similar projects and specialists' knowledge and experience. Indirect impacts (cumulative) likely to be induced by the identified proposed development impacts have also been included in the report, including impacts likely to emanate because of the potential no-development option.

The impact rating was undertaken using a matrix selection process, the most used methodology, for determining the significance of potential impacts/risks. This methodology takes into account two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided into the following categories in (**Table 2-2**).

Table 2-1: Impact Assessment Factors

Occurrence		Severity	
Probability of occurrence	Duration of occurrence	Scale/extent of impact	Magnitude of impact

Table 2-2: Impact assessment scoring methodology

Value	Description
Magnitude	
10	Very high/ unknown
8	High
6	Medium
4	Low
2	Minor
Duration	
5	Permanent (impact continues post closure)
4	Long Term (>15 years)
3	Medium-term (5-15 years) (Impact ceases after the operational phase)
2	Short term (2-5 years) (impact ceases after the construction phases)
1	Immediate (0-1 year)
Scale/ Geographic Extent	
5	International
4	National
3	Regional
2	Local
1	Site Only
0	None
Probability	
5	Definite/ Unknown (impact will definitely occur)
4	Highly Probable (most likely, 60% - 90% chance)
3	Probable (40% - 60% chance)
2	Low Probability (5% - 40% chance)
1	Improbable (less than 5% chance)
0	None

Table 2-3: Significance of impacts based on point allocation.

Significance Points Ranking	Negative Aspects	Positive Aspects
SP>60 - High significance	Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.	Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.
SP 30-60 - Medium significance	Has characteristics that could cause negative impacts.	Has characteristics that could cause positive impacts.

SP<30 - Low significance	Will never exceed legislation or standards. Unlikely to cause significant negative impacts.	Will always comply with all legislation and standards. Unlikely to cause significant positive impacts.

Significance Points = (Magnitude + Duration + Scale) x Probability.

2.2.4. Mitigation measures

The significance of an impact indicates the level of mitigation measures required to minimise negative impacts and enhance positive impacts during the various project phases. Suitable and appropriate mitigation measures have been identified for each potential impact based on specialist recommendations and expertise.

2.3. Limitations and Assumptions

» This SIA Report is intended to provide an overview of the current social environmental and assist in the identification of potential social impacts.
» This SIA Report was prepared based on information which was available to the specialist at the time of preparing the report. The sources consulted are not exhaustive, and the possibility exists that additional information which might strengthen arguments, contradict information in this report, and / or identify additional information might exist.
» Some of the project projections reflected in this SIA Report (i.e., with regards to job creation and local content) may be subject to change, and therefore may be higher or lower than those estimated by the project proponent.
» It is assumed that the motivation for, and planning and feasibility study of the project was undertaken with integrity; and that information provided by the project proponent was accurate and true at the time of preparing this SIA Report.

3. LEGISLATION AND POLICY REVIEW

The legislative and policy context applicable to a project plays a significant role in identifying and assessing the potential social impacts associated with the development. In this regard a key component of the SIA process is to assess a proposed development in terms of its suitability with regards to key planning and policy documents.

The following key pieces of documentation were reviewed as part of this legislation and policy review process:

National Policy and Planning Context:
- » Constitution of the Republic of South Africa, 1996
- » National Environmental Management Act (No. 107 of 1998) (NEMA)
- » White Paper on the Energy Policy of the Republic of South Africa (1998)
- » White Paper on Renewable Energy (2003)
- » National Energy Act (No. 34 of 2008)
- » Integrated Energy Plan (IEP) (2016)
- » National Development Plan (NDP) 2030 (2012)
- » Integrated Resource Plan for Electricity (IRP) 2010 – 2030, Updated Report (2013)

Provincial Policy and Planning Context:
- » Renewable Energy Strategy for the North West Province (2012)
- » North West Spatial Development Framework (2016)

Local Policy and Planning Context:
- » Bojanala District Municipality Integrated Development Plan (2023-2024)
- » Kgetlengrivier Local Municipality Integrated Development Plan (IDP) (2021-2022)
- » Rustenburg Local Municipality Integrated Development Plan (2022 - 2027)

3.1. National Policy and Planning Context

Any project which contributes positively towards the objectives mentioned within national policies could be considered strategically important for the country. A review of the national policy environment suggests that the increased utilisation of Renewable Energy (RE) sources is considered integral to reducing South Africa's carbon footprint, diversifying the national economy, and contributing towards social upliftment and economic development. As the project comprises a RE project and would contribute RE supply to provincial and national targets set out and supported within these national policies, it is considered that the project fits within the national policy framework.

A brief review of the most relevant national legislation and policies is provided in table format (**Table 3.1**) below.

Table 3.1: Relevant national legislation and policies for the Boshoek Solar 1 project

Relevant legislation or policy	Relevance to the proposed project
Constitution of the Republic of South Africa, 1996	Section 24 of the Constitution pertains specifically to the environment. It states that Everyone has the right to an environment that is not harmful to their health or well-being, and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The Constitution outlines the need to promote social and economic development. Section 24 of the Constitution therefore requires that development be conducted in such a manner that it does not infringe on an individual's environmental rights, health, or well-being. This is especially significant for previously disadvantaged individuals who are most at risk to environmental impacts.
National Environmental Management Act (No. 107 of 1998) (NEMA)	This piece of legislation is South Africa's key piece of environmental legislation and sets the framework for environmental management in South Africa. NEMA is founded on the principle that everyone has the right to an environment that is not harmful to their health or well-being as contained within the Bill of Rights. The national environmental management principles state that the social, economic, and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed, and evaluated, and decisions must be appropriate in the light of such consideration and assessment. The need for responsible and informed decision-making by government on the acceptability of environmental impacts is therefore enshrined within NEMA.
White Paper on the Energy Policy of the Republic of South Africa (1998)	The White Paper on Energy Policy places emphasis on the expansion of energy supply options to enhance South Africa's energy security. This can be achieved through increased use of RE and encouraging new entries into the generation market. South Africa has an attractive range of cost-effective renewable resources, taking into consideration social and environmental costs. Government policy RE is thus concerned with meeting the following challenges: » Ensuring that economically feasible technologies and applications are implemented. » Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential, and compared to investments in other energy supply options. » Addressing constraints on the development of the renewable industry. The policy states that the advantages of renewable energy include minimal environmental impacts during operation in comparison with traditional supply technologies, generally lower running costs, and high labour intensities. Disadvantages include higher capital costs in some cases; lower energy densities; and lower levels of availability, depending on specific conditions, especially with sun and wind-based systems. Nonetheless, renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future. The White Paper on Energy Policy, therefore, supports the advancement of renewable energy sources and ensuring energy security through the diversification of supply.
White Paper on Renewable Energy (2003)	The White Paper on Renewable Energy supplements the White Paper on Energy Policy, which recognises that the medium and long-term potential of renewable energy is significant. This

Relevant legislation or policy	Relevance to the proposed project
	Paper sets out Government's vision, policy principles, strategic goals, and objectives for promoting and implementing renewable energy in South Africa. What is being proposed now is a strategic programme of action to develop South Africa's renewable energy resources. particularly for power generation or reducing the need for coal-based power generation. Renewable energy has been . cognised in the Integrated Energy Plan (IEP) (DME, 2003) developed by the DME. Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels. The proportion of final energy consumption currently provided by renewable energy has come about largely as a result of poverty (e.g. fuelwood and animal waste used for cooking and heating). Strategic goals and supporting objectives will be instrumental in facilitating the development. of an enabling framework in order for Government to meet its commitment to promoting renewable energy. Four key strategic areas have been addressed, i.e., financial instruments, legal instruments, technology development, and awareness raising, capacity building and education. » **Financial Instruments**: The goal is to promote the implementation of sustainable renewable energy through the establishment of appropriate financial instruments. » **Legal Instruments**: The goal is to develop, implement, maintain, and continuously improve an effective legislative system to promote the implementation of renewable energy. » **Technology Development**: The goal is to promote, enhance and develop technologies for the implementation of sustainable renewable energy. » **Awareness Raising, Capacity Building and Education**: The goal is to develop mechanisms to raise public awareness of the benefits and opportunities of renewable energy
National Energy Act (No.34 of 2008)	The purpose of the National Energy Act (No. 34 of 2008) is to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, while taking environmental management requirements into account. In addition, the Act also provides for energy planning and increased generation and consumption of Renewable Energies (REs). The objectives of the Act, are to amongst other things, to: » Ensure uninterrupted supply of energy to the Republic. » Promote diversity of supply of energy and its sources. » Facilitate energy access for improvement of the quality of life of the people of the Republic. » Contribute to the sustainable development of South Africa's economy. The National Energy Act therefore recognises the significant role which electricity plays in growing the economy while improving citizens' quality of life. The Act provides the legal framework which supports the development of RE facilities for the greater environmental and social good and provides the backdrop against which South Africa's strategic planning regarding future electricity provision and supply takes place. It also provides the legal framework which supports the development of RE facilities for the greater environmental and social good.

Relevant legislation or policy	Relevance to the proposed project
Integrated Energy Plan (2016)	The IEP (which was developed under the National Energy Act (No. 34 of 2008)), recognises that energy is essential to many human activities, and is critical to the social and economic development of a country. The purpose of the IEP is essentially to ensure the availability of energy resources, and access to energy services in an affordable and sustainable manner, while minimising associated adverse environmental impacts. Energy planning therefore needs to balance the need for continued economic growth with social needs, and the need to protect the natural environment. The IEP is a multi-faceted, long-term energy framework which has multiple aims, some of which include: » To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector. » To guide the selection of appropriate technologies to meet energy demand (i.e., the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels). » To guide investment in and the development of energy infrastructure in South Africa. » To propose alternative energy strategies which are informed by testing the potential impacts of numerous factors such as proposed policies, introduction of new technologies, and effects of exogenous macro- economic factors.
National Development Plan 2030 (2012)	The National Development Plan (NDP) 2030 is a plan prepared by the National Planning Commission in consultation with the South African public which is aimed at eliminating poverty and reducing inequality by 2030. In terms of the Energy Sector's role in empowering South Africa, the NDP envisages that, by 2030, South Africa will have an energy sector that promotes: » Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates while supporting economic growth through job creation. » Social equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households. » Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change. The NDP aims to provide a supportive environment for growth and development, while promoting a more labour-absorbing economy. The development of the grid connection infrastructure is considered to be relevant to the plan due to the need of the infrastructure for economic growth within the Local Municipality (LM) municipal area.
Integrated Resource Plan (IRP) 2010 – 2030 Updated Report (2019)	South Africa's NDP 2030 offers a long-term plan for the country. It defines a desired destination where inequality and unemployment are reduced, and poverty is eliminated so that all South Africans can attain a decent standard of living. Electricity is one of the core elements of a decent standard of living. The NDP envisages that, by 2030, South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates; that is socially equitable through expanded access to energy at affordable tariffs; and that is environmentally sustainable through reduced emissions and pollution. In formulating its vision for the energy sector, the NDP took as a point of departure the Integrated Resource Plan (IRP) 2010–2030 promulgated in March 2011.

Relevant legislation or policy	Relevance to the proposed project
	The Aim of the IRP 2010 is to provide an indication of the country's current and forecast electricity demand and the strategy and budget necessary to meet these demands. Dentons' Africa chief Executive Officer, Noor Kapdi, in line with his duties as a member of the advisory council to the former Minister of Energy, formed part of the Advisory Commission formulated to refine and advise on both the IRP 2010 and the Energy Resources Plan. The Department of Energy (DOE) released the updated Draft IRP 2018 in August of the same year. The aim of the updated IRP was to address the point of departure between assumptions made in the original IRP, and the legislative mandate for electricity supply-demand optimisation based on a least-cost path. The IRP emphasised the following: » electricity consumption continues to decline on an annual basis. Current usage is comparable to those of the year 2007. For the fiscal year ending March 2018 the actual total electricity consumed is some 30% less than the figure projected in the IRP 2010. » Eskom's existing generation plant performance is not at expected levels. Eskom's own reports show that plant availability is below the IRP 2010 assumptions of 80% and above. » to date, an additional 18,000MW of new generation capacity in the form of coal, pumped storage and renewable energy has been committed to, with most of the capacity already connected to the grid and the rest to be realised by 2022. » reduced cost of new generation technologies. » actualisation of the least-cost option. » reduced carbon emission obligations on South Africa; and » the phased decommissioning of Eskom's power generation facilities as they reach the end of their life spans over the next 32 years. The envisaged energy mix by 2030 will consist of 34,000MW of coal (46%); 1,860MW of nuclear (2.5%); 4,696MW of hydro (6%); 2,912MW of pumped storage (4%); 7,958MW of solar PV (10%); 11,442MW of wind (15%); 11,930MW of gas (16%) and 600MW of concentrated solar power (1%). According to the IRP (2019), Solar PV, wind and CSP with storage present an opportunity to diversify the electricity mix, to produce distributed generation and to provide off-grid electricity. Renewable technologies also present immense potential for the creation of new industries, job creation and localisation across the value chain.

3.2. Provincial Policies

This section provides a brief review of the most relevant provincial policies. The proposed Boshoek Solar 1 and associated infrastructure is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

A brief review of the most relevant provincial policies is provided in table format (**Table 3.2**) below.

Table 3.2: Relevant provincial policies for the Boshoek Solar 1 Project

Relevant legislation or policy	Relevance to the proposed project
Renewable Energy Strategy for the North West Province (2012)	The renewable energy strategy aims to improve the North West Province's environment, reduce the North West Province's contribution to climate change, and alleviate energy poverty, whilst promoting economic development and job creation in the province whilst developing its green economy. The North West is rated as the fourth largest electricity consuming province in South Africa and consumes approximately 12% of the available electricity. This is mainly due to the high demand of the electrical energy-intensive mining and related industrial sector. Approximately 63% of the electricity supplied to the North West Province is consumed in its mining sector. The introduction and adoption of the New Growth Path in South Africa has seen increased emphasis towards developing and growing the green economy within the country, supported among others, by the Industrial Policy Action Plan (IPAP2) of 2010 and revised Integrated Resource Plan (IRP2). Nationally, there is also a White Paper on Renewable Energy which has been adopted by Parliament. Various funding mechanisms and programmes related to renewable energy have also been considered. One of these, the Independent Power Producer Procurement Programme contributes substantially towards socio-economic and environmentally sustainable growth. It is also aimed at stimulating the renewable energy industry in South Africa. This programme has opened the market for RE substantially in South Africa and holds sustainable potential for the North West Province. South Africa has an abundance of renewable energy resources available. The applicability of these RE resources depend on a number of factors and are consequently not equally viable for the NWP. The renewable energy sources that were identified to hold the most potential and a competitive strength for the North West Province are Solar Energy (photovoltaic as well as solar water heaters), Municipal Solid Waste, hydrogen and fuel cell technologies, biomass, and energy efficiency. This strategy attempts to focus the efforts of all stakeholders and provides a foundation to make the North West Province a primary contributor towards the renewable energy sector within South Africa. To achieve the goals set out in the Renewable Energy Strategy for the North West four key strategic areas have been considered as follows: » Financial Instruments: The goal is to promote the implementation of sustainable renewable energy through the leveraging and utilisation of appropriate existing and future financial instruments and partnerships within the province. » Legal Instruments: The goal is to develop, implement, maintain, and continuously improve an effective legislative system within the powers of the NWPG to promote the implementation of renewable energy. » Technology Development: The goal is to promote, enhance, support, and develop technologies for the implementation of sustainable renewable energy. » Awareness Raising, Capacity Building and Education: The goal is to develop mechanisms to raise public awareness and build capacity within the industries and municipalities of the NWP on the benefits and opportunities of renewable energy.

Relevant legislation or policy	Relevance to the proposed project
North West Spatial Development Framework (2016)	In terms of sustainability, the North West Province Spatial Development Framework needs to provide objectives which: » Adopt a comprehensive approach to spatial development in order to minimise the long-term negative impacts of current land use or development decisions. » Ensure that spatial planning serves national, provincial and/or local interest. » Support the long-term adequacy or availability of physical, social, and economic resources to support or carry development. » Protect existing natural, environmental, and cultural resources. » Ensure that land which is currently in agricultural use would only be reallocated to other uses where real need exists, and prime agricultural land should remain in production. » Support mining as a vital economic driver in the province without jeopardizing the biodiversity value of the environment. » Adopt a climate change strategy that will provide for responsible actions to curb the effect of global warming and climate change. Strategic Objective 3: Infrastructure Investment of the North West Spatial Development Framework (2016) emphasises the importance of maintaining a balance between investments aimed at meeting social needs of communities, and investments aimed at promoting economic development and job creation. As part of achieving these goals the following Spatial Development Strategies are suggested: Basic Infrastructure » Ensure efficient supply of water, electricity, and waste management services to sustain additional industry growth. » Eradicate backlogs in water and sanitation, electricity, housing. » Improve basic services. » Provide green infrastructure e.g., water tanks, renewable energy (e.g., solar) » Eradicate backlogs and maintain basic services. Social Infrastructure » Social infrastructure/facilities include education, health and emergency services, social and cultural facilities, social services, civil services, and recreational infrastructure. » Eliminate inequalities among and within communities. » Improve the quality of life especially of poor communities, provide for law and order, and enhance the stability of a community. » Promote equitable access to social services for all communities and contribute to the development of integrated and sustainable human settlements through the application of norms and standards for social infrastructure requirements. » Ensure that sufficient land is reserved for these essential facilities. Finally, in order to plan and manage the spatial implementation of development in the province it is crucial that all stakeholders agree on the core values which will help shape the spatial framework of the province. The core values are intended to achieve integration between stakeholders through better linkages connecting sector programmes, aligned infrastructure, social services, government spending, private sector investment and

Relevant legislation or policy	Relevance to the proposed project
	economic development. Some of the core values as pertains to the proposed project, for the Northwest Province are as follows: » Environmental integrity and sustainability through achieving a balance between safeguarding natural resources, optimizing the livelihoods of communities, and developing a flourishing economy. » Optimum use of existing resources including agriculture, forestry, renewable energy potential, already impacted land (brown field areas) minerals, bulk infrastructure, roads, transportation, and social facilities. » Rapid economic growth that is sustained and inclusive. » Government spending on fixed investment focused on localities of economic growth and/ or economic potential in order to gear up private sector investment stimulate sustainable activities and create long-term employment opportunities. » Development of productive land uses (creating economic opportunity) could stimulate needed economic growth, job creation and tax base expansion. This will increase municipal income enabling increased public sector investment to be focused on social upliftment. » Where low economic potential exists investments should be directed at projects and programmes to address poverty and the provision of basic services in order to address past and current social inequalities.

3.3. District and Local Municipalities Policies

The strategic policies at a district and local level have similar objectives for the respective areas, namely, to accelerate economic growth, create jobs, and uplift communities. The proposed Boshoek Solar 1 project is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor. A brief review of the most relevant district and local municipal policies is provided in table format (**Table 3.3**) below.

Table 3.3: Relevant district and local municipal policies for the Boshoek Solar 1 Project

Relevant policy	Relevance to the proposed project
Bojanala District Municipality Integrated Development Plan (2023-2024)	The 2023/24 Reviewed IDP is a result of extensive consultation with the various role players as demonstrated by the developmental priorities that each municipality put forward. A situation analysis is made of where the municipalities are at present and where they want to be in future. The infrastructure and services delivery, socio-economic, spatial development and economic framework are respectively outlined. The way forward is subsequently concretized by a strategic long-term vision and secondly, by the detail in which these strategic objectives will be achieved. The district municipality derives the following mandate from Section 152 of the Constitution of South Africa, Act 108 of 1996, » To promote democratic and accountable local government. » To ensure the provision of services to communities in a sustainable manner/. » To promote social and economic development. » To promote a safe and healthy environment; and

Relevant policy	Relevance to the proposed project
	» To encourage the involvement of communities and community organizations in the matters of local government The Bojanala Platinum District Municipality (BPDM) Integrated Development Plan emphasises the import of the nine-point plan as announced during the 2015 state of the Nation Adress as part for the government's strategy to implement the NDP. Among others the nine-point plan focus on critical areas such as energy, tourism, agriculture, boosting Small Medium and Micro Enterprise (SMMES), science and technology, industrialisation, and transport. The components of the nine-point plan include: » Resolving the energy challenge » Revitalising agriculture and the agro-processing value chain » Advancing beneficiation or adding value to the mineral wealth » More effective implementation of a higher impact Industrial Action Policy Action Plan (IPAP) » Encouraging private-sector investment » Moderating workplace conflict » Unlocking the potential of SMMEs, cooperatives, townships, and rural enterprises » State reform and boosting the role of state-owned companies, science, technology and innovation, information, and communications technology infrastructure or broadband roll-out, water, sanitation, and transport infrastructure. » Operation Phakisa, which is aimed at growing the ocean economy and other sectors. Although the nine-point plan is led by national departments, the local government, as the sphere closest communities play a significant role in its realisation, hence the need for the IDP to take cognisance of the plan.
Kgetlengrivier Local Municipality Integrated Development Plan (IDP) (2021-2022)	The integrated Development Process (IDP) is an approach to planning that involves the whole municipality and its citizens in finding the best solutions to achieve effective long-term development. The IDP is done in line with the Municipal Systems Act: Section 23, which requires each municipal council to within a prescribed period after the start of its elected term, adopt a single, inclusive, and strategic plan for the development of its area of jurisdiction. The IDP development objectives are an indication of what the municipality would like to achieve in the medium term to deal with the problems outlined in phase one. All strategies and political objectives of (KRLM) are indicated in this section. The five strategic objectives are listed below. Strategic Goal 1: To provide Sustainable services to the communities. Strategic Goal 2: to create economic opportunities within the municipality. Strategic Goal 3: To provide prudent management and effective administration. Strategic Goal 4: To provide sound good governance to the local communities. Strategic Goal 5: To ensure a sound fiscal management and viability. KRLM does not have a Local Economic Development (LED) Strategy in place. LED one of the ways through which the municipality can contribute to decreeing unemployment and poverty. The goal of local economic development is for the municipality to take the lead in growing the local economy by creating jobs and favourable environment for other stakeholders to create jobs. LED is a process by which public, business, and non-governmental sectors work jointly to create better circumstances for economic growth and job creation to advance a local area's economic identity. Local economic development is part of

Relevant policy	Relevance to the proposed project
	Integrated Development Planning and as such all stakeholders must play a role in the development and implementation of the LED strategy. The following are some of the objectives that are outlined in the IDP: <u>Economy & Employment</u> » Identify sectors with development opportunities. » Develop SMMEs in each sector and promote participation. » Broaden the economic base through the integration of diverse economic initiatives. » Improve developmental capability of the public and private sector as PPPs. » Improve local job creation. <u>Infrastructure</u> » Develop infrastructure to provide access to services and promote rural inclusion. » Improve public transport and mobility in rural areas. <u>Sustainable and Enabling Environment</u> » Use natural resources more efficiently. » Increase awareness and participation among rural communities. » Ensure proposed strategies comply with environmental requirements. » Create a stable business environment. » Increase confidence levels of the public and private sector investors. » Unlock under-utilised resources. <u>Social Protection</u> » Ensure provision to social welfare services. » Establish an effective and comprehensive social welfare system. » Ensure poverty alleviation. » Promote redistribution of opportunities and wealth. » Improve efficiency in the delivery of services, reduce exclusions and address administrative bottlenecks.
Rustenburg Local Municipality Integrated Development Plan (2022 - 2027)	The 2023/2027 five-year IDP is the 5th generation plan of the Rustenburg Local Municipality. The IDP is an attempt to refocus to get the basics right to achieve the LMs vision and ensure attainment of the basic developmental aspirations of our populace in the following areas: » Human Settlements. » Water and Sanitation Supply. » Electricity Supply. » Roads & Storm water » Refuse Removal; and » Local Economic Development & Job Creation Rustenburg LM has a Climate Change Management Plan. It is through this plan and other recent climate change information platforms that education and awareness initiatives to the Rustenburg LM directorates are driven from. There will be quarterly information sharing in the form of articles to individual directorates on emissions of greenhouse gasses caused by their day-to-day activities. The initiatives will include but are not limited to:

Relevant policy	Relevance to the proposed project
	» Decarbonization of Electricity –transition from coal powered electricity to renewable energy (DTIS Electrical) » Decarbonization of Transport- transition to low emissions vehicles- Electric vehicles (RRT) » Decarbonization of Economy-transition to Green Economy projects (LED) » Decarbonization of Planning-transition to a lower Greenhouse Gas emissions and climate resilient development/building/housing (DPHS) The Agricultural Sector is also a major sector in the economy of the municipality, most of the land contained in the municipality has been cultivated and therefore environmental-significant land is mostly contained within the protected area along the Magaliesburg Mountain Range. The main purpose of the Spatial Development Framework (SDF) is to guide the form and location of the future physical development within a Municipal Area. The SDF should be flexible and be able to change its priorities, whereas the Land Use Management System (LUMS) should be tighter and only amended where required for a particular development. The SDF should inform the content of the LUMS and does not act as a direct source of rights and control itself. In this regard, the SDF should: » Act as a strategic, indicative, and flexile forward planning tool to guide planning and decision on land development. » Develop a clear argument or approach for spatial development in the area of jurisdiction of the municipality. » Develop a spatial logic which guides private sector investments. » Ensure the social, economic, and environmental sustainability of the area. » Establishment priorities for public sector development and investment » Identify spatial development priorities and places. The purpose of the SDF is not to infringe upon existing land but to guide future land uses, and the maps should be used as a systematic representation of the desired spatial form to be achieved by the municipality.

Implementation of the Boshoek Solar 1 would contribute in a small way towards addressing the key issues regarding high levels of poverty and unemployment, skills shortage, and inequality through the creation of employment opportunities, the provision of skills training opportunities, and local economic growth, including growth in personal income levels of those community members who would be employed during the construction and operation phases of the project.

The review of relevant legislation, policies and documentation pertaining to the energy sector indicate that renewable or green energy (i.e. energy generated by naturally occurring renewable resources) and therefore the establishment of the Boshoek Solar 1 is supported at a national, provincial, and local level, and that the proposed project will contribute positively in a small way towards a number of targets and policy aims; specifically those relating to employment creation, social and economic development and upliftment, and an increase in renewable energy and electricity supply which has the potential to further improve individuals' standard of living.

4. SOCIAL PROFILE

The Boshoek Solar 1 Project, including its associated infrastructure, is situated 33km northwest of Rustenburg on the edge of the Rustenburg LM, within the Kgetlengrivier LM and the Bojanala District Municipality (DM), in the North West province. (refer to **Table 4-1**).

Table 4-1: Spatial Context of the study area for the development of Boshoek Solar 1

Province	**North West Province**
District Municipality	Bojanala District Municipality
Local Municipality	Kgetlengrivier Local Municipality
Ward number	6
Local Municipality	Rustenburg Local Municipality
Ward number	1
Nearest town(s)	Rustenburg
Preferred access	The site is accessible via an unnamed gravel road surrounding the site, off the R556 (Lindleyspoort) tar road.

This Chapter provides an overview of the socio-economic environment of the province, DM, and LM within which the Boshoek Solar 1 is proposed and provides the socio-economic basis against which potential issues can be identified.

4.1. North West Province

The North West province is South Africa's fourth-smallest province and is bordered by the country of Botswana to the north, and the South African provinces of the Northern Cape to the west, Gauteng to the east, Limpopo to the north-east, and Free State to the south. The North West Province occupies the relatively flat interior plateau of south Africa and stretches from the usually dry Molopo River southward to the Vaal Rivier.

Mahikeng, formerly Mafeking, serves as the provincial capital. Other significant towns include Brits, Klerksdorp, Lichtenburg, Potchefstroom, Rustenburg, and Sun City. The province has two universities: the University of North West, which was formerly called the University of Bophuthatswana in Mmabatho; and Potchefstroom University for Christian Higher Education. The province is home to an estimated 3.5 million people, with the most dominant ethnic group is the Setswana-speaking Tswana, joined further by smaller populations of Afrikaans, Sesotho, and IsiXhosa speaking people.

The northern and western parts of the province are occupied with many sheep, cattle, and game farms. The eastern and southern parts of the province produce various crops, including maize, sunflower, tobacco, cotton, and citrus fruits. Mining plays a significant role in the province's economy, consisting of diamonds, chromite, platinum, and uranium. The province is blessed with natural beaty with the Magaliesburg mountain range in the north east extending for 130 km from Pretoria in Gauteng to Rustenburg. The area is also the home of Madikwe Game Reserve and the Pilanesberg Game Reserve.

4.2. Bojanala Platinum District Municipality

BPDM is one of the four District Municipalities in the North West Province and is situated to the east of the province. BPDM is a Category C municipality in terms of the Municipal Structures Act, Act No 58 of 1999, and also in terms of Section 152 of the Constitution of the Republic of South Africa, Act No. 108 of 1996.

Figure 4-1: Map of South Africa with North West Province

BPDM is surrounded by Waterberg District Municipality (Limpopo Province) to the north, Tshwane Metropolitan Municipality (Gauteng Province), and West Rand District Municipality (Gauteng Province) to the South-East, Dr. Kenneth Kaunda District Municipality to the south, and Ngaka Modiri Molema District Municipality to the west. The seat of the BPDM is in Rustenburg City, which is in the Rustenburg Local Municipality. The district comprises 17% of the total area of the province, with a population of over 1.6 million people, making up 44% of the population of the province.

The district is located in the "platinum belt" of South Africa, a region known for being amongst the world's top three multinational platinum producers. The Cradle of Humankind, which is a popular World Heritage site in South Africa, can be found in the district. The majority of the area can be classified as rural with incredibly low densities that makes the provision of basic services difficult and expensive. The more formal urban areas are located in the southern side of the district. These include Rustenburg and Brits, which are vibrant economic nodes.

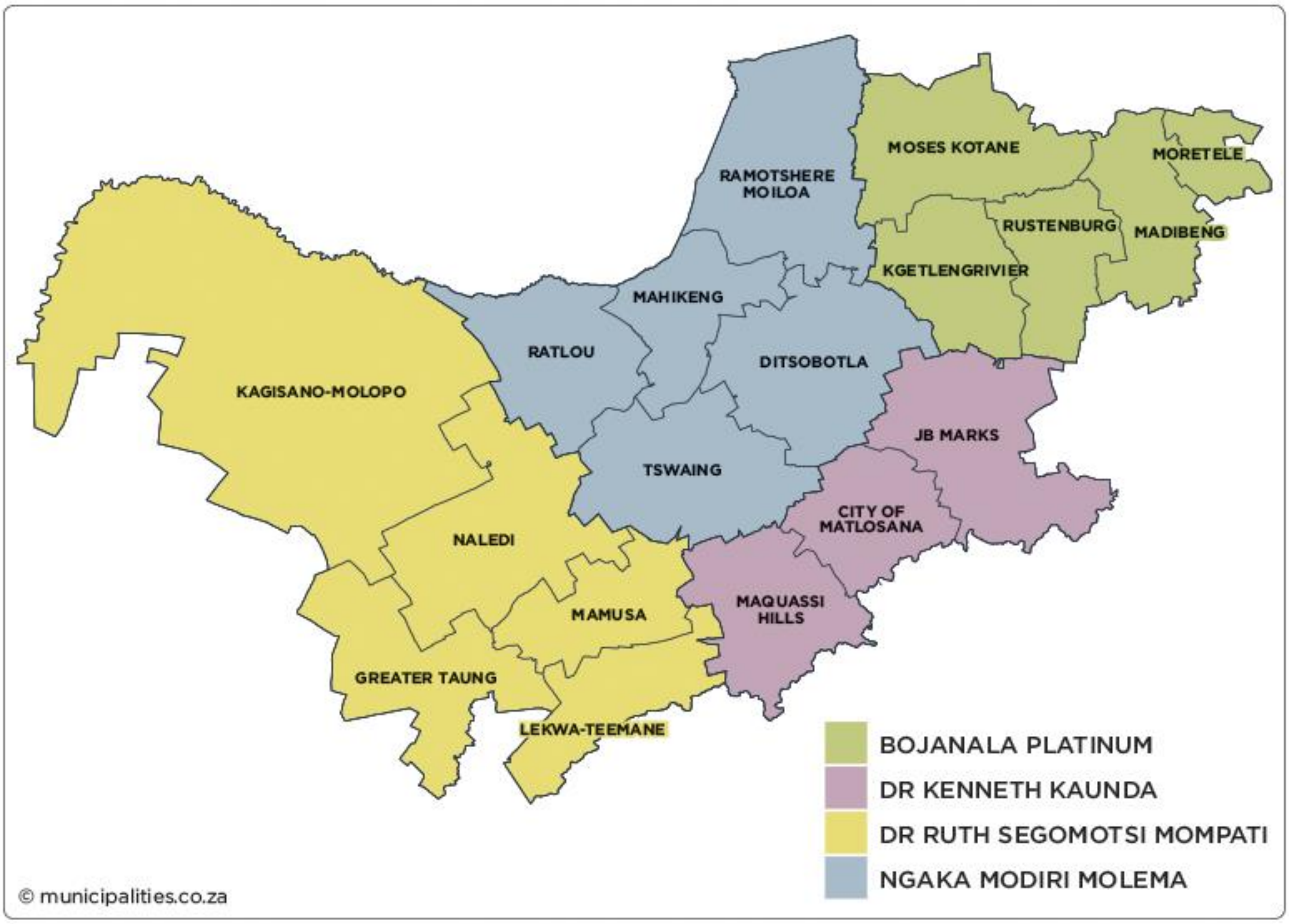

Figure 4-2: Local and District Municipalities in the North West Province

4.3. Kgetlengrivier Local Municipality (LM)

The Kgetlengrivier Local Municipality LM is a Category B municipality located in the south-eastern prat of the North West Province and forms part of the BPDM. The LM is one of the five local municipalities found in the BPDM in the Northwest Province. It is located in the south-eastern parts of the province and is situated on the N4 national road that runs between Pretoria and Botswana, and towns that can be found in the municipality are Reagile, Borolelo and Koster.

The area's rich environment and natural resource base provides opportunities for agriculture and slate quarry development. The area's mining activities are those related to diamonds, slate, and aggregate sand. The main town in the Municipality is Derby, Koster and Swartruggens. Key economic sectors are agriculture and mining.

4.4. Rustenburg Local Municipality

Rustenburg Local Municipality is located in Bojanala District Municipality. The Rustenburg LM was established as a Category B municipality with an Executive Mayor and Ward Committees. The total geographical area is 3,423 km2. The Municipality is located in the eastern parts of the North-West Province and is accessible to a number of major South African urban centres. These centres include Johannesburg and Tshwane, which are located approximately 120km from Rustenburg. Smaller centres surrounding Rustenburg are Madibeng, Mogale City, Brits, Lichtenburg, and Zeerust in the Ramotshere Moilwa LM. Rustenburg is linked to the above urban centres through an extensive regional road network. The most notable of these are the N4 Freeway or Platinum Corridor, which links Rustenburg to Tshwane in the east and Zeerust to the west. The R24 links Rustenburg to Pretoria to the east, Johannesburg in the south and the Pilanesberg to the north.

The area thrives on its agricultural industry which produces beef, citrus, wheat, sunflower and wheat. The area is also a well-known mining area because of its proximity to the Bushveld Igneous Complex. Rustenburg is home to the two largest platinum mines in the world and the world's largest platinum refinery, which processes around 70% of the world's platinum.

4.5. Study Area Description

The solar facility is within a few kilometres from economic zones, including mining sites (see **Figure 4-3**), which is some seven kilometres from the site; and Sun City, a tourism hub, some nine kilometres from the site. Some small communities can also be found in the surrounding area (see **Figure 4-4**). To the North lies Phatsima (B), with Rasimone, Robega and Chaneng to the East. These settlements are generally small with populations recorded as approximately 5,000 to 7,000. Boshoek also to the east has a few small businesses servicing the area. The Boshoek central business district is located approximately six km from the project area. The area has an Engen Garage, some retail stores, small- and large-scale businesses, as well as informal traders. There are a few numbers of formal and information residential buildings, some of which have been converted to guesthouses.

In the ridge to the east of the project site acts as a geographical barrier that isolates the area and the few residents near the proposed project. The area has little support from local government with most of the services being supplied by the local residents themselves. A few services such as a mobile clinic do service the area, however those who can afford it go to Rustenburg for medical treatment. Moses Kotane Hospital is, however, much closer, located 17 min to the north in the town of Ledig.

The road traffic associated with the mines and settlements in the area do make use of the tar road in the area and should not be significantly impacted the proposed project. The area is generally quiet and though used at times by heavy vehicles traveling to and from the mines, as well as for agricultural use at times.

The Sundown Country Estate is roughly 4 km to the east of the project site. The facility offers accommodation and leisure. A similar establishment, the African Elegance Tented Lodge is nearby, to the north. A number of such small businesses in the form of accommodation, Bed and Breakfasts, Lodges and similar kinds are active in the area (see **Figure 4-5**). These small businesses make an income by taking advantage of the location, the proximity to Pilanesberg Natural reserve, the attractions of Sun City, the need for accommodations for people employed by the mines. Few of these establishments would be directly negatively affected as a result of the development, as most are not in close proximity to the project site. The literature related to the impact on renewable projects on tourism and accommodations are however not clear cut and could be influenced by local nuances.

> "The tourist's focus is usually on the positive impact that the renewable energy sources create. However, at the same time, bad feelings typically emerge from the residents in and around the areas where the alternative sources such as wind turbines and solar panels erected. In the case studies

shown above, it is argued that tourists see renewable energy sources as the future, while it does not affect their decision on the particular place they want to travel to "(Prinsloo, 2015)

Further impacts can likely be managed through mitigation such as keeping a barrier of foliage or fencing around the area that would result in a reduced visual impact. The impact on the associated infrastructure however is harder to mitigate, more details should be related in the visual impact assessment. As for our example, the Sundown country Estate will have no view of the solar panels, as there is a ridgeline between the estate and the proposed solar farm.

Lastly, through measuring the overall occurrence of 17 major community reported crimes (see **Figure 4-6**), statistics derived from the ISS Crime Hub indicates that crime in Kgetlengrivier LM has remained low and stable since 2005, however neighbouring Rustenburg LM sees a great deal more occurrences. This should not be surprising as the Rustenburg LM has a significantly larger population (see **Table 4-2**), as well as the large town of Rustenburg and seven Police Precincts, vs the two Police Precincts of Kgetlengrivier LM.

4.6. Project Site Description

The Boshoek Solar 1 project site is located South of the R556 main road and accessed through existing gravel farm roads. There are no existing buildings on the proposed site location however the site is in close proximity to a few homesteads and a Guesthouse (Selons River Lodge) to the south (See **Figure 5-1**). The Grid Connection links with that of the Boshoek 2 Solar PV project, following the road east and then crossing north to connect to the future planned Eskom collector switch station ~3.5 km north-east of the site.

The site has been utilized for agricultural purposes. The agricultural activities in the area and on the site consists predominantly of grazing areas for livestock. Neighbouring farms similarly use the land as grazing for livestock and wildlife in the case of nearby game and breeding farms. There are few instances of growing crops or animal feed from neighbouring properties.

The area sees few people moving around except for residents and a farmworker. Because of the low population density and the limited agricultural activity, there is limited foot or road traffic in the area. Security cameras can be seen at the entrance roads, and these are controlled and maintained by local residents and the private security *Plaas Wag*[1] that they are part of. As reported by local resident, the area sees limited severe criminal activity, however cable and livestock theft are a concern.

The roads to access the area is in reasonably good condition, with few potholes on the tar road and the gravel road being well maintained by local residents. During construction, the majority of the access road will follow existing, gravel roads that may require widening. Where new sections of road need to be constructed (/lengthened), this will be gravel/hard surfaced access road and only tarred if necessary. A network of gravel internal access roads and a perimeter road will be constructed to provide access to the various components of the PV development.

An area of up to 1ha will be occupied by buildings during the construction phase which will include (but is not limited to) a 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre. As noted above, the future planned Eskom collector switching station will

[1] Translated from Afrikaans as "Farm Guard"

facilitate the connection of the facility substation to the Ngwedi 400/132kV MTS via a single or double circuit 132 kV overhead powerline.

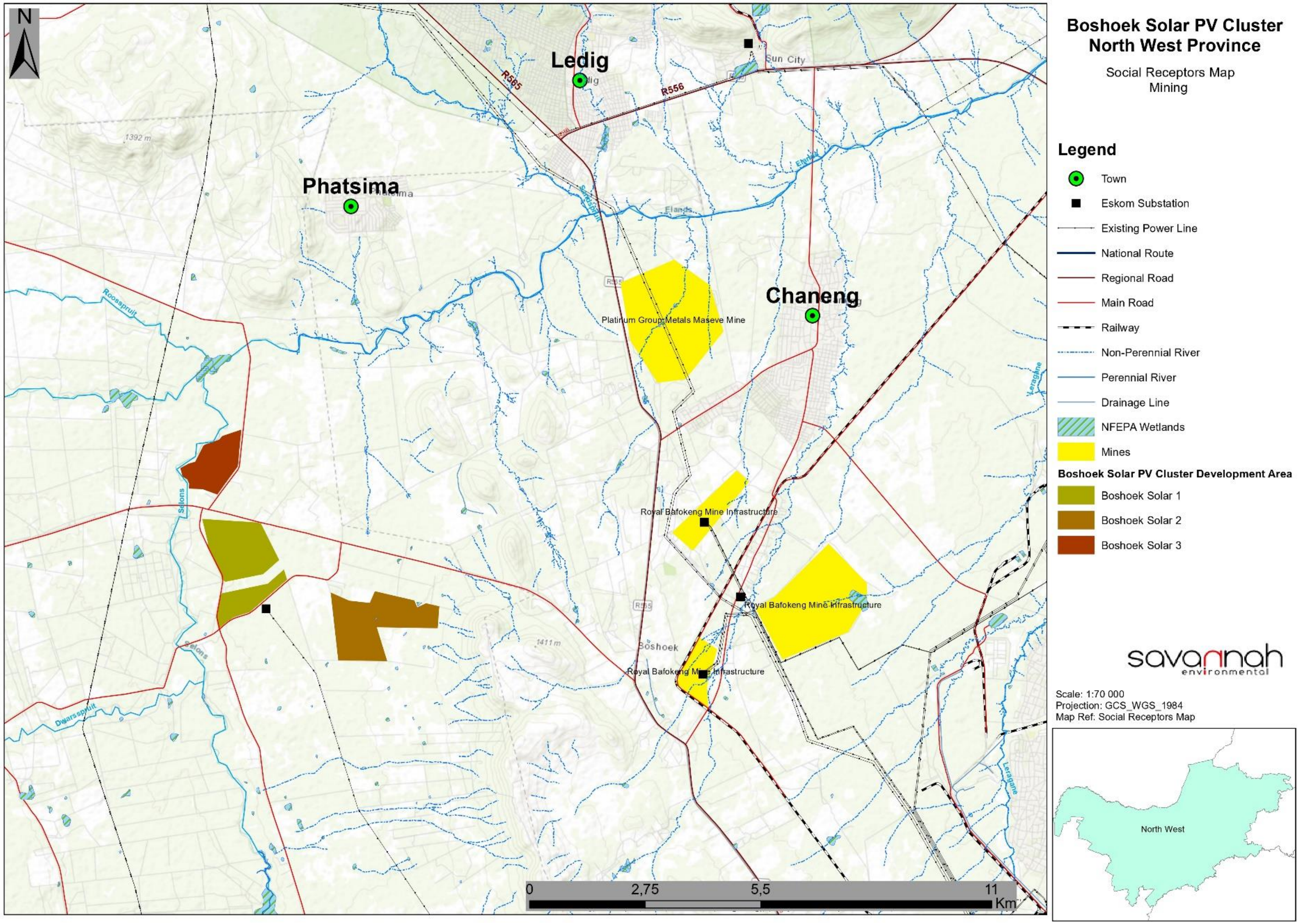

Figure 4-3: Map indicating the identified Social Receptor and Mining Areas local to the project site, and the Boshoek Solar PV Cluster

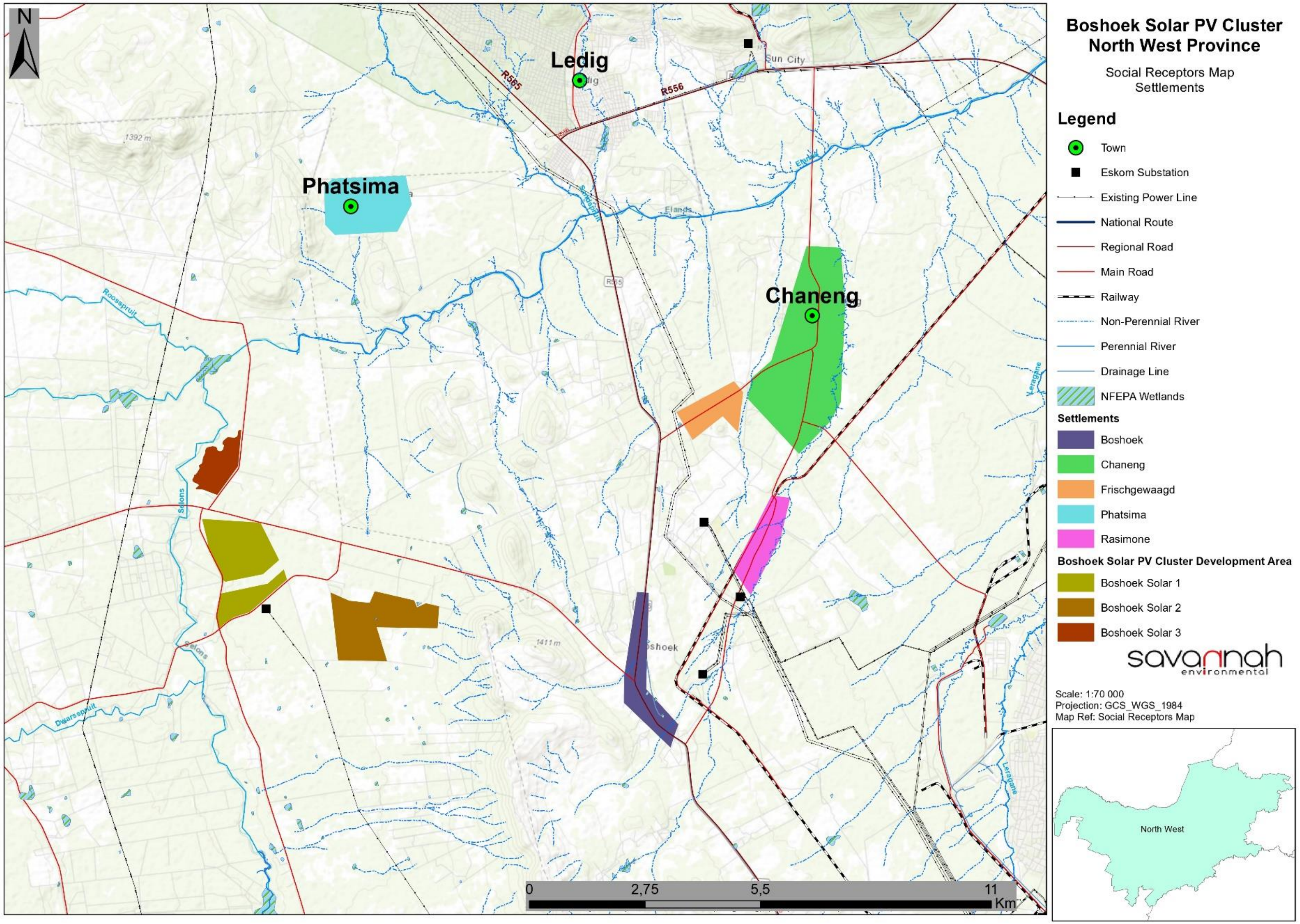

Figure 4-4: Map indicating the identified Social Receptor and Settlements local to the project site, and the Boshoek Solar PV Cluster

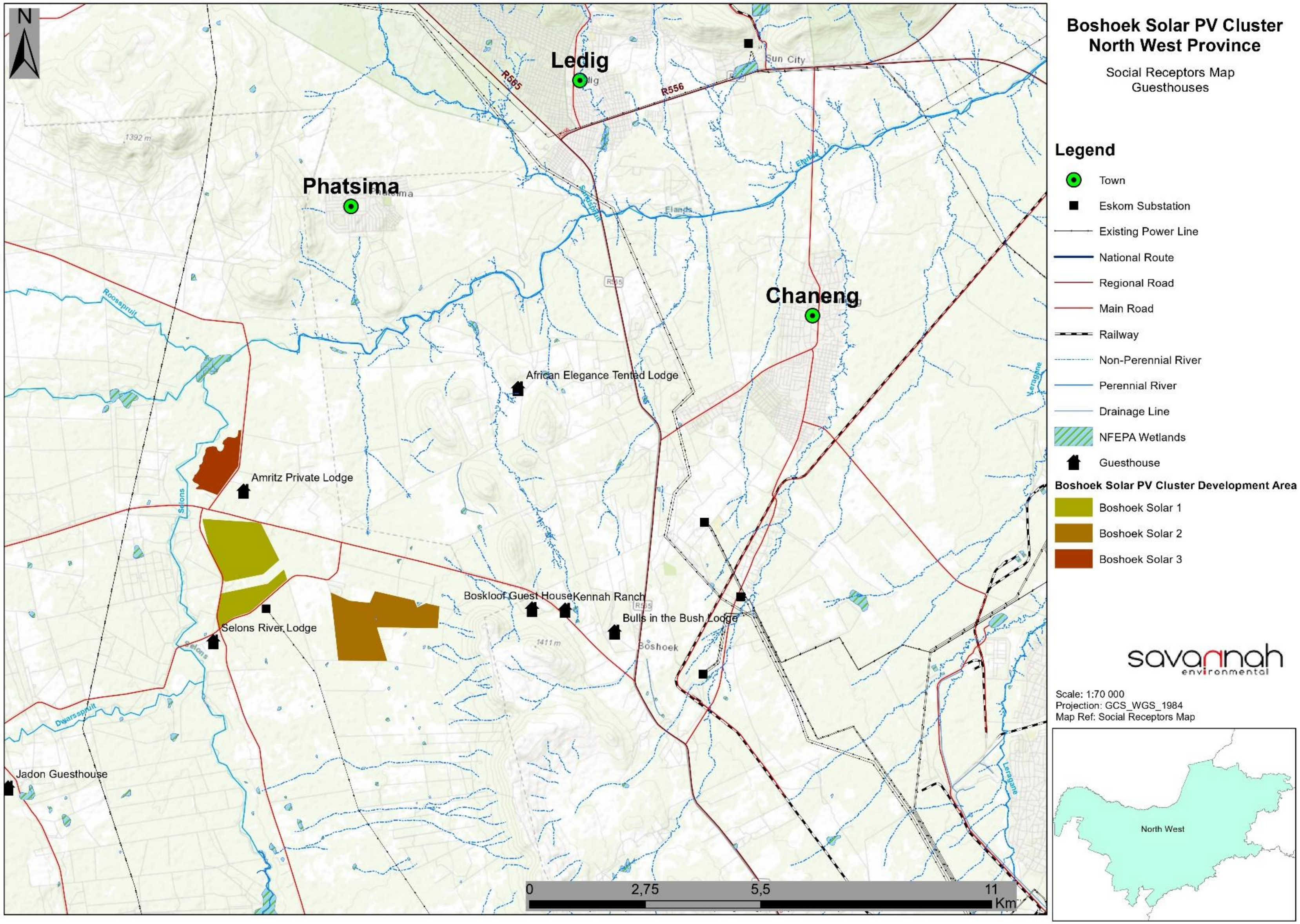

Figure 4-5: Map indicating the identified Social Receptor. Guesthouses and Accommodations local to the project site, and the Boshoek Solar PV Cluster

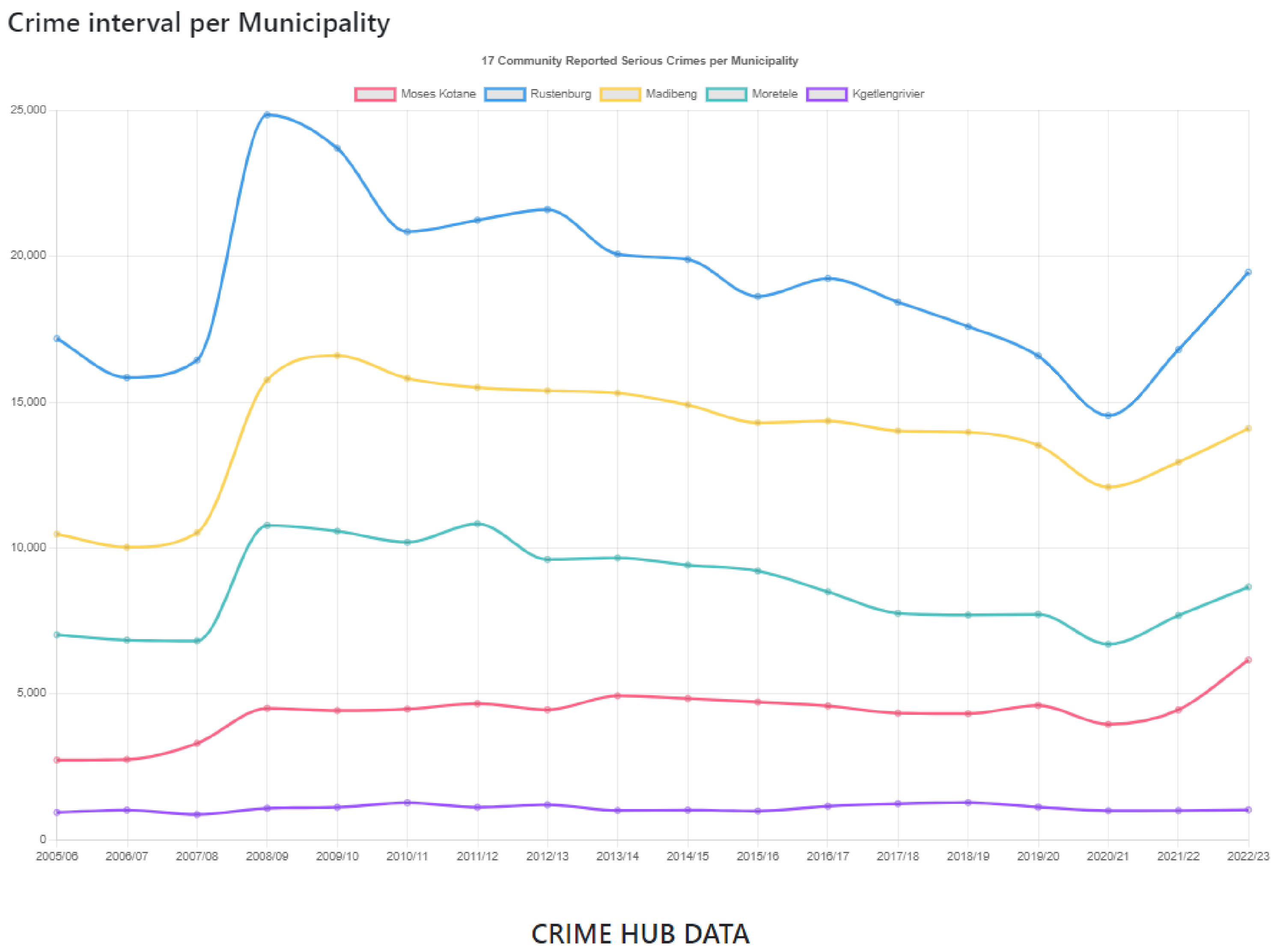

Figure 4-6: Community Reported Serious Crimes per Municipality, 2005 - 2023

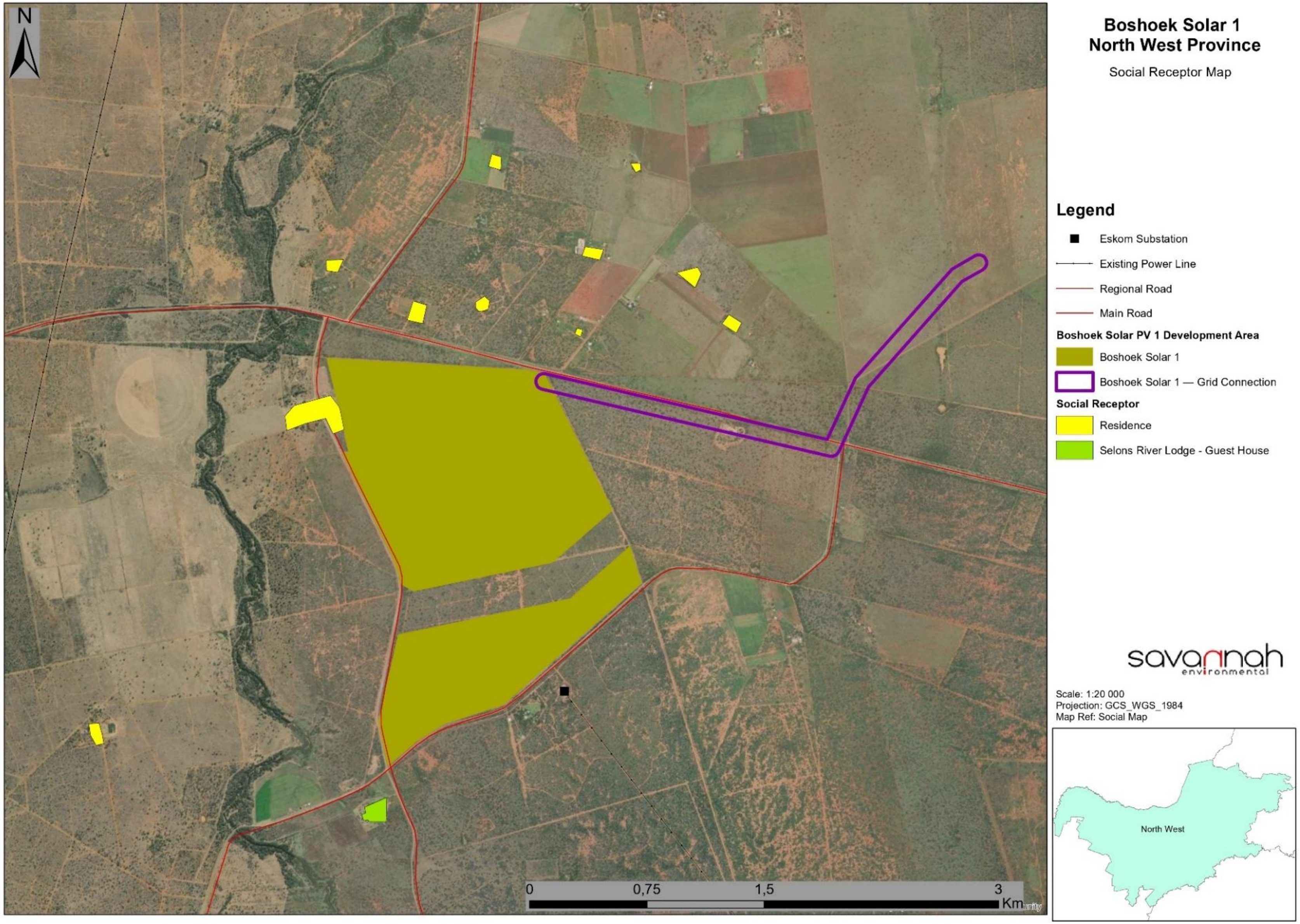

Figure 4-7: Map indicating the identified Social Receptor. Boshoek Solar 1

4.7. Baseline Description of the Social Environment

Table 4.2 provides a baseline summary of the socio-economic profile of the Kgetlengrivier LM within which Boshoek Solar 1 is proposed. To provide context against which the LM's socio-economic profile can be compared, the socio-economic profiles of neighbouring LMs, the DM, province, and South Africa have also been provided where applicable. The data presented in this section have been derived from the 2011 and 2022 Census, 2016 Community Survey, as well as demographic information derived from documents made available by the LM and DM.

Table 4-2: Baseline description of the socio-economic characteristics of the area within which the Boshoek Solar 1 is proposed.

Population characteristics
» Rustenburg LM has remained the most populous LM in the BPDM, with an estimated 562 031 population in 2022, an increase from 549 750 in 2011. » Kgetlengrivier LM has also experienced an increase in population size. In 2011 there was a population of 51 049 people, and 54 759 in 2022. » The population in the BPDM rose from 1 507 505 in 2011 to 1 624,144 in 2022. » The dependency ratio in Rustenburg LM was 45.2 in 2016, which is an increase from the 37.9 in 2011, whereas Kgetlengrivier LM experienced an increase from 52.5 in 2011 to 64.0 in 2016, an increased number of dependents across the study area by 2016 (StatsSA, 2016). The 2022 census suggest the dependency ratio for the Rustenburg LM at 40.3, and the Kgetlengrivier LM at 52.1. » Setswana is the home language, with approximately 400,487 (64%) of the population in Rustenburg LM, 1 071 678 (65%) in Bojanala Platinum, and 43 050 (72%) in Kgetlengrivier LM. Afrikaans, Sesotho, IsiXhosa, and Xitsonga are also present in the area, though much less so (Community Survey, 2016).
Economic, education and household characteristics
» A decrease was noted in the number of people with no schooling (people over the age of 20) from 2011 to 2022 in both Kgetlengrivier LM (from 15.8% to 8.5%) and Rustenburg LM (from 5.4% to 3.9%). This was echoed in the BPDM seeing a decrease from 7.5% to 5.5% during the same period. » The mining sector is a crucial driver of BPDMs economy contributing the figure of R 71,5 billion. That figure accounts for 52.1% of the total Gross Value Add (GVA) in the district municipality's economy, and more than half of the District's Gross Domestic Product (GDP). » According to the Municipal IDP, 2020/21, Rustenburg's economy largely revolves around the production of platinum, which contributed 66% to provincial GVA in 2013, followed by the trade and finance sector which contributed 29% and 28%, respectively, in the same period. The decline in Rustenburg's GDP (-3.5%) in the year 2012 was influenced by the decline in the mining sector, which resulted in a negative growth in the overall province (Municipal IDP,2020/21). » In the Kgetlengrivier LM, 45% people are economically active (employed or unemployed but looking for work), and of these, 12% are unemployed. Of the 9 142 economically active youths (between 15 – 34 years) in the area, 27% are unemployed. (Community Survey, 2016). » Rustenburg LM accounted for 196 080 (49%) employed people, while 70 391 (18%) were unemployed. The majority of individuals are employed in the formal sector in both Rustenburg LM, which accounts for 147 924 (75%) people, and Kgetlengrivier LM, accounting for 7 575 (49%) people (Community Survey, 2016).
Services
» There are approximately 125 healthcare facilities across the BPDM. There are 10 Community Health Care Centres that offering 24-hour service. 17 smaller facilities offer additional services that provide 24-hour services. 19 Mobile Clinics service with numerous service points across the district. Further, Mobile Clinics mainly provide preventative and promotive health services (Bojanala Platinum IDP, 2021/22). » Approximately 94% of households in the BPDM uses electricity for lighting. This compared to 94.5% in the Rustenburg LM and 94.4% in Kgetlengrivier LM. (Census 2022)

- The households in the BPDM with access to piped water in their dwellings increased from 26% to 41.6% from 2011 to 2022. This is well below the national average of 59.7% (2022). The Rustenburg LM showed improvements as well, with 53% having access in 2022, while households in Kgetlengrivier LM stood at 58%. (Census 2022)

Household characteristics

- In 2011, Rustenburg LM comprised 199,035 households and by 2022, the number had increased to 203,658. Average size of households remained at 2.8 over this period. Kgetlengrivier LM had an increase of 510 households, going from 14,673 households in 2011 to 15,183 in 2022 The average household size in Kgetlengrivier LM has seen a slight increase from 3.5 in 2011 to 3.6 in 2022. (Census 2022)
- From 2011 to 2022, there was a significant shift in the ratio of males and females in the BPDM from 111.4 males to every 100 females, to 103.3 males to 100 females. A similar shift was noted in the two LMs. The Rustenburg LM went from 121.8 to 108.4. The smaller Kgetlengrivier LM went from a ratio of 112.6 to 97.8 during the same period. (Census 2022)
- There has been a significant decline in the number of people residing in informal dwellings. Rustenburg LM saw a rise formal dwelling, from 68.7% to 85.9%. Similarly, Kgetlengrivier LM saw a rise in formal dwellings from 72% to 89.5%.

5. IDENTIFICATION AND ASSESSMENT OF POTENTIAL SOCIAL IMPACTS

This Chapter provides a description and assessment of the potential social impacts that have been identified, which may be associated with the development of the Boshoek Solar 1. Potential impacts have been identified based on the current understanding of the project and the socio-economic environment within which it is proposed.

Social impacts are expected to occur during both the construction and operation phases of the associated infrastructure. The status of the impacts will either be positive or negative and either mitigation or enhancement measures are recommended for the management of the impacts depending on the status of the impacts.

5.1. Potential Social Impacts during the Construction Phase

The majority of social impacts associated with the project are anticipated to occur during the construction phase of the development and are typical of the type of social impacts generally associated with construction activities. These impacts will be temporary and short-term (~24 months) but could have long-term effects on the surrounding social environment if not planned or managed appropriately. It is therefore necessary that the detailed design phase be conducted in such a manner so as not to result in permanent social impacts associated with the ill-placement of project components or associated infrastructure or result in the mismanagement of the construction phase activities.

The positive and negative social impacts identified that will be assessed for the **construction phase** include:

» Direct employment opportunities
» Multiplier Effects on the Local Economy
» Influx of jobseekers and change in population.
» Safety and Security
» Local Services/Resources
» Impacts on daily living and movement patterns
» Nuisance Impacts
» Impacts associated with the loss of agricultural land.

Table 5-1: Impact Assessment on Direct Employment Opportunities During the Construction Phase

Impact Phase: Construction							
Potential impact description: Employment opportunities and skills development The impact will occur at a local and regional level. The creation of employment opportunities will assist to an extent in alleviating unemployment levels within the area. Construction of the project will result in the creation of several direct and indirect employment opportunities, which will assist in addressing unemployment levels within the area and aid in the skills development of communities in the area.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	L	M	L	Positive	M	L	M
With Mitigation	M	M	L	Positive	M	M	M
Can the impact be reversed?		Yes					

Will impact cause irreplaceable loss or resources?	No, the impact will be positive
Can impact be avoided, managed, or mitigated?	Yes, enhancements will result in increased positive outcomes

Mitigation measures to reduce residual risk or enhance opportunities:

To enhance local employment, skills development and business opportunities associated with the construction phase the following measures should be implemented:

» It is recommended that the local employment policy be adopted where possible to maximise the opportunities made available to the local labour force. The project should make it a requirement for contractors to implement a 'locals first' policy, especially for semi and low skilled job categories., if this is not possible, then the broader focus areas should be considered for sourcing workers.
» Employment opportunities will be for the immediate local area Rustenburg and Kgetlengrivier LM, if this is not possible, then the broader focus areas should be considered for sourcing employees.
» During the recruitment selection process, consideration must be given to women.
» It is recommended that realistic local recruitment targets be set for the construction phase.
- » Training and skills development programmes should be initiated prior to the commencement of the construction phase.…

Residual impact	*Improved pool of skills and experience in the local area*

Table 5-2: Impact Assessment on Multiplier Effects on the Local Economy During the Construction Phase

Impact Phase: Construction							
Potential impact description: Multiplier effects on the local economy The construction period will last for two years at most and will include mostly local and some regional impacts. The project will drive increased cash flow from wages, local procurement, economic growth, taxes, LED, and Human Resource Development (HRD) initiatives. Will depend on the proportion of local spending by employees; the capacity of local enterprises to supply; the effectiveness of LED and HRD initiatives; and contributions to local government.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	L	M	L	Positive	M	L	M
With Mitigation	M	M	L	Positive	M	M	M
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss or resources?			No, the impact will be positive				
Can impact be avoided, managed, or mitigated?			Yes, enhancements will result in increased positive outcomes				

Mitigation measures to reduce residual risk or enhance opportunities:

» It is recommended that the developer adopts a local procurement policy to maximise the benefit to the local economy, where feasible (Rustenburg and Kgetlengrivier LM).
» Boshoek Solar 1 (Pty) Ltd should develop a database of local companies, specifically Historically Disadvantaged (HD) companies, which qualify as potential service providers (e.g., construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work, where applicable.
» It is a requirement to source as many goods and services as possible from the local area.
» Engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods, and products from local suppliers, where feasible.

Residual impact	*Improved local service sector and growth in local business.*

Table 5-3: Impact Assessment on the Influx of Jobseekers and change of Population During the Construction Phase

<table>
<tr><th colspan="8">Impact Phase: Construction</th></tr>
<tr><td colspan="8">Potential impact description: Influx of Jobseekers and change of population.

The influx of people seeking jobs from outside the area, or even province could lead to negative impacts. local residents and businesses could be affected by the increase of people through stress on local services as well as an increase in social ills. The area has few existing issues with crime and social disruptions. Even a small increase in people could have an impact.</td></tr>
<tr><th></th><th>Severity</th><th>Extent</th><th>Duration</th><th>Status</th><th>Probability</th><th>Significance</th><th>Confidence</th></tr>
<tr><td>Without Mitigation</td><td>M</td><td>M</td><td>L</td><td>Negative</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>With Mitigation</td><td>L</td><td>M</td><td>L</td><td>Negative</td><td>M</td><td>L</td><td>M</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">Yes, after the construction phase, people will go elsewhere for work.</td></tr>
<tr><td colspan="3">Will impact cause irreplaceable loss or resources?</td><td colspan="5">No, it is likely to be temporary.</td></tr>
<tr><td colspan="3">Can impact be avoided, managed, or mitigated?</td><td colspan="5">Yes, steps can be taken to lessen the amount of people that come from outside areas.</td></tr>
<tr><td colspan="8">Mitigation measures to reduce residual risk or enhance opportunities:

» Access in and out of the construction area should be strictly controlled by a security company.
» The appointed Engineering, Procurement and Construction (EPC) contractor must appoint a security company and appropriate security procedures are to be implemented.
» Advertisement for employment opportunities should be targeted and preferably focused on local LMs.
» With the preference and focus on hiring locally, it should reduce the amount of people coming to look for work from further afield.
» Access in and out of the construction area should be strictly controlled by a security company.
» A Community Liaison Officer should be appointed, and an appropriate grievance mechanism implemented. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.</td></tr>
<tr><td colspan="2">Residual impact</td><td colspan="6">None anticipated. Impacts will be significantly reduced once construction is completed.</td></tr>
</table>

Table 5-4: Impact Assessment on Safety and Security During the Construction Phase

<table>
<tr><th colspan="8">Impact Phase: Construction</th></tr>
<tr><td colspan="8">Potential impact description: Safety and security

The impact will affect road users and local residents from nearby communities. It could place the safety and security of neighboring community members and road users at risk. Fear of crime is often at high levels during the construction phase of the project.</td></tr>
<tr><th></th><th>Severity</th><th>Extent</th><th>Duration</th><th>Status</th><th>Probability</th><th>Significance</th><th>Confidence</th></tr>
<tr><td>Without Mitigation</td><td>M</td><td>M</td><td>L</td><td>Negative</td><td>M</td><td>L</td><td>M</td></tr>
<tr><td>With Mitigation</td><td>L</td><td>L</td><td>L</td><td>Negative</td><td>L</td><td>L</td><td>M</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">Yes, after the construction phase, people will go elsewhere for work.</td></tr>
<tr><td colspan="3">Will impact cause irreplaceable loss or resources?</td><td colspan="5">No, it is likely to be temporary.</td></tr>
<tr><td colspan="3">Can impact be avoided, managed, or mitigated?</td><td colspan="5">Yes, steps can be taken to manage safety and security concerns in the area</td></tr>
<tr><td colspan="8">Mitigation measures to reduce residual risk or enhance opportunities:</td></tr>
</table>

» Access in and out of the construction area should be strictly controlled by a security company. » The appointed Engineering, Procurement and Construction (EPC) contractor must appoint a security company and appropriate security procedures are to be implemented. » The contractor must ensure that open fires on the site for heating, smoking, or cooking are not allowed except in designated areas. » Contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff. » A comprehensive employee induction programme which covers land access protocols, fire management and road safety should be prepared. » A Community Liaison Officer should be appointed, and an appropriate grievance mechanism implemented. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.	
Residual impact	*None anticipated. Impacts will be removed once construction is completed.*

Table 5-5: Impact Assessment on Local Services/Resources During the Construction Phase

Impact Phase: Construction							
Potential impact description: Increased pressure on local services/resources Construction may affect resource management on the local district municipal level, intensify existing service delivery and resource problems and backlogs, especially water sanitation, and medical services. Population influx will affect the ability of the local municipality to meet increased demand.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	L	Negative	M	L	M
With Mitigation	L	L	L	Negative	L	L	M
Can the impact be reversed?			Yes, after the construction phase, people will go elsewhere for work.				
Will impact cause irreplaceable loss or resources?			No, it is likely to be temporary.				
Can impact be avoided, managed, or mitigated?			Yes, steps can be taken to manage the impact.				
Mitigation measures to reduce residual risk or enhance opportunities: » Preference should be given to local jobseekers to lessen the pressure on local services as there will not be a high number of people adding to the pressure on local services.							
Residual impact	*Possibility of outside workers remaining in the area after construction is completed and subsequent pressure on local infrastructure.*						

Table 5-6: Impact Assessment on Daily Living and Movement Patterns During the Construction Phase

Impact Phase: Construction							
Potential impact description: Disruption of daily living and movement patterns The project will affect road users from nearby communities. The magnitude will be increased due to the limited number of people in the area. Small increases could be significant in a low-population area.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	L	Negative	H	L	M
With Mitigation	L	L	L	Negative	M	L	H
Can the impact be reversed?			Yes, levels of traffic should lessen a great deal after construction				

Will impact cause irreplaceable loss or resources?	No, it is likely to be temporary.
Can impact be avoided, managed, or mitigated?	Yes, steps can be taken to mitigate some of the negative impacts
Mitigation measures to reduce residual risk or enhance opportunities: » All vehicles must be road-worthy and drivers must be qualified, obey traffic rules, follow speed limits, and be made aware of potential road safety issues. » Heavy vehicles should be inspected regularly to ensure their road safety worthiness. » Implement penalties for reckless driving for the drivers of heavy vehicles as a way to enforce compliance with traffic rules. » Avoid heavy vehicle activity during 'peak' hours (when people are driving to and from work). » The developer and engineering, procurement, and construction (EPC) contractors must ensure that any damage/wear and tear caused by construction-related traffic to the roads is repaired. » A comprehensive employee induction programme which covers land access protocols and road safety should be prepared. » A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.	
Residual impact	*None anticipated.*

Table 5-7: Impact Assessment on Nuisance Impacts During the Construction Phase

Impact Phase: Construction							
Potential impact description: Nuisance impacts (noise & dust) Dust generated from site clearance and noise during construction from equipment and other source of noise including vehicle traffic during the construction phase. This will remain within the project extent from construction activities. Dust impacts and noise nuisance from construction activities. The movement of heavy equipment associated with construction has a high potential to create noise and dust in the area.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	L	Negative	H	L	M
With Mitigation	L	L	L	Negative	M	L	H
Can the impact be reversed?			Yes, after the construction phase, people will go elsewhere for work.				
Will impact cause irreplaceable loss or resources?			No, it is likely to be temporary.				
Can impact be avoided, managed, or mitigated?			Yes, steps can be taken to manage and avoid nuisance impacts.				
Mitigation measures to reduce residual risk or enhance opportunities: » All vehicles must be road-worthy and drivers must be qualified, obey traffic rules, follow speed limits, and be made aware of potential road safety issues. » Heavy vehicles should be inspected regularly to ensure their road safety worthiness. » Implement penalties for reckless driving for the drivers of heavy vehicles as a way to enforce compliance with traffic rules. » Avoid heavy vehicle activity during 'peak' hours (when people are driving to and from work). » The developer and engineering, procurement, and construction (EPC) contractors must ensure that any damage/wear and tear caused by construction-related traffic to the roads is repaired. » A comprehensive employee induction programme which covers land access protocols and road safety should be prepared.							

» A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.	
Residual impact	*None anticipated.*

Table 5-8: Impact Assessment on Loss of Agricultural Land During the Construction Phase

Impact Phase: Construction							
Potential impact description: Impacts associated with the loss of agricultural land, (as per the Soil and Agricultural Report) An agricultural impact is a change to the future agricultural production potential of land. In most developments, including the one being assessed here, this is primarily caused by the exclusion of agriculture from the footprint of the development							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	L	Negative	H	L	M
With Mitigation	L	L	L	Negative	M	L	H
Can the impact be reversed?			Yes, the use of the land for solar power will cause minimal loss of agricultural production potential				
Will impact cause irreplaceable loss or resources?			No, the use of the land for solar power will cause minimal loss of agricultural production potential				
Can impact be avoided, managed, or mitigated?			Yes, steps can be taken to mitigate some of the negative impacts associated with construction.				
Mitigation measures to reduce residual risk or enhance opportunities: » A system of stormwater management, which will prevent erosion on and downstream of the site, will be an inherent part of the engineering design on site. » Any excavations done during the construction phase, in areas that will be re-vegetated at the end of the construction phase, must separate the upper 30 cm of topsoil from the rest of the excavation spoils and store it in a separate stockpile. When the excavation is back-filled, the topsoil must be back-filled last, so that it remains at the surface. Topsoil should only be stripped in areas that are excavated. Across the majority of the site, including construction lay-down areas, it will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire cut surface. It will be advantageous to have topsoil and vegetation cover below the panels during the operational phase to control dust and erosion.							
Residual impact	*None anticipated.*						

5.2. Potential Social Impacts during the Operation Phase

It is anticipated that the Boshoek Solar 1 will operate for up to 25 years (which is equivalent to the operational lifespan of the project). The majority of positive outcomes are associated with the operational phase of the project. If managed appropriately, the positive impact can be effectively enhanced, and the negative impacts mitigated.

The potential positive and negative social impacts that could arise as a result of the operation of the proposed project include the following:

» Direct employment and skills development opportunities
» Development of clean, renewable energy infrastructure
» Visual impact and impact on sense of place
» Benefits Associated with Socio-Economic Contributions

» Impacts associated with the loss of agricultural land.

Table 5-9: Impact Assessment on Direct Employment and Skills Development Opportunities During the Operation Phase

Impact Phase: Operation							
Potential impact description: Direct Employment and skills development during operation It is anticipated that ~10 jobs will be generated during the operation phase, and the facility will be operational for ~25 years. Several highly skilled personnel may need to be recruited from outside the local municipal area.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	L	M	H	Positive	M	L	M
With Mitigation	M	M	H	Positive	H	L	H
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss or resources?			No, the impact is likely to be positive				
Can impact be avoided, managed, or mitigated?			Yes, steps can be taken to enhance the positive impacts associate with the operation phase of the project.				
Mitigation measures to reduce residual risk or enhance opportunities: » A local employment policy should be adopted by the developer to maximise the project opportunities being made available to the local community. » Enhance employment opportunities for the immediate local area, Rustenburg, and Kgetlengrivier LM. If this is not possible, then the broader focus areas should be considered for sourcing employees. » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. » The developer should establish vocational training programs for the local employees to promote the development of skills.							
Residual impact	*An improved pool of skills and experience in the local area*						

Table 5-10: Impact Assessment on the Development of Clean, Renewable Energy Infrastructure During the Operation Phase

Impact Phase: Operation							
Potential impact description: Development of clean, renewable energy infrastructure. Bringing renewable energy sector to Rustenburg and Kgetlengrivier LM economy may contribute to the diversification of the local economy and provide greater economic stability. The generation of renewable energy will contribute to South Africa's electricity generation capacity. As the project is only proposed to be 150MW, the contribution will be limited. Facility will help reduce the total carbon emissions associated with non-renewable energy generation							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	H	Positive	H	L	H
With Mitigation	M	M	H	Positive	H	L	H
Can the impact be reversed?			Yes, the project is due to operate for 25 years after which it can be closed and rehabilitated.				
Will impact cause irreplaceable loss or resources?			No, the impact is likely to be positive				

Can impact be avoided, managed, or mitigated?	No, as none is necessary
Mitigation measures to reduce residual risk or enhance opportunities: None required.	
Residual impact	*Reduce carbon emissions through the use of renewable energy and contribute to reducing global warming*

Table 5-11: Impact Assessment on The Visual Impacts and Impacts on Sense of Place During the Operation Phase (As per the Visual Report)

Impact Phase: Operation							
Potential impact description: Visual impacts and impacts on sense of place, (as per visual report) Impact on the sense of place relates to the change in the landscape character and visual impact of the proposed solar energy facility. The impact is dependent on the demographics of the population that resides in the area and their perceptions There are already existing power and transmission lines, roads, substations, and other infrastructure that affect the area.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	H	Negative	H	M	M
With Mitigation	L	L	H	Negative	M	L	H
Can the impact be reversed?	Yes, the project is due to operate for 25 years after which it can be closed and rehabilitated.						
Will impact cause irreplaceable loss or resources?	No, the impact is likely to be positive						
Can impact be avoided, managed, or mitigated?	Yes, steps can be taken to mitigate negative impacts.						
Mitigation measures to reduce residual risk or enhance opportunities: » Suppress dust during operation by maintaining access roads, substations, and office/admin areas with appropriate dust suppressants. » Ensure effective maintenance of the tree screens around the property. » Limit need for security lighting and ensure it is aimed away from sensitive receptor areas » Use non-reflective materials. » Paint all other project infrastructure elements such as operational buildings a dark colour to blend with the general environment.							
Residual impact	*Low significance with successful mitigation*						

Table 5-12: Impact Assessment on The Benefits associated with socio-economic contributions During the Operation Phase

Impact Phase: Operation							
Potential impact description: Benefits associated with socio-economic contributions. The economic opportunities created with the operation facility and grid will benefit the lives of the people involved as well as their dependents. The benefits of the project will likely be felt by local to regional people. The positive outcomes will persist for the duration of the project.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	H	Positive	H	L	H
With Mitigation	M	M	H	Positive	H	L	H

Can the impact be reversed?	Yes, the project is due to operate for 25 years after which it can be closed and rehabilitated.
Will impact cause irreplaceable loss or resources?	No, the impact is likely to be positive
Can impact be avoided, managed, or mitigated?	Yes, steps can be taken to enhance positive impacts
Mitigation measures to reduce residual risk or enhance opportunities: » Emphasis should be placed on prioritising local contractors, subcontractors, and suppliers » Skills development programs and opportunities for on-the-job experience should be created. » Excess power from the site should where possible be used for the benefit of the local energy supply	
Residual impact	» *The increase in opportunities for local and regional people* » *Increased skill pool for similar projects, or where skills are transferable.* » *Security and income for local families and dependents.*

Table 5-13: Impact Assessment on The Loss of Agricultural land During the Operation Phase

Impact Phase: Operation							
Potential impact description: Impacts associated with the loss of agricultural land, (as per the Soil and Agricultural Report) An agricultural impact is a change to the future agricultural production potential of land. In most developments, including the one being assessed here, this is primarily caused by the exclusion of agriculture from the footprint of the development							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	H	Negative	H	L	M
With Mitigation	L	L	H	Negative	M	L	H
Can the impact be reversed?	Yes, the use of the land for solar power will cause minimal loss of agricultural production potential						
Will impact cause irreplaceable loss or resources?	No, the use of the land for solar power will cause minimal loss of agricultural production potential						
Can impact be avoided, managed, or mitigated?	Yes, steps can be taken to mitigate some of the negative impacts associated with the operation of the facility.						
Mitigation measures to reduce residual risk or enhance opportunities: » A system of stormwater management, which will prevent erosion on and downstream of the site, will be an inherent part of the engineering design on site. » Any excavations done during the construction phase, in areas that will be re-vegetated at the end of the construction phase, must separate the upper 30 cm of topsoil from the rest of the excavation spoils and store it in a separate stockpile. When the excavation is back-filled, the topsoil must be back-filled last, so that it remains at the surface. Topsoil should only be stripped in areas that are excavated. Across the majority of the site, including construction lay-down areas, it will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire cut surface. It will be advantageous to have topsoil and vegetation cover below the panels during the operational phase to control dust and erosion.							
Residual impact	*None anticipated.*						

5.3. Assessment of Cumulative Impacts

The Boshoek Solar 1 alone has a limited potential for resulting in significant cumulative impacts in the area as the nearest similar project is ~35 km away. Considered however along with the Boshoek 2, and Boshoek 3 Solar Facility, the Boshoek Cluster will have a more significant positive cumulative impact. The resulting impacts could create a number of socio-economic opportunities for the area, which in turn, will result in a positive social benefit. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. Benefits to the local, regional, and national economy through employment and procurement of services could be substantial should many renewable energy facilities proceed. This benefit will increase significantly should critical mass be reached that allows local companies to develop the necessary skills to support construction and maintenance activities and that allows for components of the renewable energy facilities to be manufactured in South Africa. Furthermore, at municipal level, the cumulative impact could be positive and could incentivize operation and maintenance companies to centralize and expand their activities towards education and training.

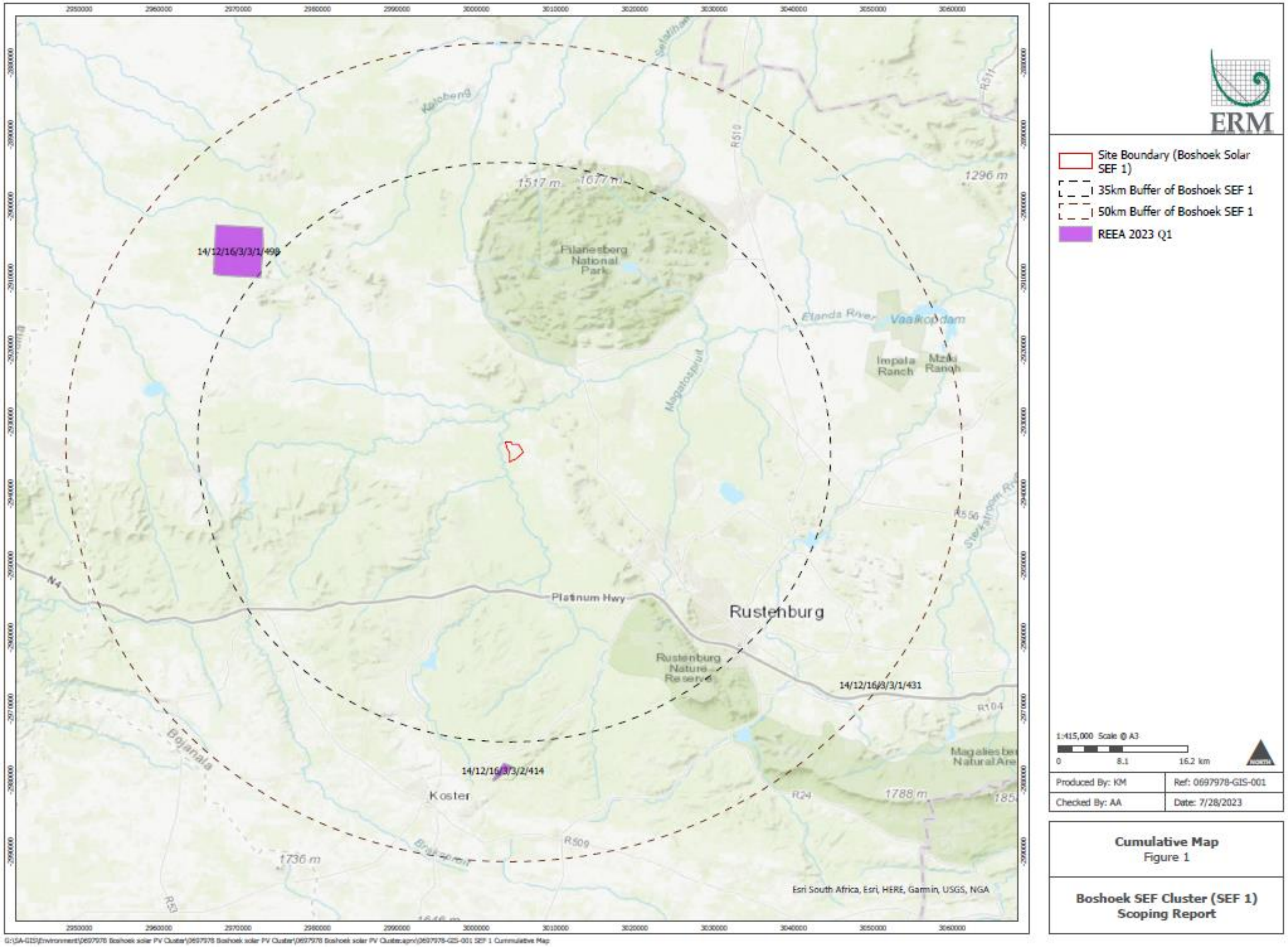

Figure 5-1: Cumulative Impacts map for Boshoek Solar 1 Facility

As illustrated in Error! Reference source not found. (above), as of the writing of this report, there are no other renewable projects within a 30km radius of the proposed project site. The Boshoek 1 Solar PV Facility, as part of the Boshoek Solar Cluster are the only similar projects in close proximity. The REEA 2024 Q1 project (Marked in purple) is a 15 MW Solar PV Facility that applied for EA in 2012 (Ref: 14/12/16/3/3/1/498). This project could be considered too far to be considered to contribute to the cumulative impact of the Boshoek Solar 1 Facility. It is however relevant to consider the Boshoek Cluster as a cumulative impact.

The Boshoek Solar 1 project forms part of a wider growing industry that will alleviate some of the pressures from the energy crisis in South Africa. The project will also add benefits such as skills development and job creation to the area, as well as further contributing to the local economy. Similarly, it would contribute to the negative aspects of development, potentially increasing crime, change in sense of place, visual, dust, and other impacts.

Table 5-14: Positive Cumulative Impacts Associated with the Project

Impact Phase: Operation							
Potential impact description: An increase in employment opportunities, skills development, and business opportunities with the establishment of more than one solar energy facility The establishment of more solar energy facilities in the area has the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development, and business opportunities.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	H	Positive	M	L	M
With Mitigation	M	M	H	Positive	H	M	H
Can the impact be reversed?			Yes, the use of the area can revert to its original state through rehabilitation after the operation of the facility and grid.				
Will impact cause irreplaceable loss or resources?			No, the impacts associated with the project and others like it can be reversed.				
Can impact be avoided, managed, or mitigated?			Yes, steps can be taken to enhance the potential positive impacts of similar projects in the area.				
Mitigation measures to reduce residual risk or enhance opportunities: The positive benefits will be enhanced if local employment policies are adopted, and local services providers are utilised where possible, by the developers to maximise the project opportunities available to the local community.							
Residual impact	*None anticipated.*						

Table 5-15: Negative Cumulative Impacts Associated with the Project

Impact Phase: Operation							
Potential impact description: An increase in security and safety risks resulting from the influx of job seekers and road activity associated with the construction and operations of similar facilities. The establishment of more solar facilities has the potential to exasperate the negative social impacts associated with the construction and operation of the facility.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	M	M	H	Negative	H	M	M
With Mitigation	L	L	H	Negative	M	L	H

Can the impact be reversed?	Yes, the use of the land for solar power will cause minimal loss of agricultural production potential
Will impact cause irreplaceable loss or resources?	No, the use of the land for solar power will cause minimal loss of agricultural production potential
Can impact be avoided, managed, or mitigated?	Yes, steps can be taken to mitigate some of the negative impacts associated with the operation of the facility.
Mitigation measures to reduce residual risk or enhance opportunities: These impacts can be effectively mitigated through the implementation of good policies and measures.	
Residual impact	*None anticipated.*

5.4. No-Development Alternative

The No-Development alternative is the option of not constructing the proposed solar project. The operation and construction of the project is expected to result in a number of positive and negative impacts. The majority of the negative impacts identified for the project are associated with the construction phase of the project, while the positive impact identified is associated with the operational phase, while still evident in the construction phase.

The positive and negative social impacts identified that will be assessed for the construction phase include:

» Direct employment opportunities
» Economic multiplier effects
» Influx of jobseekers and change in population.
» Safety and security impacts
» Nuisance impacts, including noise and dust.
» Visual impacts and impacts on the sense of place.

The potential positive and negative social impacts that could arise as a result of the operation of the proposed project include the following:

» Direct employment and skills development opportunities
» Development of clean, renewable energy infrastructure
» Visual impact and impact on sense of place

The impacts of pursuing the "no-go" alternative can therefore be summarised as follows:

» The benefits would be that there is no disruption from nuisance impacts particularly, visual impacts and safety and security impacts. The impact is therefore neutral.
» There would be an opportunity loss in terms of limiting job creation, skills development, community upliftment and associated economic business opportunities for the local economy as identified, constituting a negative impact.
» There would also be a loss of opportunity to strengthen the grid connection within the municipal area which will have a negative impact on economic growth and development and therefore result in various negative social impacts.

The No-Development option would mean that the electricity generated through renewable sources, in this case solar energy, is not generated and fed into the national electricity grid. In the current socio-economic and policy context, the no-Development option would represent a negative outcome. Further, the employment opportunities associated with the project, as well as the direct and ancillary socio-economic benefits to the region would be forgone.

6. CONCLUSION AND RECOMMENDATIONS

This SIA has focused on the collection of primary and secondary data to identify and assess social issues and potential social impacts. Primary and Secondary data was collected and presented in a literature review environmental assessment framework for the assessment of relevant criteria which were applied to evaluate the significance of the potential impacts.

A summary of the potential positive and negative impacts identified for the detailed design, construction and operation phases are presented in **Table 6-1** and **Table 6-2** for the potential impacts identified.

Table 6-1: Summary of potential social impacts identified for the detailed design and construction phase of Boshoek Solar 1

Impact	Significance without mitigation/enhancement	Significance with mitigation/enhancement
Positive Impacts		
Direct employment and skills development	Low	Medium
Economic multiplier effects	Low	Medium
Negative Impacts		
Influx of Jobseekers and Change of Population	Medium	Low
Safety and security risks	Low	Low
Impacts on Local Services/Resources	Medium	Low
Disruption of daily living and movement patterns	Medium	Low
Nuisance impact (noise and dust)	Medium	Low
The loss of agricultural land	Medium	Medium

Table 6-2: Summary of potential social impacts identified for the operation phase of Boshoek Solar 1

Impact	Significance without mitigation/enhancement	Significance with mitigation/enhancement
Positive Impacts		
Direct employment and skills development	Medium	Medium
Development of clean, renewable energy infrastructure	Medium	Medium
Benefits associated with socio-economic contributions	Medium	High
Negative Impacts		
Visual and sense of place impacts	Medium	Low
The loss of agricultural land	Medium	Medium

6.1. Key findings and Recommendations

6.1.1. Key Findings

From a social perspective, it is concluded that the proposed project and its associated infrastructure is supported, but that mitigation measures should be implemented and adhered to. Positive and negative social impacts have been identified. The assessment of the key issues indicated that there are no negative impacts that can be classified as fatal flaws, and which are of such significance that they cannot be successfully mitigated. Positive impacts could be enhanced by implementing appropriate enhancement measures and through careful planning. Based on the social assessment, the following general conclusions and findings can be made:

» The potential negative social impacts associated with the construction phase are typical of construction related projects and not just focussed on the construction of PV facilities (these relate to influx of non-local workforce and jobseekers, intrusion and disturbance impacts, safety, and security) and could be reduced with the implementation of the mitigation measures proposed.
» Employment opportunities will be created in the construction and operation phase and the impact is rated as positive even if only a small number of individuals benefit in this regard.
» The proposed project could assist the local economy to a small extent in creating entrepreneurial development, especially if local business could be involved in the provision of general materials and services during the construction and operational phases.
» Capacity building and skills training among employees is critical and would be highly beneficial to those involved, especially if they receive portable skills to enable them to also find work elsewhere and in other sectors.
» The proposed development also represents an investment in infrastructure for the generation of clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

6.1.2. No-development Alternative

Should the project not continue, the negative impacts associated with the project's construction and operation phases will not occur and the status quo will continue. The area will likely remain undeveloped, and the visual impacts associated with the solar facility will not occur. Further, the potential safety and security issues associated with projects and developments will not occur, the same for the influx of job seekers to the area.

The region will however likewise not benefit from the construction of the project. The area will miss the opportunities for jobs that the project will create, as well as the indirect economic benefits associated with the construction and operation of the facility. Further, the use of green renewable energy will serve to provide alternative clean energy in the face of the realities of climate change. The project will also serve to stabilise and bolster the struggling power supply in South Africa, which has done untold damage to the economy and society of the region and country.

6.1.3. Recommendations

The following recommendations are made based on the SIA and a thorough review of the concerns and suggestions raised by stakeholders and I&AP during the stakeholder engagement process. The proposed mitigation measures should be implemented to limit the negative impacts and enhance the positive impacts. Based on the social assessment, the following recommendations are made:

- In terms of employment related impacts, it is important to consider that job opportunities for the unskilled and semi-skilled are scarce commodities in the study area and could create competition among the local unemployed. Introducing an outside workforce will therefore most likely worsen local endeavours to obtain jobs and provoke discontent as well as put pressure on the local services available. Local labour should be utilised where possible, to enhance the positive impact of employment creation in the area. Local businesses should be involved with the construction activities where possible. It is imperative that local labour be sourced to ensure that benefits accrue to the local communities. Preference should thus be given to the use of local labour during the construction and operational phases of the project as far as possible.
- Locals should also be allowed an opportunity to be included in a list of possible local suppliers and service providers, enhancing the multiplier effect. This aspect would serve to mitigate other subsequent negative impacts such as those associated with the inflow of outsiders to the area, the increased pressure on the infrastructure and services in the area, as well as the safety and security concerns.
- Impacts associated with the construction period should be carefully mitigated to minimise any possible dust and noise pollution.
- Safety and security concerns should be considered during the planning and construction phases of the proposed project.

6.1.4. Overall Conclusion

The proposed Boshoek Solar 1 is unlikely to result in permanent damaging social impacts. Boshoek Solar 1 has the potential to result in significant positive cumulative impacts, specifically as the Boshoek Cluster will create socio-economic opportunities for the region, which in turn, can result in positive social benefits. The positive cumulative impacts include the creation of employment, skills development and training opportunities, and downstream business opportunities. The cumulative benefits to the local and regional economy through employment and procurement of services are more considerable than that of the Boshoek Solar 1 alone. From a social perspective, it is concluded that the proposed project and associated infrastructure are acceptable and should be developed subject to the implementation of the recommended mitigation measures and management actions contained in this report.

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8. APPENDIX A: KEY STAKEHOLDERS CONTACTED AND MEETING SCHEDULED

A local site visit was undertaken on the 11th and 12th of March to meet with local landowner and other I&AP's as follows:

Mr. A. Lit & J. Lit – Local Residents

In a face-to-face meeting they explained that they were not aware of the project in the area. Further, they expressed concerns over theft and other crimes increasing the area during the construction and operational phases of the projects. They noted that the project is likely to drive in-migration that will exasperate security concerns. A local community driven security network is active and should form part of local security efforts. They also noted concerns over property values in the area. Lastly, they noted that maintenance of the road and healthy environmental conditions are key to their own business and income as local farmers and producers.

Their information was forwarded for inclusion in the project database.

Mr. C. Few & H. Few – Local Residents

In a face-to-face meeting they indicated their general support of the projects as they would personally benefit from the arrangement. They also suggest that the project will be a local economic driver, providing jobs to locals. Lastly, the increase in security that the project will provide would benefit local residents.

Mr. C. Ferreira – Local Resident

In a face-to-face meeting indicated suggested that the project is likely to be mostly beneficial in the area. The project is likely to assist in improvements to the local economy, as well as aid in security concerns. They do emphasize the important of a liaison officer from the developer during the construction phase. They also support the project and the income generated through renting their property to the developer.

Mr. R. Harding – Local Resident

In a face-to-face meeting indicated their concern over the potential influx of people into the area because of the development. Few people call the area their home and the influx of a few dozen people during the construction phase could lead to disturbances. They are however eager for the increase in security in the area and believe that the project would be positive.

Mr. H Wessels– Local Resident

In a face-to-face meeting indicated their support for the project as they will directly benefit from the development. They note that the increase of security in the area is likely to increase general security in the area. They have no real concerns related to the project.

forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE
Social Impact assessment Report: Boshoek 1 Solar Photovoltaic (PV) Energy Facility

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Social Impact Assessment
Specialist Company Name	Savannah Environmental Pty Ltd
Specialist Name	Cornelius A. Holtzhausen
Specialist Identity Number	9001245024087
Specialist Qualifications:	M.Soc.Sci Cultural Anthropology
Professional affiliation/registration:	IAP2SA (IAP2SA145)
Physical address:	Woodlands Drive & Western Service Road, Woodmead 2191
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Postal address	Click or tap here to enter text.
Telephone	011 656 3237
Cell phone	060 978 8396
E-mail	Cornelius@savannahsa.com

2. DECLARATION BY THE SPECIALIST

I, Cornelius A. Holtzhausen declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

____
Signature of the Specialist

Savannah Environmental (Pty) Ltd
____
Name of Company:

16 Aug 2024
____
Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Cornelius A, Holtzhausen_________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Savannah Environmental (Pty) Ltd

Name of Company

16 Aug 2024

Date

Click or tap here to enter text.

Signature of the Commissioner of Oaths

Click or tap to enter a date. 2024-08-16

Date

SOUTH AFRICAN POLICE SERVICE
CLIENT SERVICE CENTRE
SANDTON
2024 -08- 16
KLIENTE DIENSSENTRUM
SANDTON
SUID-AFRIKAANSE POLISIEDIENS

DOCUMENT CONTROL SHEET			
Document Title	**Traffic Assessment for the Proposed Construction of the Boshoek Solar PV 1 facility and associated infrastructure, near the town of Boshoek in the Northwest Province.**		
Electronic Reference	https://techsosmartsolutions-my.sharepoint.com/personal/steve_techso_co_za/Documents/TECHSO/Projects/Projects 2023/Rustenburg Solar/Boshoek Solar PV 1/TA - Boshoek Solar PV 1 (20240614).docx TJ2311		
Date	14 June 2024		
Short Description	This Traffic Assessment Report provides input to the Basic Assessment for the construction, operations and decommissioning of the proposed Boshoek Solar PV 1 facility.		
Contact Person	Stephen Fautley steve@techso.co.za		
		Prepared for: ***ERM Southern Africa (Pty) Ltd***	
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	Name	**Signature**	**Date**
Compiled by:	Stephen Fautley (Pr. Tech Eng. - ECSA Reg # 200270171)		14 June 2024
Reviewed by			

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1. PROJECT DESCRIPTION

The proposed Boshoek Solar PV 1 development site is located approximately 30 kilometers north-east of the town of Rustenburg in the Matzikama Local Municipality, in the Nort West Province.

Boshoek Solar 1 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, within the Rustenburg Local Municipality and the Bojanala District Municipality, in the Northwest Province.

The facility will comprise several arrays of Solar PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW.

The development area for the Solar PV facility and associated infrastructure will be located on the following properties:

Boshoek Solar PV 1 facility

Farm Name	Farm No.	Portion No.
Rhenosterdoorns	531	0
Zwaarverdiend	234	1

The project is planned as part of a larger cluster, which includes two additional Solar PV facilities (Boshoek Solar PV 2 and Boshoek Solar PV 3) up to 150 MW and 50 MW respectively.

An assessment area of approximately 290 ha is being assessed as part of this EIA process and the infrastructure associated with the 150 MW Boshoek 1 Solar PV facility includes:

- PV modules (mono- or bifacial) and mounting structures.
- Inverters and transformers.
- Battery Energy Storage System (BESS).
- Site access road.
- Internal access roads.
- Auxiliary construction (switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.).
- Temporary and permanent laydown area.
- Grid connection infrastructure, including:
  - Underground medium-voltage cabling between the project components and the facility substation;
  - Up to 132kV facility substation;
  - Switching station;

A network of gravel internal access roads and a perimeter road (cumulatively up to 33 km in length), each with a width of up to ± 6 m, will be constructed to provide access to the various components of the PV development.

An area of up to 1 ha will be occupied by construction which will include (but not limited to) a 33 kV switch room, a gate house, ablutions, workshops, storage and warehousing areas, site offices and a control centre.

The Battery Energy Storage System (BESS) will take up approximately 5 Ha.

On-site cabling will largely follow the road infrastructure where possible, and will be either overhead, or underground.

2. BASELINE CONDITIONS

The R565 route to site, passing though Boshoek, was observed during a typical PM peak period (around 17:00 on a weekday on 11 September 2023, and in the off-peak period (around 11:00 on a weekday, on 13 September 2023). These are typical normal days to assess traffic conditions in urban context as per COTO TMH 16 guidelines below:

> " 2.2.2 The assessment hours must be selected from normal or abnormal days of the year or both, as follows:
> a) In urban areas, the assessment hours must be selected from normal days, except when land uses are specifically focussed on abnormal days, such as holiday resorts."

The section of the R565 at the Boshoek OK local shopping hub is expected to be at its busiest in the PM peak period and this location was visited at this period and assessed as it also coincides with the Solar PV peak development trips.

The proposed 150 MW Solar PV Facility site is accessed via a gravel public access road (called "site access road" in this report) as indicated in red in **Figure 2-1** below.

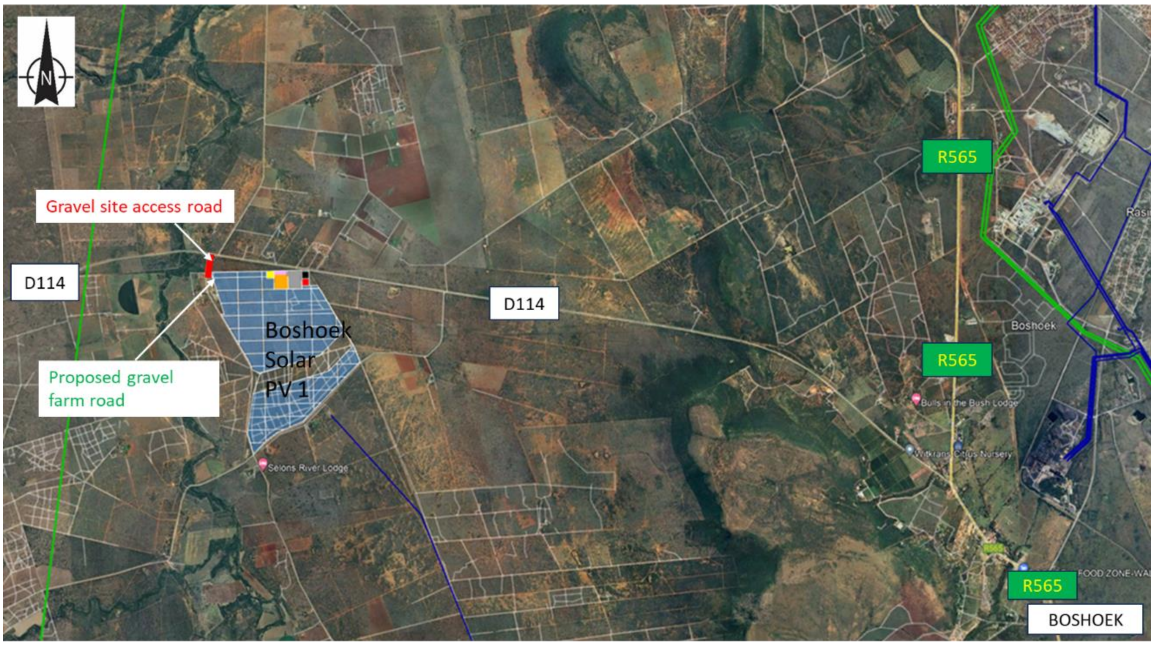

Figure 2-1: Site Location

Access from the D114 is attained via a gravel site access road. The road is 6 m wide and is of sufficient width to accommodate two-way traffic.

The gravel site access road has a low trip generation, evidenced by the unsurfaced nature of the road and as observed during a site visit on the morning of 12 September 2023, which is regarded as a normal traffic day relevant for assessment of traffic conditions.

Electrical Grid Connection and Associated Infrastructure:
A single circuit 132 kV power line is proposed from the switching station to the future planned Eskom collector switching station some 3.5 km north of the site.

The connection infrastructure associated with this grid solution (i.e. between the collector switching station and the MTS) falls outside of the scope of this report and will be assessed as part of a separate Environmental Application.

3. PURPOSE OF REPORT

This report assesses the expected traffic and transport impact for the project lifecycle.

4. TRAFFIC SPECIALIST CREDENTIALS

This Site Assessment is undertaken by Mr. Stephen Mark Fautley, who is a Professional Engineering Technologist registered with the Engineering Council of South Africa (ECSA) and is a member of SAICE (see Curriculum Vitae Annexure A).

His career encompasses the civil, traffic and transportation engineering discipline for ten (10) years at the Western Cape Government, 1,5 years with Kantey and Templer Consulting Engineers and 10 years at local authority (City of Cape Town) before joining Techso in 2008, as a Senior Transport Engineer.

Stephen has extensive experience in Traffic Impact Assessments and Site Assessments, including Impact Assessments for various renewable energy plants in South Africa, and is a registered Road Safety Auditor.

5. IMPACT ASSESSMENT METHODOLOGY

This report assesses the expected traffic and transport impact during the Construction Phase, Operation Phase and Decommissioning Phase of the proposed Solar PV Facility.

The requirements in the TMH 16 Vol 1 & 2 South African Traffic Impact and Site Traffic Assessment Manual, August 2012, compiled by the Committee of Transport Officials (COTO) were used for this study.

The requirements as per EIA Regulations of 4 December 2014, as amended by GNR 326 on 7 April 2017, Appendix 6, are adhered to (see Annexure C).

Trip generation rates were based on the Scope of Work and an anticipated construction programme.

A site visit was conducted on 11, 12 and 13 September 2023 to assess the routes providing access to the site and to gain insight to possible issues and constraints along the local road network / various routes surrounding the site.

The National Road network and high order arterials (R565) that from part of the abnormal road network are assumed to be used for long distance equipment deliveries to site with abnormal loads being transported under permit to be obtained by the abnormal load transport carrier.

Traffic impacts resulting from other similar developments within 35 km of the site were estimated, based on previous experience of similar developments, and understanding of their cumulative impact on traffic and road network associated with the subject Solar PV Facility.

The Impact Assessment Methodology assists in evaluating the overall effect of a proposed activity on the environment. The environmental impact is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts is undertaken through an assessment of the significance of the impacts.

SIGNIFICANCE OF ENVIRONMENTAL ASPECTS

The significance of environmental aspects can be determined and ranked by considering the criteria presented in Table 1. In some cases, it may be necessary to undertake the impact assessment to determine whether a particular aspect is significant. Therefore, a fair degree of iteration is unavoidable during the assessment process.

Table 1 – Criteria used to determine the significance of environmental aspects

Significance Ranking	Negative Aspects	Positive Aspects
H (High)	Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.	Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.
M (Moderate)	Has characteristics that could cause negative impacts.	Has characteristics that could cause positive impacts.
L (Low)	Will never exceed legislation or standards. Unlikely to cause significant negative impacts.	Will always comply with all legislation and standards. Unlikely to cause significant positive impacts.

The aspect identification and ranking process is largely a screening exercise whereby the aspects that do not have the potential to cause significant impacts are eliminated. Aspects ranked "high" and "moderate" are significant and the possible impacts associated with their presence will need to be determined. Aspects ranked "low" do not warrant further attention.

The significance of the aspects should be ranked on the assumption that the management recommended in the EIA will be in place i.e. *with management*. This represents the scenario that the proponent wishes to have considered for approval. The environmental aspects associated with the proposed project activities during the construction, operational, closure phases (where appropriate) need to be identified. The influence of various project alternatives on the significance of the aspects must also be considered.

It may be desirable to also undertake a *without management* aspect ranking, since this highlights the sensitivity of the key risk areas to management and, hence, the management priorities. However, the dilemma in such an exercise is deciding on how much management to include. In the case of a mining project, for example, does one assume that the tailings dam will be completely absent or merely operated poorly?

A useful rule of thumb is to assume that all the management required for operational reasons will be in place, but that any management specifically for environmental control will be absent. The danger in presenting *without management* ranking scenario in an EIA report is that it does not represent the scenario that the proponent wishes to have approved.

SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Where significant environmental aspects are present ("high" or "moderate"), significant environmental impacts ***may*** result. The significance of the impacts associated with the significant aspects can be determined by considering the risk:

Significance of Environmental Impact (Risk) = Probability x Consequence

The consequence of impacts can be described by considering the severity, spatial extent and duration of the impact.

Severity of Impacts

Table 2 presents the ranking criteria that can used to determine the severity of impacts on the bio- physical and socio-economic environment. Table 3 provides additional ranking criteria for determining the severity of negative impacts on the bio-physical environment.

Table 2 – Criteria for ranking the *Severity* of environmental impacts.

Type of Criteria	Negative			Positive		
	H-	**M-**	**L-**	**L+**	**M+**	**H+**
Qualitative	Substantial deterioration. Death, illness or injury.	Moderate deterioration. Discomfort.	Minor deterioration. Nuisance or minor irritation.	Minor improvement.	Moderate improvement.	Substantial improvement.
Quantitative	Measurable deterioration.		Change not measurable i.e., will remain within current range.		Measurable improvement.	
	Recommended level will often be violated.	Recommended level will occasionally be violated.	Recommended level will never be violated.		Will be within or better than recommended level.	
Community Response	Vigorous community action.	Widespread complaints.	Sporadic complaints.		No observed reaction.	Favourable publicity

Table 3 – Criteria for ranking the *Severity* of negative impacts on the bio-physical environment.

Environment	Ranking Criteria		
	Low (L-)	**Medium (M-)**	**High (H-)**
Soils and land capability	Minor deterioration in land capability. Soil alteration resulting in a low negative impact on one of the other environments (e.g. ecology).	Partial loss of land capability. Soil alteration resulting in a moderate negative impact on one of the other environments (e.g. ecology).	Complete loss of land capability. Soil alteration resulting in a high negative impact on one of the other environments (e.g. ecology).
Ecology (Plant and animal life)	Disturbance of areas that are degraded, have little conservation value or are unimportant to humans as a resource. Minor change in species variety or prevalence.	Disturbance of areas that have some conservation value or are of some potential use to humans. Complete change in species variety or prevalence.	Disturbance of areas that are pristine, have conservation value or are an important resource to humans. Destruction of rare or endangered species.
Surface and Groundwater	Quality deterioration resulting in a low negative impact on one of the other environments (ecology, community health etc.)	Quality deterioration resulting in a moderate negative impact on one of the other environments (ecology, community health etc.).	Quality deterioration resulting in a high negative impact on one of the other environments (ecology, community health etc.).

Spatial Extent and Duration of Impacts

The duration and spatial scale of impacts can be ranked using the following criteria:

Table 4 – Ranking the *Duration* and *Spatial Scale* of impacts.

	Ranking Criteria		
	L	**M**	**H**
Duration	Quickly reversible Less than the project life Short-term	Reversible over time Life of the project Medium-term	Permanent Beyond closure Long-term
Spatial Scale	Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread. Far beyond site boundary Regional/national

Where the severity of an impact varies with distance, the severity should be determined at the point of compliance or the point at which sensitive receptors will be encountered. This position corresponds to the spatial extent of the impact.

Consequence of Impacts

Having ranked the severity, duration and spatial extent, the overall consequence of impacts can be determined using the following qualitative guidelines:

Table 5 – Ranking the *Consequence* of an impact.

			SEVERITY = L		
DURATION	Long-term	**H**			
	Medium-term	**M**			**MEDIUM**
	Short-term	**L**	**LOW**		
			SEVERITY = M		
DURATION	Long-term	**H**			**HIGH**
	Medium-term	**M**		**MEDIUM**	
	Short-term	**L**	**LOW**		
			SEVERITY = H		
DURATION	Long-term	**H**			
	Medium-term	**M**			**HIGH**
	Short-term	**L**	**MEDIUM**		
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national
			SPATIAL SCALE		

To use Table 5, firstly go to one of the three "layers" based on the severity ranking obtained from Table 2 and/ or Table 3. Thereafter determine the consequence ranking by locating the intersection of the appropriate duration and spatial scale rankings.

Overall Significance of Impacts

Combining the consequence of the impact and the probability of occurrence, as shown by Table 6, provides the overall significance (risk) of impacts.

Table 6 – Ranking the *Overall Significance* of impacts.

PROBABILITY	Definite Continuous	**H**	**MEDIUM**		**HIGH**
	Possible Frequent	**M**		**MEDIUM**	
	Unlikely Seldom	**L**	**LOW**		**MEDIUM**
			L	**M**	**H**
			CONSEQUENCE (from Table 5)		

The overall significance ranking of the negative environmental impacts provides the following guidelines for decision making:

Table 7 – Guidelines for decision-making

Overall Significance Ranking	Nature of Impact	Decision Guideline
High	Unacceptable impacts.	Likely to be a fatal flaw.
Moderate	Noticeable impact.	These are unavoidable consequence, which will need to be accepted if the project is allowed to proceed.
Low	Minor impacts.	These impacts are not likely to affect the project decision.

6. TRAFFIC ASSESSMENT

6.1 Routes to site

750 km

Considering the site location, Durban Harbour is the preferred port for particularly large equipment and machinery for the proposed Solar PV Facility. The most prominent equipment are the Solar PV panels and support/mounting infrastructure. The latter would likely be sourced from Johannesburg.

The N3, N1 Summit Road, R511, N4, R565 and D114 (Lindley Road) and a short section of gravel site access road will be used to transport equipment from the Port of Durban (Durban Harbour) to site. The last leg of the journey leading from the D114 is a 1km short section of gravel site access road. The gravel site access road intersects with D114 at 25°27'40.34"S"S/ 26°58'54.86"E.

Figure 6-1: Route for Durban Harbour to site

It is noted that the gravel site access road intersection with D114 has a concrete edge beam and is not hard surfaced. The edge beam has some edge drop-off that poses a traffic hazard.

6.2 Construction Period and Trip Generation

The Solar PV facility construction period is expected to last 16 months (stages 1 to 5). The construction period will generate the most traffic, both on public roads and on-site.

Anticipated Project Execution Plan (Construction, Operations and Decommissioning Stages)								
STAGE	**ACTIVITY DESCRIPTION**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**	**Stage 6**	**Stage 7**
	# Months	**1**	**2**	**6**	**5**	**2**	**300**	**2**
1	Site Establishment and Civils	x						
2	Delivery of PV Modules and Structures		x					
3	Construction of Trackers and Mounting Modules		x	x				
4	Electrical Works			x	x	x		
5	Commissioning					x		
6	Operations						x	
7	De-commissioning							x

The trip generation and average daily trips to site are insignificant, as detailed below:

Construction:

» The construction period has the highest trip generation as below: (see Tables below).

- Solar PV equipment and mounting modules arrive at site on an average of 12 off-peak trips to site and 12 from site per day over Stage 2 (2 months).
- An average of 108 light vehicles and 6 buses to site per day during Stages 4 and 5 (total of 7 months), with same number departing in the PM peak hour.
- Some heavy earthmoving vehicles will be transport by abnormal load vehicles.

Table 6-1 - Summary of vehicle trips per development stages

Anticipated Project Execution Plan (Construction, Operations and Decommissioning Stages)								
SUMMARY OF SITE STAFF AND VEHICLE LOADS								
ITEM	**DESCRIPTION**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**	**Stage 6**	**Stage 7**
	# Months	1	2	6	5	2	300	2
	From	1	2	4	10	15	17	317
	To	1	3	9	14	16	316	318
1	Site Staff / Employees on site (Day shift only)	269	556	541	464	464	15	267
	MONTHLY ARRIVE AT START OF STAGE AND LEAVE AT END OF PHASE							
4a - 4i	Miscellaneous vehicles arrive (and stay on site for extended periods) and leave site at end of period.	27	5	32	0	0	0	10
	PER MONTH (ARRIVE OUTSIDE PEAK HOURS)							
5	Tipper Truck Packaging Waste Removal (Monthly)	0	229	0	0	0	0	0
6	Steel Structure to site (Interlinks from Johannesburg) (Monthly)	0	76	0	0	0	0	0
7	PV Panels to site (ISO Container Trucks) (Monthly)	0	154	0	0	0	0	0
8	BESS Containers to site (Monthly)	0	0	34	0	0	0	0
4i	Anxillary Buildings, etc. Heavy vehicles - trucks and lowbed		9					0
4j	10 and 20 m3 trucks (50/50 split)							120
4k - 5	Calculated - Average # vehicles per day (outside Peak Hours)	0	18	1	0	0	0	5
	DAILY (IN PEAK HOUR)							
2a	Light Vehicles to site **daily** (arrive in AM Peak Hour, remain on site, depart in PM Peak Hour)	23	70	52	108	108	5	14
3a	Buses / *Taxis* (arrive in AM Peak Hour, remain on site, depart in PM Peak Hour)	4	8	8	6	6	*1*	4

Monthly and Daily Solar Panels, Solar Packaging Waste removal and Solar Mounting trips to site are shown in the Tabe below:

Table 6-2 - Summary of PV related daily trips

Monthly	Daily	%	Description
229	9	50%	Tipper Solar PV Packaging waste removal
76	3	17%	PV structures and mountings
154	6	34%	PV Panels
460	**18**	**100%**	**Total**

The worker/staff component on site would peak around 560 persons in Stages 2 and 3 (as detailed below).

Table 6-3 - Summary of peak staff stages

Staff Category	Per shift (Stage 2)			Months	2
	Staff	Vehicle	Staff per veh type	Vehicle Occupancy	# Vehicles
Construction Labourers	445	Bus	473	60	8
Foremen	28				
Specialists	28	Private	83	1,2	70
Engineers	28				
Project Managers	28				
TOTAL	556				

Staff Category	Per shift (Stage 3)			Months	6
	Staff	Vehicle	Staff per veh type	Vehicle Occupancy	# Vehicles
Construction Labourers	448	Bus	479	60	8
Foremen	31				
Specialists	31	Private	62	1,2	52
Engineers	15				
Project Managers	15				
TOTAL	541				

Most of the worker/staff component would be transported by bus to site from nearby towns such as Boshoek and Rustenburg.

Note, the information provided is an informed estimate. Construction related traffic may however vary and be different from the information provided above due to suppliers' delivery schedule updates/changes, etc.

6.3 Potential Impacts

6.3.1 Construction Period

» **Traffic congestion.** Increased light and heavy vehicles traffic flow on R565 route to site, resulting in more traffic congestion at Boshoek OK Grocer shopping hub. Traffic congestion was noted during the site visit on 12 September 2023 with turning movements into the shopping hub and taxis parked / stopped in the road.

Note trucks parked alongside the R565 at Boshoek OK Grocer shopping hub

Taxis were noted stopped alongside R565 alongside the guardrail (should be stopped in the roofed taxi loading area). The main delay was due to a right-turn vehicle (i.e. movement as shown in image below) and taxi stopped alongside thus preventing vehicles bypassing the right-turn vehicle.

Note faded road markings and also block pedestrian crossing in the intersection.

This can be mitigated by improving traffic road markings on D114 in Boshoek and focussed traffic law enforcement particularly during the PM peak hours.

Alternate strategy to mitigate development traffic impacts in Boshoek would be to encourage light vehicles to/from site to travel outside the traffic peak hours, or by accommodating at least 50% of specialists and artisans in buses (1 bus equates to 50 vehicles) to/from site.

» **Road safety at D114/R565 intersection.** Poor road markings at the D114/R565 intersection in Boshoek (see pictures below) could result in vehicle crashes due to motorists misreading the intersection.

D114 approach to R565 lacks signage and is confusing giving the impression that one could possibly turn right.

View along D114 on its approach to R565

D114 intersection with R565

View along R565 towards Boshoek from D114/R565 intersection

This can be mitigated by improving traffic road markings on D114/R565 intersection in Boshoek, particularly to clearly indicate that vehicles need to keep-left of the splitter island.

» **Road safety at D114/site access road:** There is potential for vehicle crashes at D114/gravel site access road (site access road) intersection with motorists not expecting construction vehicles at the intersection, over an extended period.

This can be mitigated by ensuring construction vehicles are roadworthy, construction vehicle drivers are licensed, and by installation temporary roadworks “crossing vehicles” warning signage on the D114 approaches to the gravel site access road intersection. Road markings and stop signage are required on the access road approach to D114 and the site access road should be hard surfaced for 30 m from its intersection with D114 to limit material carry onto the D114. This will also effectively deal with the edge beam drop-off.

View of gravel site access road at its intersection with D114.

View of gravel site access road approach to D114 (Priority control road signage in place)

View to left of gravel site access road intersection with D114

View to right of gravel site access road intersection with D114. Note concrete edge beam.

Concrete edge beam drop-off close to road edge poses a traffic danger to motorists

Road edge breakaway on D114 opposite site access road in need of repair (damage due to large vehicles turning right from gravel site access road and / or through traffic passing vehicles turning right into gravel site access road).

» **Road safety at site access.** The site access is located close to a horizontal curve but has clear sight lines in both directions. The proposed site access needs to be designed to accommodate two-way traffic flow to avoid vehicles queuing outside the access gate.

Proposed site access position

View right of proposed access (towards D114)

View to left of proposed site access.

This can be mitigated by installing signage warning of trucks crossing on both approaches to the access. The access needs to be designed to accommodate two-way traffic flow.

» **Degradation of gravel site access road pavement** that has potential for vehicle damage or injury crashes.

The site access is via a gravel site access road section between D114 and the site access. Extensive use of the gravel site access road by heavy vehicles will lead to deterioration of the road structure that could result in vehicle crashes (see picture above).

This can be mitigated by regular maintenance of the gravel site access road section used by development traffic.

» **Dust on gravel site access road**: This has potential to cause accidents due to reduced forward visibility for motorists.

This can be mitigated by 50 km/h speed restriction signage for construction vehicles on the gravel site access road section. Consideration could also be given to the application of an appropriate dust suppressant where needed.

» **Vehicle / pedestrian safety on site:** Buses and light vehicles will arrive on site and park for extended periods in addition to large delivery vehicles driving on site. Site staff (skilled and semi-skilled) will need to walk to the site work area or be transported on site. This increases the risk of vehicle/pedestrian conflict and crashes on site.

This can be mitigated by a well-designed parking area (s) with clearly defined well-lit pedestrian walkways separated from general delivery and operational traffic and well considered on-site protocols (appropriate vehicles, boarding and alighting areas and routes on site).

6.3.2 Operations Period

The Solar PV site will be operational all hours except during maintenance, breakdowns or interruption of the connection to the Eskom grid.

Regular maintenance will be minimal with very few vehicles.

A small staff component (15 persons) is anticipated during the operation phase of the project, with technicians/maintenance and security personnel on site as required. This would generate very low vehicle trips (6 light vehicles to site), as shown in the Table below:

Staff Category	Per shift (Stage 6)			Months	300
	Staff	Vehicle	Staff per veh type	Vehicle Occupancy	# Vehicles
Construction Labourers	7	Taxi	8	12	1
Foremen	1				
Specialists	4	Private	6	1,2	5
Engineers	2				
Project Managers	1				
TOTAL	**15**				

» **Road safety at site access.** The proposed site access is located on the inside of a bend with sufficient motorist visibility, however approaching motorists might not anticipate intensified use of the access, that could lead to vehicle crashes.

This can be mitigated by installing temporary signage warning of trucks crossing on the approaches to the site access. The access needs to be widened to accommodate two-way traffic flow.

6.3.3 Decommissioning Period

The Solar PV Facility is expected to be operational for 25 years with the possibility of extending operations for a further 25 years.

Trip generation at the decommissioning stage is likely to be outside commuter peak hours.

Decommissioning will entail less traffic than the construction phase, and recyclable components would be transported to appropriate recycling facilities. Other materials would be transported to the local dump if not recyclable or sold to local scrap merchants or other buyers if the items have salvage value.

Decommissioning should be in accordance with the agreement reached with the affected landowners.

Daily trips for the decommissioning period are expected to be low and will typically comprise dump trucks or low-bed vehicles, with equipment and components cut to size on site.

» **Road Safety at D114/site access road:** There is potential for vehicle crashes at D114/gravel site access road (site access road) intersection with motorists not expecting construction vehicles at the intersection, over an extended period.

  This can be mitigated by ensuring construction vehicles are roadworthy, construction vehicle drivers are licensed, and by installation temporary roadworks "crossing vehicles" warning signage on the D114 approaches to the gravel site access road intersection. In addition to this the hard surfaced intersection bell mouth requires maintenance and road markings and stop signage are required on the gravel site access road approach to D114.

» **Road safety at site access:** There is potential for vehicle crashes at D114/gravel access road (Site access road) intersection with motorists not expecting heavy vehicles at the intersection, over an extended period.

  This can be mitigated by installing temporary signage warning of trucks crossing on both approaches to the access. The access needs to be widened to accommodate two-way traffic flow.

» **Road maintenance:** Degradation of gravel site access road pavement that has potential for vehicle damage or injury crashes.

  The site access is via a gravel site access road section between D114 and the site access. Extensive use of the gravel site access road by heavy vehicles will lead to deterioration of the road structure that could result in vehicle crashes.

  This can be mitigated by regular maintenance of the gravel site access road section used by development traffic.

» **Dust on site access road:** This has potential to cause accidents due to reduced visibility for motorists.

This can be mitigated by reduced travel speed for heavy vehicles on the gravel site access road.

6.4 Impact Assessment

The following impacts are identified for the Solar PV Facility project lifecycle.

» **Construction:**
- Traffic congestion in Boshoek
- Road safety at D114/R565 intersection
- Road safety at D114/site access road intersection
- Road safety at site access
- Degradation of gravel site access road
- Dust on gravel site access road
- Pedestrian safety on-site

» **Operations**
- Road safety at site access

» **Decommissioning:**
- Road safety at site access
- Degradation of gravel site access road
- Dust on gravel site access road
- Pedestrian safety on-site

» **Cumulative:**
- Traffic congestion in Boshoek

The Impact Assessment ratings for the proposed Solar PV Facility are shown in the Tables below.

6.4.1 Construction

<table>
<tr><td colspan="8">Impact Phase: Construction</td></tr>
<tr><td colspan="8">Potential impact description: Traffic congestion
Increased development related light and heavy vehicles traffic flow on the R565 route to site, resulting in more traffic congestion in the PM at the Boshoek OK Grocer shopping hub.</td></tr>
<tr><td></td><td>Severity</td><td>Extent</td><td>Duration</td><td>Status</td><td>Probability</td><td>Significance</td><td>Confidence</td></tr>
<tr><td>Without Mitigation</td><td>Medium</td><td>Medium</td><td>Low</td><td>Negative</td><td>High</td><td>Medium</td><td>Medium</td></tr>
<tr><td>With Mitigation</td><td>Low</td><td>Medium</td><td>Low</td><td>Negative</td><td>Medium</td><td>Medium</td><td>Medium</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">Yes. This is temporary during Construction</td></tr>
<tr><td colspan="3">Will the impact cause irreplaceable loss of resources?</td><td colspan="5">No</td></tr>
<tr><td colspan="3">Can the impact be avoided, managed or mitigated?</td><td colspan="5">Yes, this can mitigated or managed</td></tr>
<tr><td colspan="8">Mitigation measures to reduce risk or enhance opportunities:
• This can be mitigated by the following:
* Improving traffic road markings on R565 in Boshoek.
* Focussed traffic law enforcement on R565 at Boshoek shopping hub particularly during PM peak hours.
* Plan for light vehicles to/from site to travel outside the traffic peak hours, and or accommodate at least 50% of specialists and artisans in buses (1 bus equates to 50 vehicles) to/from site.
* Undertake a TIA
* Produce a TMP</td></tr>
</table>

Rationale for scoring as shown in the table above.

Severity: Medium**:** Moderate deterioration with higher level of traffic congestion (disruption and nuisance) on R565 in Boshoek in PM
Low: Minor deterioration with lower increase in traffic congestion (disruption and nuisance) on R565 in Boshoek in PM with mitigation measures

Spatial Extent: Medium: Beyond site boundary

Duration: Low: Quickly reversible, construction phase, short-term,

Probability: High: Definite possibility
Medium: Low probability

Confidence: Medium: Definite increase in traffic and traffic impacts in Boshoek

Impact Phase: Construction							
Potential impact description: Road safety at DR114/R565 intersection Poor road markings at the D114/R565 intersection in Boshoek (see pictures below) could result in vehicle crashes due to motorists misreading the intersection.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Medium	Low	Negative	High	Medium	High
With Mitigation	High	Medium	Low	Positive	Low	Low	High
Can the impact be reversed?			Yes. Improved road markings will extend beyond the project construction and benefit all road users				
Will the impact cause irreplaceable loss of resources?			Yes, loss of life or disability due to crashes				
Can the impact be avoided, managed or mitigated?			Yes, this can mitigated or managed				
Mitigation measures to reduce risk or enhance opportunities: • This can be mitigated by the following: * improving road markings on D114/R565 intersection in Boshoek, particularly to clearly indicate that vehicles need to keep-left of the splitter island.							

Rationale for scoring as shown in the table above.

Severity: High: Likelihood of vehicle crashes with possible loss of life or disability and or injury

Spatial Extent: Medium: Beyond site boundary

Duration: Low: Quickly reversible, construction phase, short-term

Probability: High: Definite
Low: Low probability

Status: Negative: Current unsafe situation
Positive: Improvement to road markings creating safer road environment

Confidence: High: Definite increase in traffic and traffic impacts at intersection

Impact Phase: Construction							
Potential impact description: Road safety at DR114/Site access road intersection There is potential for vehicle crashes at D114/gravel site access road intersection with motorists not expecting construction vehicles at the intersection, over an extended period.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Medium	Low	Negative	Medium	Medium	Medium
With Mitigation	High	Medium	Low	Negative	Low	Low	Medium
Can the impact be reversed?			Yes. This is temporary during Construction				
Will the impact cause irreplaceable loss of resources?			Yes, loss of life or disability due to crashes				
Can the impact be avoided, managed or mitigated?			Yes, this can mitigated or managed				
Mitigation measures to reduce risk or enhance opportunities: • This can be mitigated by the following: * Ensure construction vehicles are roadworthy, construction vehicle drivers are licensed. * installation temporary roadworks “crossing vehicles” warning signage on the D114 approaches to the gravel site access road intersection. * Hard surfaced 30 m of site access road to reduce materials carry into D114. * Provide road markings and stop signage are on the gravel site access road approach to D114. * Repair D114 road edge opposite the site access road.							

Rationale for scoring as shown in the table above.

Severity: High: Likelihood of vehicle crashes with possible loss of life or disability and or injury

Spatial Extent: Medium: Beyond site boundary

Duration: Low: Quickly reversible, construction phase, short-term,

Probability: Medium: Probable that there will be crashes
Low: Low likelihood of crashes

Confidence: Medium: Definite increase in traffic and possible traffic impacts at intersection

Impact Phase: Construction							
Potential impact description: Road safety at site access The site access is located on the outside of a bend however motorists sight lines are compromised by vegetation, which could result in vehicle crashes.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	Medium
With Mitigation	Low	Medium	Low	Negative	Low	Low	Medium
Can the impact be reversed?		Yes. This is temporary during Construction					
Will the impact cause irreplaceable loss of resources?		Yes, loss of life or disability due to crashes					
Can the impact be avoided, managed or mitigated?		Yes, this can mitigated or managed					
Mitigation measures to reduce risk or enhance opportunities: • This can be mitigated by the following: * Install signage warning of trucks crossing on both approaches to the site access. * Design site access to accommodate two-way traffic flow.							

Rationale for scoring as shown in the table above.

Severity: Medium: Likelihood of vehicle crashes with possible disability and or injury
Low: Possibility of lower speed vehicle crashes with possible injury

Spatial Extent: Medium: Beyond site boundary

Duration: Low: Quickly reversible, construction phase, short-term,

Probability: Medium: Probable
Low: Low probability

Confidence: Medium: Definite increase in traffic and possible traffic impacts at site access

Impact Phase: Construction							
Potential impact description: Degradation of gravel site access road Additional heavy traffic on the site access road could degrade the existing road pavement with increased potential for vehicle damage or injury crashes.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	High
With Mitigation	Medium	Medium	Low	Negative	Low	Low	High
Can the impact be reversed?			Yes. This is temporary during Construction				
Will the impact cause irreplaceable loss of resources?			Yes, disability due to crashes				
Can the impact be avoided, managed or mitigated?			Yes, impacts can be managed and mitigated				
Mitigation measures to reduce risk or enhance opportunities: * Carry out regular maintenance of the gravel site access road to ensure that its condition is maintained or improved to good condition.							

Rationale for scoring as shown in the table above.

Severity: Medium: Likelihood of vehicle crashes with possible disability and or injury

Spatial Extent: Medium: Beyond site boundary

Duration: Low: Quickly reversible, construction phase, short-term,

Probability: Medium: Probable
Low: Low probability

Confidence: High: Definite substantial increase in heavy and light vehicle traffic leading to deterioration of the road surface

Impact Phase: Construction							
Potential impact description: Dust on gravel site access road Additional traffic on gravel site access road will result in more dust. This reduces forward visibility and increased potential for crashes on the gravel site access road.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	High
With Mitigation	Medium	Medium	Low	Negative	Low	Low	High
Can the impact be reversed?		Yes. This is temporary during Construction					
Will the impact cause irreplaceable loss of resources?		No					
Can the impact be avoided, managed or mitigated?		Yes, impacts can be managed and mitigated					
Mitigation measures to reduce risk or enhance opportunities: Reduce travel speed on gravel site access road to reduce dust: * Post 50km/h speed restriction signage for construction vehicles on the gravel site access road. * Actively enforce construction vehicles to adhere to posted speed limits. * Where deemed necessary (due to wind conditions) apply appropriate dust suppressant.							

Rationale for scoring as shown in the table above.

Severity: Medium: Likelihood of vehicle crashes with possible disability and or injury

Spatial Extent: Medium: Beyond site boundary

Duration: Low: Quickly reversible, less than the project life cycle, short-term,

Probability: Medium: Probable
Low: Unlikely

Confidence: High: Definite substantial increase in heavy and light vehicle traffic leading to increased likelihood of dust reducing motorists' visibility.

Impact Phase: Construction							
Potential impact description: Pedestrian safety on-site Buses and light vehicles will arrive on site and park for extended periods in addition to large delivery vehicles driving on site. Site staff (skilled and semi-skilled) will need to walk to the site work area or be transported on site. This increases the risk of vehicle/pedestrian conflict and crashes on site.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Low	Low	Negative	High	Medium	Medium
With Mitigation	High	Low	Low	Negative	Low	Low	High
Can the impact be reversed?			Yes. This is temporary during Construction				
Will the impact cause irreplaceable loss of resources?			Yes, possible death or disability				
Can the impact be avoided, managed or mitigated?			Yes, impacts can be managed and mitigated				
Mitigation measures to reduce risk or enhance opportunities: This can be mitigated by: * Designing and implementing a well-designed parking area (s) with clearly defined well-lit pedestrian walkways separated from delivery and operational traffic. * Implementing well considered on-site protocols (appropriate vehicles, boarding and alighting areas and routes on site).							

Rationale for scoring as shown in the table above.

Severity: High: Likelihood of vehicle crashes with possible disability and or injury

Spatial Extent: Low: On-site

Duration: Low: Quickly Construction Phase, short-term,

Probability: High: Probable
Low: Low possibility

Confidence: Medium: Definite substantial increase in buses, light vehicles and heavy vehicle traffic leading to likelihood of vehicle/pedestrian conflicts on-site
High: Well-planned measures to separate vehicle and pedestrian conflicts on site will increase pedestrian safety

6.4.2 Operations

Impact Phase: Operations							
Potential impact description: NONE							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation							
With Mitigation							
Can the impact be reversed?							
Will the impact cause irreplaceable loss of resources?							
Can the impact be avoided, managed or mitigated?							
Mitigation measures to reduce risk or enhance opportunities: • This can be mitigated by the following:							

Rationale for scoring as shown in the table above.

No impact identified for this phase.

6.4.3 Decommissioning

Impact Phase: Decommissioning							
Potential impact description: Road safety at site access The site access is located on the outside of a bend however motorists sight lines are compromised by vegetation, which could result in vehicle crashes.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	Medium
With Mitigation	Low	Medium	Low	Negative	Low	Low	Medium
Can the impact be reversed?		Yes. This is temporary during Construction					
Will the impact cause irreplaceable loss of resources?		Yes, loss of life or disability due to crashes					
Can the impact be avoided, managed or mitigated?		Yes, this can mitigated or managed					
Mitigation measures to reduce risk or enhance opportunities: • This can be mitigated by the following: * Install signage warning of trucks crossing on both approaches to the site access.							

Rationale for scoring as shown in the table above.

Severity: Medium: Likelihood of vehicle crashes with possible disability and or injury
Low: Possibility of lower speed vehicle crashes with possible injury

Spatial Extent: Medium: Beyond site boundary

Duration: Low: Quickly reversible, decommissioning phase, short-term,

Probability: Medium: Probable
Low: Low probability

Confidence: Medium: Definite increase in traffic and possible traffic impacts at access in distant future

Impact Phase: Decommissioning							
Potential impact description: Degradation of gravel site access road Additional heavy traffic on the site access road could degrade the existing road pavement with increased potential for vehicle damage or injury crashes.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	Low	Negative	Medium	Medium	Medium
With Mitigation	Medium	Medium	Low	Negative	Low	Low	Medium
Can the impact be reversed?			Yes. This is temporary during Decommissioning				
Will the impact cause irreplaceable loss of resources?			Possibly, disability due to crashes				
Can the impact be avoided, managed or mitigated?			Yes, impacts can be managed and mitigated				
Mitigation measures to reduce risk or enhance opportunities: • This can be mitigated by the following: * Carry out regular maintenance of the gravel site access road to ensure that its condition is maintained or improved to good condition.							

Rationale for scoring as shown in the table above.

Severity: Medium: Likelihood of vehicle crashes with possible disability and or injury

Spatial Extent: Medium: Beyond site boundary

Duration: Low: Quickly reversible, decommissioning phase, short-term,

Probability: Medium: Probable
Low: Low probability

Confidence: Medium: Definite substantial increase in heavy and light vehicle traffic leading to possible deterioration of the road surface

Impact Phase: Decommissioning							
Potential impact description: Dust on gravel site access road Additional traffic on gravel site access road will result in more dust. This reduces forward visibility and increases potential for crashes on the gravel road.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Low	Low	Negative	Medium	Medium	Medium
With Mitigation	Low	Low	Low	Negative	Low	Low	Medium
Can the impact be reversed?		Yes. This is temporary during Decommissioning					
Will the impact cause irreplaceable loss of resources?		Possibly, disability due to crashes					
Can the impact be avoided, managed or mitigated?		Yes, impacts can be managed and mitigated					
Mitigation measures to reduce risk or enhance opportunities: Reduce travel speed on gravel site access road to reduce dust: * Post 50km/h speed restriction signage for construction vehicles on gravel site access road. * Actively enforce construction vehicles to adhere to posted speed limits							

Rationale for scoring as shown in the table above.

Severity: High: Likelihood of vehicle crashes with possible disability and or injury
Low: Possibility of vehicle crashes with possible injury

Spatial Extent: Medium: Beyond site boundary

Duration: Low: Quickly reversible, decommissioning phase, short-term

Probability: Medium: Probable
Low: Low probability

Confidence: Medium: Definite substantial increase in heavy and light vehicle traffic leading to increased likelihood of dust reducing motorists' visibility

Impact Phase: Decommissioning							
Potential impact description: Pedestrian safety on site Buses and light vehicles will arrive on site and park for extended periods in addition to large delivery vehicles driving on site. Site staff (skilled and semi-skilled) will need to walk to the site work area or be transported on site. This increases the risk of vehicle/pedestrian conflict and crashes on site.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Low	Low	Negative	Medium	Medium	Medium
With Mitigation	Medium	Low	Low	Negative	Low	Low	Medium
Can the impact be reversed?			Yes. This is temporary during Decommissioning				
Will the impact cause irreplaceable loss of resources?			Possibly, disability due to crashes				
Can the impact be avoided, managed or mitigated?			Yes, impacts can be managed and mitigated				
Mitigation measures to reduce risk or enhance opportunities: This can be mitigated by: * Designing and implementing a well-designed parking area (s) with clearly defined well-lit pedestrian walkways separated from delivery and operational traffic. * Implementing well considered on-site protocols (appropriate vehicles, boarding and alighting areas and routes on site).							

Rationale for scoring as shown in the table above.

Severity: High: Likelihood of vehicle/pedestrian crashes with possible disability and or injury
Medium: Possibility of vehicle/pedestrian crashes with possible injury

Spatial Extent: Low: On-site

Duration: Low: Quickly reversible, decommissioning phase, short-term,

Probability: Medium: Possible
Low: Low probability

Confidence: Medium: Definite substantial increase in buses, light vehicles and heavy vehicle traffic leading to increased likelihood of vehicle/pedestrian conflicts on-site but over short period

6.4.4 Solar PV Facility Cumulative Impacts

The Table below shows a list of similar projects within 35 km radius of the Boshoek 2 Solar PV Facility. The cumulative capacity of the nearby Solar Polar Voltaic (PV) sites is 200 MW. It is pointed out that these facilities are within 5 km of the subject site.

Table 6-4: Similar developments within 35 km from site (Cumulative development)

#	Project Title	Application Received	Applicant	EAP	Local Mun	Technology	Megawatt	Project Status
1	Proposed Boshoek Solar PV 2	NA	Atlantic Renewable Energy Partners (PTY) Ltd	ERM Southern Africa (Pty) Ltd	Rustenburg Local Municipality	Solar PV	150	Pre-submission
2	Proposed Boshoek Solar PV 3	NA	Atlantic Renewable Energy Partners (PTY) Ltd	ERM Southern Africa (Pty) Ltd	Rustenburg Local Municipality	Solar PV	50	Pre-submission
							200	TOTAL

These projects are by the same developer, and as a worst-case scenario, they could be completed within the same timeline and the subject project.

The estimated trip generation to site for the Boshoek Solar PV 1 facility and the other similar facilities (Boshoek Solar PV 2 and Boshoek Solar PV 3) within 35 km of the subject site are shown in the Table below.

Table 6-5: Summary of proposed and cumulative development vehicle trips per development stage

SOLAR PV PLANT - ANTICIPATED PLANT EXECUTION PLAN Anticipated Project Execution Plan (Construction, Operations and Decommissioning Stages) SUMMARY OF SITE STAFF AND VEHICLE LOADS								
ITEM	**DESCRIPTION**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**	**Stage 6**	**Stage 7**
	# Months	1	2	6	5	2	300	2
	From	1	2	4	10	15	17	317
	To	1	3	9	14	16	316	318
1	Site Staff / Employees on site (Day shift only)	627	1298	1262	1082	1082	35	623
	MONTHLY ARRIVE AT START OF STAGE AND LEAVE AT END OF PHASE							
4a - 4i	Miscellaneous vehicles arrive (and stay on site for extended periods) and leave site at end of period.	27	5	32	0	0	0	10
	PER MONTH (ARRIVE OUTSIDE PEAK HOURS)							
5	Tipper Truck Packaging Waste Removal (Monthly)	0	535	0	0	0	0	0
6	Steel Structure to site (Interlinks from Johannesburg) (Monthly)	0	178	0	0	0	0	0
7	PV Panels to site (ISO Container Trucks) (Monthly)	0	360	0	0	0	0	0
8	BESS Containers to site (Monthly)	0	0	11	0	0	0	0
4i	Anxillary Buildings, etc. Heavy vehicles - trucks and lowbed		18					0
4j	10 and 20 m3 trucks (50/50 split)							281
4k - 5	Calculated - Average # vehicles per day (outside Peak Hours)	0	42	0	0	0	0	11
	DAILY (IN PEAK HOUR)							
2a	Light Vehicles to site **daily** (arrive in AM Peak Hour, remain on site, depart in PM Peak Hour)	54	162	120	252	252	13	32
3a	Buses / *Taxis* (arrive in AM Peak Hour, remain on site, depart in PM Peak Hour)	9	18	19	13	13	*2*	10

Cumulative monthly and daily solar panels, solar packaging waste removal and solar mounting vehicle trips to site are shown in the Tabe below:

Table 6-6 - Summary of cumulative PV related monthly and daily trips

Monthly	Daily	%	Description
535	21	50%	Tipper Solar PV Packaging waste removal
178	7	17%	PV structures and mountings
360	14	34%	PV Panels
1073	**41**	**100%**	**Total**

Assuming that all developments are built simultaneously and to similar project programme the cumulative solar PV Facility sites would generate approximately 252 peak hour light vehicle trips and 13 buses to site per day. These are single directional trips (to site in AM / from site in PM). The 252 peak hour trips are significant.

This can be mitigated by constructing the three Solar PV facilities consecutively, or, assuming all facilities are built simultaneously, by encouraging artisan and specialist staff to travel outside peak hours or by providing at least 3 buses for artisans and specialist staff to the various sites.

The cumulative development impact assessment is shown in the Table below.

Impact Phase: Cumulative							
Potential impact description: Traffic congestion Increased development related light and heavy vehicles traffic flow on the R565 route to site, resulting in more traffic congestion in the PM at the Boshoek OK Grocer shopping hub.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Medium	Low	Negative	High	Medium	Medium
With Mitigation	Low	Medium	Low	Negative	Low	Low	Medium
Can the impact be reversed?		Yes. This is temporary during Construction					
Will the impact cause irreplaceable loss of resources?		No					
Can the impact be avoided, managed or mitigated?		Yes, this can mitigated or managed					
Mitigation measures to reduce risk or enhance opportunities: • This can be mitigated by the following: * Constructing the Solar PV sites concurrently, * Improving traffic road markings on R565 in Boshoek. * Focussed traffic law enforcement on R565 at Boshoek shopping hub particularly during PM peak hours. * Plan for light vehicles to/from site to travel outside the traffic peak hours, and / or accommodate most of the specialists and artisans in buses (3 busses equates to 150 vehicles) to/from site. * Undertake a TIA * Produce a TMP							

Rationale for scoring as shown in the table above.

Severity: High**:** High deterioration with higher level of traffic congestion (disruption and nuisance) on R565 in PM
Low: Minor deterioration with lower increase in traffic congestion (disruption and nuisance) on R565 in PM with mitigation measures

Spatial Extent: Medium: Beyond site boundary

Duration: Low: Quickly reversible, construction phase, short-term,

Probability: High: Definite
Low: Low probability

Confidence: Medium: Definite increase in traffic and traffic impacts in Boshoek

7. TRAFFIC IMPACT ASSESSMENT AND TRAFFIC MANAGEMENT PLAN

The development traffic involving staff/worker transport will produce substantial commuter peak hour trips on the road network, where a few areas of concern are identified. This will be more so with a cumulative development scenario. Consequently, a Traffic Impact Assessment as outlined below is required to determine development traffic impact and to effectively manage the increase in traffic due to the development/solar PV facility.

Traffic Impact Assessment (TIA) particular requirements:

1. Determine weekday AM and PM peak hour capacity at D114 approach to R565.
2. Determine weekday AM and PM peak hour capacity at R565 accesses to OK Grocer shopping hub and Non-motorised Transport (NMT) safety.
3. Determine reasonable number of development trips that could be added to the above intersections to maintain acceptable Level of Service (LOS) and determine requisite intersection upgrading requirements to accommodate development traffic impact.
4. Determine effective development phasing and transport strategies to align with calculated peak hours development trips due to identified intersection capacity constraints (with or without intersection(s) upgrading). This must also consider the cumulative development scenario and determine appropriate phasing and / or transport strategies to mitigate development traffic impact.
5. Conceptual design proposals for:
   5.1. Collection areas for workers/staff in selected towns (consider safe transport locations for vehicle access and pedestrian boarding / alighting areas)
   5.2. On-site delivery and equipment transport areas separated from public and private transport accommodation including NMT safety in worker/staff parking area and to work areas).
6. Road signage drawings for the following intersection
   6.1. D114 / site access road intersection
   6.2. Site access road / site access
7. Include statement regarding signage maintenance required at D114/R565 intersection for attention by the local municipality/road authority.
8. Any other concerns /suggestions identified at areas of study.
9. Conclusions.
10. Recommendations.

Traffic Management Plan (TMP) requirements.

A short Traffic Management Plan should set out practical steps / means to implement the recommendations of the TIA.

8. CONCLUSIONS

It is concluded that:

Construction Phase:

1. The proposed Boshoek 1 Solar PV facility is expected to be built over a period of 16 months.
2. The Solar PV facility could generate significant traffic volumes on the road network.
3. A TIA and a TMP are required to address possible issues on the R565 in Boshoek at the OK Grocer shopping hub, and on-site pedestrian safety.
4. A few abnormal load vehicles transporting heavy machinery will operate under permit obtained by the transport carrier.
5. The R565/D114 intersection requires road markings and signage to improve readability by motorists and to avoid unnecessary crashes.
6. The site access road approach to D114 should be hardened for 30 m to reduce material carry onto the D114.
7. Increased traffic/construction traffic at the D114/site access road intersection could lead to vehicle crashes, and advance warning "truck crossing" signage should be erected on the D114 approaches.
8. Increased traffic/construction traffic at the site access could lead to vehicle crashes, and advance warning "truck crossing" signage should be erected on the gravel site access road approaches to the site access.
9. Increased vehicles / construction vehicles on the gravel site access road could lead to deterioration of the road pavement, and this requires monitoring and regular road maintenance.
10. Increased traffic on the site access road could lead in increased dust, with reduced forward visibility and higher risk of vehicle crashes, and construction vehicles travel speeds should be reduced to 50km/h reduce dust.
11. High number of pedestrians with light vehicles, buses and heavy and delivery vehicles on-site carries increased potential for serious pedestrian/vehicles crashes. This can be mitigated by separating delivery/construction vehicles from buses and light vehicles in a well-designed parking area with clear vehicle/pedestrian paths separation.

Operations Phase:

1. The facility will have a low trip generation over the 25 years operations phase and no impacts are identified for this phase.

Decommissioning Phase:

1. Increased traffic/construction traffic at the D114/site access road intersection could lead to vehicle crashes, and advance warning "truck crossing" signage should be erected on the D114 approaches t the site access road.
2. Increased traffic/construction traffic at the site access could lead to vehicle crashes, and advance warning "truck crossing" signage should be erected on the gravel site access road approaches to the site access.
3. During the 2 months decommissioning phase increased number of heavy vehicles on the gravel site access road could lead to deterioration of the pavement, which

increases risk of crashes. The condition of the site access road should be monitored and maintained to a good standard.

4. Increased traffic on the site access road increases dust which creates forward visibility issues for motorists and increases risk of crashes. This can be mitigated by implementing a 50 km/h speed restriction for heavy vehicles on the gravel site access road, with possible dust suppressant if really needed.
5. High number of pedestrians with light vehicles, buses and heavy and delivery vehicles on-site carries increased potential for serious pedestrian/vehicles crashes. This can be mitigated by separating delivery/construction vehicles from buses and light vehicles in a well-designed parking area with clear vehicle/pedestrian paths separation.

Cumulative Impact

1. The cumulative traffic impact of planned construction of various Solar PV facilities within 35 km (within 5 km from the site) could coincide with the Boshoek Solar PV 1 facility. The cumulative traffic is significant and could increase traffic congestion on the R565 at the OK Grocer shopping centre hub. This could be mitigated by development related light vehicles travelling outside peak hours and/or providing bus transport for the majority of artisans and specialists.
2. A TIA and a TMP is required to address the cumulative development impact traffic impact.

TIA and TMP:

1. A Traffic Impact Assessment (TIA) is required to address identified development traffic impacts and determine acceptable development trips and requisite road improvements and to address vehicle/pedestrian traffic conflict/safety on-site.
2. A short Traffic Management Plan (TMP) should set out practical steps / means to implement the recommendations of the TIA.

9. RECOMMENDATIONS

It is recommended that:

1. The traffic and transport related impacts of the proposed Solar PV facility construction, operations and decommissioning be mitigated as set out in this report, including a Traffic Impact Assessment (TIA) addressing aspects as outlined in this report along with a Traffic Management Plan in accordance with recommendations from the TIA.

10. SPECIALIST STATEMENT

Taking the above findings into consideration it can be concluded that the development of the Boshoek Solar PV 1 facility and associated infrastructure should not have undue detrimental impact on traffic and that identified impacts can be suitable mitigated.

It is the reasoned opinion of the specialist that the development of the Boshoek Solar PV 1 facility can be approved, from a traffic and transport engineering perspective, subject to the specific requirements / mitigation measures included within this report.

11. REFERENCES

1. TMH 16 Vol 1 & 2 South African Traffic Impact and Site Traffic Assessment Manual, August 2012, compiled by the Committee of Transport Officials (COTO)
2. South African Trip Generation Rates, Second Edition, Department of Transport – June 1995
3. Institute of Transport Engineers Trip Generation Manual 8th Edition
4. Committee of Transport Officials (COTO) TRH 11 - Dimensional and Mass Limitations and Other Requirements for Abnormal Load Vehicles (8th Edition 2010) as published by South African Department of Transport
5. An Innovative Approach to Structuring Environmental Impact Assessment Reports Part 2: Ranking the Significance of Environmental Aspects and Impacts By: T. Hacking Anglo American plc (Currently Environmental Manager at Konkola Copper Mines plc, Zambia)

ANNEXURE A – Curriculum Vitae

S Fautley
Abbreviated Curriculum Vitae

Profession
Traffic & Transportation Engineer

Current Position
Western Cape
Senior Transportation Engineer

Date and Place of Birth:
15 July 1961, Cape Town

Joined Techso:
2008

Nationality
South African

Academic Qualifications
NHD in Civil Engineering, Cape Technikon 1989

Professional Associations
The Engineering Council of South African (ECSA)

Specialisation
Traffic Engineering and Transportation Planning

Languages
Afrikaans, English

Appointments
- 1986– 1992: Principal Industrial and (1986 - 1991) Industrial Technician: Geometric Design: Provincial Administration: Western Cape
- 1993– 1994: Chief Industrial Technician: Mapping and Proclamations: Provincial Government: Western Cape
- 1994 – 1995: Chief Industrial Technician Regional Services: Provincial Government: Western Cape
- 1995 - 1996: Chief Industrial Technician, Urban Transportation: Provincial Government: Western Cape
- 1997 – 1998: Senior Technician, Kantey and Templer
- 1998 - 2006: Principal Technician: Traffic Engineering, City of Cape Town
- 2006 – 2008: Regional Head, Traffic Impact Assessments and Development Control, City of Cape Town
- 2008 - Senior Transportation Engineer, Techso

Contact Details
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Mobile: +27 (0) 84 300 7722
E-mail: steve@techso.co.za

Key Experience

Stephen is a traffic engineering technologist with 30 years of experience in traffic and transportation engineering. He has completed the Transportation Planning and Study Methodology course and the Highway Capacity course at the University of Stellenbosch. Stephen has been involved with civil, traffic and transportation engineering for ten (10) years at Provincial Government of the Western Cape, 1,5 years with Kantey and Templer Consulting Engineers and 10 yrs at local authority/city level and joined Techso in August 2008.

Traffic & Transportation:
- Transportation Planning
- Traffic Engineering
- Road Safety Audits

Projects:
- Local Traffic Engineering and Transportation Plans, such as Traffic Signal Design, Traffic Calming, Parking, Road Safety Audits, Road Design, Road Signs and Lane Marking for City of Cape Town.
- Developed Structure Parking Ramp Design Guidelines for the City of Cape Town.
- Project Management: Blaauwberg Road and Diep River Bridge Design, Milnerton
- Transport Systems Management Project Design and Implementation (City of Tygerberg & City of Cape Town)
- Technical Input to the City of Cape Town Kerbside Adjudication Bid Evaluation Committee.
- Project Management sub-consultant: City of Cape Town - Integrated Rapid Transport intersection and traffic signal design.
- Traffic Engineer sub-consultant: City of Cape Town - Conceptual design of Eastern Region non-motorised transport project
- Transport Impact Assessments – Commercial and Residential Developments, Schools, Gym, Hospital, Service Stations, Building lines, Sand-mines, Road Closures, Extensive housing development and road improvements
- Transportation Modelling – TIA for Windhoek Prime Ministers Offices
- Rustenburg Municipality – Integrated Rapid Transport System – AFC
- Ekhurleni Municipality – Integrated Rapid Public Transport Network – AFC and APTMS
- Nelson Mandela Bay Municipality – Integrated Public Transport System – AFC and APTMS
- Assessment of Road Safety Risk and Enforcement Measures -Various Municipal Area
- Traffic Management Plans - R21/2 in Gauteng – SANRAL
- Road Safety Audits – City of Cape Town - Integrated Rapid Transit Phase 1B, and R27 Reversible Bus lane, SANRAL- N1 in Polokwane
- Transport Studies – Input to Various Environmental Impact Assessment and Land Use Applications (residential developments, renewable energy plants, power stations, mines, industrial sites)
- **RESIDENTIAL / HOUSING:**
  - TIA – Erf 2900 Lotus River (58 Unit housing development - flats)
  - TIA – Rhodes square student accommodation Erf 31990 in Mowbray (600 units – for UCT students)
  - TIA – Campuskey Student Residence Erf 41665 in Rondebosch (536 units - for UCT students)
  - TIA – The Nest Student Residence and commercial development Erf 31993 in Rondebosch (for 610 units - for UCT students)
  - TIS Erf 309 – 44 Units flats Milnerton

ANNEXURE B – Specialist Declaration of Interest

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Proposed Construction of the Boshoek Solar PV 1 facility and associated infrastructure, near the town of Boshoek in the Northwest Province.

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Techso (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement recognition	18
Specialist name:	Stephen Mark Fautley			
Specialist Qualifications:	Civil Engineering Technologist			
Professional affiliation/registration:	Civil Engineering Council of South Africa (ECSA) Registration Number 200270171 South African Institute of Civil Engineers (SAICE) Registration Number 201500599 South African Road Federation (SARF) Membership Number 29			
Physical address:	13 Riverside Drive, Milnerton, Cape Town			
Postal address:	13 Riverside Drive, Milnerton, Cape Town			
Postal code:	7441	Cell:	0843007722	
Telephone:	NA	Fax:	NA	
E-mail:	steve@techso.co.za			

2. DECLARATION BY THE SPECIALIST

I, ___Stephen Mark Fautley_______________________________, 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Techso (Pty) Ltd

Name of Company:

2024/02/29

Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 2 of 3

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, ____Stephen Mark Fautley________________________________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Techso (Pty) Ltd

Name of Company

2024/02/29

Date

7165392-9
D. MTSOKOR SGT

Signature of the Commissioner of Oaths

2024 · 02 · 29

Date

SUID-AFRIKAANSE POLISIEDIENS
SAPS BRACKENFELL
29 FEB 2024
BRACKENFELL
SOUTH AFRICAN POLICE SERVICE

ANNEXURE C – Site Verification Report

Head Office, Pretoria
Tel: +27 (0)12 844 0306
info@techso.co.za
Box 35, Mark Shuttleworth Street, The Innovation Hub, 0087, South Africa
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3 Areuna Road
Brackenfell
Cape Town, Western Cape, South Africa

TECHSO
smart solutions

My Ref: TJ2311
12 October 2023

ERM Southern Africa (PTY) LTD
1st Floor
Great Westerford
240 Main Road
Rondebosch
7700
South Africa

Attention: Anathi Manyakanyaka

Dear Madam

SITE SENSITIVITY VERIFICATION REPORT – PROPOSED CONSTRUCTION OF THE BOSHOEK SOLAR PV 1 FACILITY AND ASSOCIATED INFRASTRUCTURE, NEAR THE TOWN OF BOSHOEK IN THE NORTHWEST PROVINCE

1. SITE SENSITIVITY VERIFICATION AND MINIMUM REPORT CONTENT REQUIREMENTS

In conducting the specialist assessment, the current use of the land and the environmental sensitivity of the site under consideration identified by the national web based environmental screening tool (screening tool), was confirmed by undertaking a site sensitivity verification, with reference to the screening tool (https://screening.environment.gov.za/screeningtool) with relevant information as provided by the Environmental Practitioner for the project.

It is confirmed that:

a) there is no specific environmental theme protocol prescribed for traffic engineering specialist assessments,
b) the required level of assessment based on the findings of the site sensitivity verification are in compliance with Regulation GNR 326 of 4 December, as amended 1 April 2017, Appendix 6
c) a site visit was conducted on 12 September 2023 to assess the site, road accesses and surrounding road network from a transport perspective.

2. SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS

The site sensitivity was assessed through the following:

a) desktop analysis, using satellite imagery (Google Earth), was undertaken prior to visiting the site.

Directors: Dr SJ Andersen Ms. MJ Ntlatleng
Registration No 2005/007690/07
www.techso.co.za

b) a site visit was conducted on 2023/09/12 to assess the current farming operations and to consider environmental issues.

The outcome of the above is contained in this report, that:

a) confirms the current farming activity and the environmental sensitivity of the proposed Solar PV energy facility, from a traffic and transportation perspective is low.
b) contains a motivation and evidence (map, photographs) of the current and proposed renewable energy and environmental sensitivity (environmental impact risk assessment); and
c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations1 (EIA Regulations).

Yours faithfully

Stephen Fautley (Pr Tech Eng)
for Techso (Pty) Ltd
https://techsosmartsolutions-my.sharepoint.com/personal/steve_techso_co_za/Documents/TECHSO/Projects/Projects 2023/Rustenburg Solar/Boshoek Solar PV 1/Boshoek Solar PV 1- Site Verification - 20231012.docx

ANNEXURE D – Contents of Specialist Report - Checklist

CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	Section of Report
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	**Section 4 & Annexure A**
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	**Annexure B**
(c) an indication of the scope of, and the purpose for which, the report was prepared;	**Sections 1 & 3**
(cA) an indication of the quality and age of base data used for the specialist report;	**Section 2 (see site visits)**
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	**Sections 2, 6.1, Section 6.2 and Section 6.4.4**
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	**Section 2**
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	**Section 5**
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	**Section 5**
(g) an identification of any areas to be avoided, including buffers;	**NONE**
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	**Section 2 Fig 2.1**
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	**Section 6.2**
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	**Sections 6.4**
(k) any mitigation measures for inclusion in the EMPr;	**Sections 6.4**
(l) any conditions for inclusion in the environmental authorisation;	**Section 6.4 and Section 7 and Section 9**
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	**NA**
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	**Section 10**
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	**NA**
(p) any other information requested by the competent authority	**NA**
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	**NA**

SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE
Proposed Construction of the Boshoek Solar PV1 and associated infrastructure, near the town of Boshoek in the Northwest Province.

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Traffic Assessment
Specialist Company Name	Techso (Pty) Ltd
Specialist Name	Stephen Mark Fautley
Specialist Identity Number	6107155175083
Specialist Qualifications:	Pr. Tech Eng.
Professional affiliation/registration:	ECSA 200270171
Physical address:	13 Riverside Drive, Milnerton, 7441
Postal address:	13 Riverside Drive, Milnerton, 7441
Postal address	Click or tap here to enter text.
Telephone	021 557 7730
Cell phone	084 300 7722
E-mail	steve@techso.co.za

SPECIALIST DECLARATION FORM – AUGUST 2023

2. DECLARATION BY THE SPECIALIST

I, Stephen Fautley declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

Techso (Pty) Ltd

Name of Company:

19 Aug 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Stephen Fautley_________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Click or tap here to enter text. Techso (Pty) Ltd

Name of Company

Click or tap here to enter text. 2024/08/19

Date

7242894-5
CST
S. Jikele

Click or tap here to enter text.

Signature of the Commissioner of Oaths

Click or tap to enter a date.

Date

SUID-AFRIKAANSE POLISIEDIENS
SAPS BRACKENFELL
2024 -08- 19
SAPS BRACKENFELL
SOUTH AFRICAN POLICE SERVICE

DOCUMENT CONTROL SHEET	
Document Title	**Traffic Assessment for the Proposed Construction of the Boshoek GRID 1 and associated infrastructure, near the town of Boshoek in the North West Province.**
Electronic Reference	https://techsosmartsolutions-my.sharepoint.com/personal/steve_techso_co_za/Documents/TECHSO/Projects/Projects 2023/Rustenburg Solar/Boshoek GRID 1/TA - Boshoek GRID 1 (20240229 draft 2).docx TJ2311
Date	29 February 2024
Short Description	This Traffic Assessment Report provides input to the Basic Assessment for the construction, operations and the decommissioning of the proposed Boshoek GRID 1.
Contact Person	Stephen Fautley steve@techso.co.za
ERM The business of sustainability	*Prepared for:* ***ERM Southern Africa (Pty) Ltd***
TECHSO smart solutions	*Prepared by* ***Techso*** Techso (Pty) Ltd PO Box 35 The Innovation Hub 0087 Tel: 021 557 7730 E-mail: steve@techso.co.za

	Name	Signature	Date
Compiled by:	Stephen Fautley (Pr. Tech Eng. - ECSA Reg # 200270171)		29 February 2024
Reviewed by			

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1. PROJECT DESCRIPTION

The proposed Boshoek GRID 1 site is located approximately 30 kilometers north-west of the town of Rustenburg, in the North West Province.

Boshoek Solar 1 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, within the Rustenburg and Kgetlengrivier Local Municipalities and the Bojanala District Municipality, in the North West Province.

The GRID connection and associated infrastructure is required for the Boshoek Solar PV 1 facility of up to 150 MW.

The development area for the GRID and associated infrastructure will be located on the following properties:

Boshoek GRID 1

Farm Name	Farm No.	Portion No.
Paul Bodenstein Landgoed JG	571	RE
Elandsfontein JG	102	1
Onderstepoort JG	98	RE

The project is planned as part of a larger cluster, which includes two additional GRID facilities (Boshoek GRID 2 and Boshoek GRID 3).

» Grid connection infrastructure, includes:
  - Underground medium-voltage cabling between the project components and the facility substation;
  - Up to 132kV facility substation;
  - Switching station;
  - A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north of the site.

Connection to National GRID
The future planned Eskom collector switching station will facilitate the connection of the facility substation to the Ngwedi 400/132kV MTS via a single or double circuit 132 kV overhead powerline.

The connection infrastructure associated with this grid solution (i.e. between the collector switching station and the MTS) falls outside of the scope of this report and will be assessed as part of a separate Environmental Application.

2. BASELINE CONDITIONS

The GRID site visit was conducted on the morning of 12 September 2023.

The proposed GRID site is accessed via a gravel public access road (called "site access road" in this report) as indicated in red in **Figure 2-1** below.

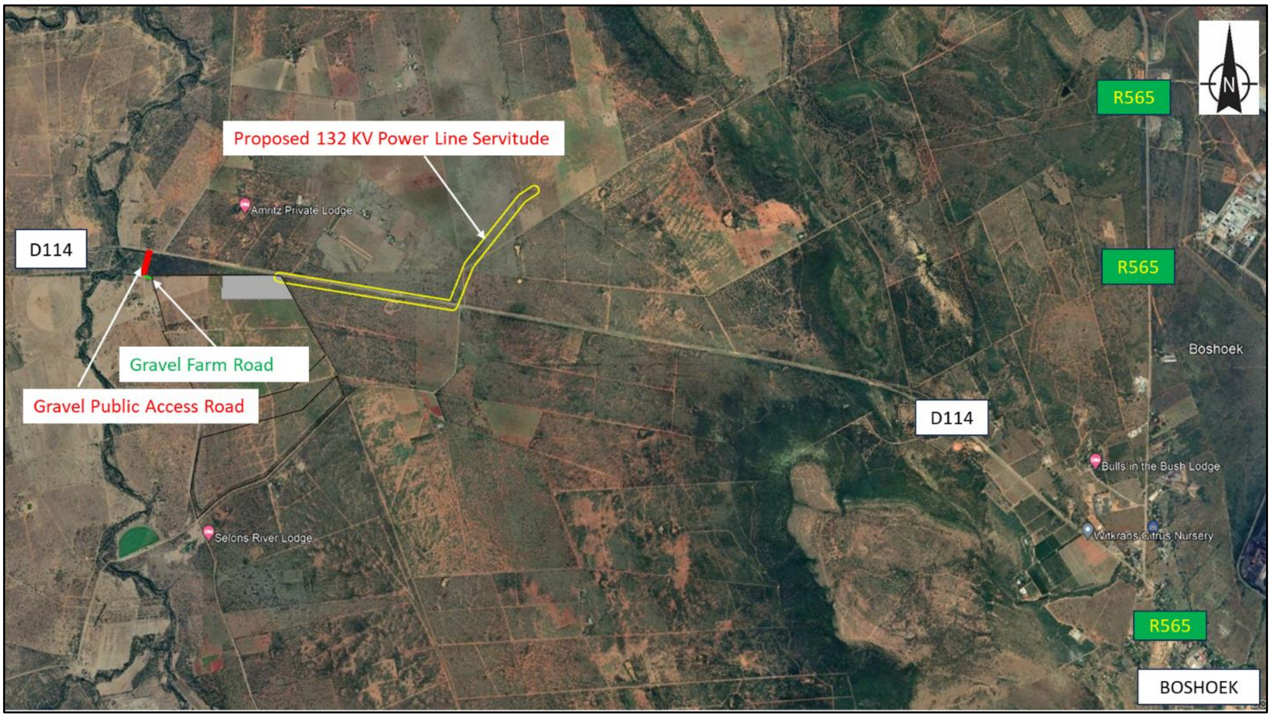

Figure 2-1: Site Location

Access from the D114 is attained via a gravel site access road. The road is 6 m wide and is of sufficient width to accommodate two-way traffic.

The gravel site access road has a low trip generation, evidenced by the unsurfaced nature of the road and as observed during a site visit on the morning of 12 September 2023, which is regarded as a normal traffic day relevant for assessment of traffic conditions.

3. PURPOSE OF REPORT

This report assesses the expected traffic and transport impact for the project lifecycle.

4. TRAFFIC SPECIALIST CREDENTIALS

This Site Assessment is undertaken by Mr. Stephen Mark Fautley, who is a Professional Engineering Technologist registered with the Engineering Council of South Africa (ECSA) and is a member of SAICE (see Curriculum Vitae Annexure A).

His career encompasses the civil, traffic and transportation engineering discipline for ten

(10) years at the Western Cape Government, 1,5 years with Kantey and Templer Consulting Engineers and 10 years at local authority (City of Cape Town) before joining Techso in 2008, as a Senior Transport Engineer.

Stephen has extensive experience in Traffic Impact Assessments and Site Assessments, including Impact Assessments for various renewable energy plants in South Africa, and is a registered Road Safety Auditor.

5. IMPACT ASSESSMENT METHODOLOGY

This report assesses the expected traffic and transport impact during the Construction Phase, Operation Phase and Decommissioning Phase of the proposed GRID.

The requirements in the TMH 16 Vol 1 & 2 South African Traffic Impact and Site Traffic Assessment Manual, August 2012, compiled by the Committee of Transport Officials (COTO) were used for this study.

The requirements as per EIA Regulations of 4 December 2014, as amended by GNR 326 on 7 April 2017, Appendix 6, are adhered to (see Annexure C).

Trip generation rates were based on the Scope of Work and an anticipated construction programme.

A site visit was conducted on 11, 12 and 13 September 2023 to assess the routes providing access to the site and to gain insight to possible issues and constraints along the local road network / various routes surrounding the site.

The National Road network and high order arterials (R565) that from part of the abnormal road network are assumed to be used for long distance equipment deliveries to site with abnormal loads being transported under permit to be obtained by the abnormal load transport carrier.

Traffic impacts resulting from other similar developments within 35 km of the site were estimated, based on previous experience of similar developments, and understanding of their cumulative impact on traffic and road network associated with the subject GRID.

The Impact Assessment Methodology assists in evaluating the overall effect of a proposed activity on the environment. The environmental impact is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts is undertaken through an assessment of the significance of the impacts.

SIGNIFICANCE OF ENVIRONMENTAL ASPECTS

The significance of environmental aspects can be determined and ranked by considering the criteria presented in Table 1. In some cases, it may be necessary to undertake the impact assessment to determine whether a particular aspect is significant. Therefore, a fair degree of iteration is unavoidable during the assessment process.

Table 1 – Criteria used to determine the significance of environmental aspects

Significance Ranking	Negative Aspects	Positive Aspects
H (High)	Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.	Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.
M (Moderate)	Has characteristics that could cause negative impacts.	Has characteristics that could cause positive impacts.
L (Low)	Will never exceed legislation or standards. Unlikely to cause significant negative impacts.	Will always comply with all legislation and standards. Unlikely to cause significant positive impacts.

The aspect identification and ranking process is largely a screening exercise whereby the aspects that do not have the potential to cause significant impacts are eliminated. Aspects ranked "high" and "moderate" are significant and the possible impacts associated with their presence will need to be determined. Aspects ranked "low" do not warrant further attention.

The significance of the aspects should be ranked on the assumption that the management recommended in the EIA will be in place i.e. *with management*. This represents the scenario that the proponent wishes to have considered for approval. The environmental aspects associated with the proposed project activities during the construction, operational, closure phases (where appropriate) need to be identified. The influence of various project alternatives on the significance of the aspects must also be considered.

It may be desirable to also undertake a *without management* aspect ranking, since this highlights the sensitivity of the key risk areas to management and, hence, the management priorities. However, the dilemma in such an exercise is deciding on how much management to include. In the case of a mining project, for example, does one assume that the tailings dam will be completely absent or merely operated poorly?

A useful rule of thumb is to assume that all the management required for operational reasons will be in place, but that any management specifically for environmental control will be absent. The danger in presenting *without management* ranking scenario in an EIA report is that it does not represent the scenario that the proponent wishes to have approved.

SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Where significant environmental aspects are present ("high" or "moderate"), significant environmental impacts ***may*** result. The significance of the impacts associated with the significant aspects can be determined by considering the risk:

Significance of Environmental Impact (Risk) = Probability x Consequence

The consequence of impacts can be described by considering the severity, spatial extent and duration of the impact.

Severity of Impacts

Table 2 presents the ranking criteria that can used to determine the severity of impacts on the bio- physical and socio-economic environment. Table 3 provides additional ranking criteria for determining the severity of negative impacts on the bio-physical environment.

Table 2 – Criteria for ranking the *Severity* of environmental impacts.

Type of Criteria	Negative			Positive		
	H-	M-	L-	L+	M+	H+
Qualitative	Substantial deterioration. Death, illness or injury.	Moderate deterioration. Discomfort.	Minor deterioration. Nuisance or minor irritation.	Minor improvement.	Moderate improvement.	Substantial improvement.
Quantitative	Measurable deterioration.		Change not measurable i.e., will remain within current range.		Measurable improvement.	
	Recommended level will often be violated.	Recommended level will occasionally be violated.	Recommended level will never be violated.		Will be within or better than recommended level.	
Community Response	Vigorous community action.	Widespread complaints.	Sporadic complaints.		No observed reaction.	Favourable publicity

Table 3 – Criteria for ranking the *Severity* of negative impacts on the bio-physical environment.

Environment	Ranking Criteria		
	Low (L-)	Medium (M-)	High (H-)
Soils and land capability	Minor deterioration in land capability. Soil alteration resulting in a low negative impact on one of the other environments (e.g. ecology).	Partial loss of land capability. Soil alteration resulting in a moderate negative impact on one of the other environments (e.g. ecology).	Complete loss of land capability. Soil alteration resulting in a high negative impact on one of the other environments (e.g. ecology).
Ecology (Plant and animal life)	Disturbance of areas that are degraded, have little conservation value or are unimportant to humans as a resource. Minor change in species variety or prevalence.	Disturbance of areas that have some conservation value or are of some potential use to humans. Complete change in species variety or prevalence.	Disturbance of areas that are pristine, have conservation value or are an important resource to humans. Destruction of rare or endangered species.
Surface and Groundwater	Quality deterioration resulting in a low negative impact on one of the other environments (ecology, community health etc.)	Quality deterioration resulting in a moderate negative impact on one of the other environments (ecology, community health etc.).	Quality deterioration resulting in a high negative impact on one of the other environments (ecology, community health etc.).

Spatial Extent and Duration of Impacts

The duration and spatial scale of impacts can be ranked using the following criteria:

Table 4 – Ranking the *Duration* and *Spatial Scale* of impacts.

	Ranking Criteria		
	L	**M**	**H**
Duration	Quickly reversible Less than the project life Short-term	Reversible over time Life of the project Medium-term	Permanent Beyond closure Long-term
Spatial Scale	Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread. Far beyond site boundary Regional/national

Where the severity of an impact varies with distance, the severity should be determined at the point of compliance or the point at which sensitive receptors will be encountered. This position corresponds to the spatial extent of the impact.

Consequence of Impacts

Having ranked the severity, duration and spatial extent, the overall consequence of impacts can be determined using the following qualitative guidelines:

Table 5 – Ranking the *Consequence* of an impact.

			SEVERITY = L		
DURATION	Long-term	**H**			
	Medium-term	**M**			**MEDIUM**
	Short-term	**L**	**LOW**		
			SEVERITY = M		
DURATION	Long-term	**H**			**HIGH**
	Medium-term	**M**		**MEDIUM**	
	Short-term	**L**	**LOW**		
			SEVERITY = H		
DURATION	Long-term	**H**			
	Medium-term	**M**			**HIGH**
	Short-term	**L**	**MEDIUM**		
			L	**M**	**H**
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/national
			SPATIAL SCALE		

To use Table 5, firstly go to one of the three "layers" based on the severity ranking obtained from Table 2 and/ or Table 3. Thereafter determine the consequence ranking by locating the intersection of the appropriate duration and spatial scale rankings.

Overall Significance of Impacts

Combining the consequence of the impact and the probability of occurrence, as shown by Table 6, provides the overall significance (risk) of impacts.

Table 6 – Ranking the *Overall Significance* of impacts.

PROBABILITY	Definite Continuous	**H**	**MEDIUM**		**HIGH**
	Possible Frequent	**M**		**MEDIUM**	
	Unlikely Seldom	**L**	**LOW**		**MEDIUM**
			L	**M**	**H**
			CONSEQUENCE (from Table 5)		

The overall significance ranking of the negative environmental impacts provides the following guidelines for decision making:

Table 7 – Guidelines for decision-making

Overall Significance Ranking	Nature of Impact	Decision Guideline
High	Unacceptable impacts.	Likely to be a fatal flaw.
Moderate	Noticeable impact.	These are unavoidable consequence, which will need to be accepted if the project is allowed to proceed.
Low	Minor impacts.	These impacts are not likely to affect the project decision.

6. TRAFFIC ASSESSMENT

6.1 Routes to site

The GRID structural elements, equipment and materials will primarily be sourced from Rustenburg and Johannesburg. The transformer is expected to be transported from Durban Harbour, via the national and provincial road network (see Figure 2-1 below).

The last leg of the journey leading from the D114 is a 0.4km short section of gravel site access road. The gravel site access road intersects with D114 at 25°27'40.34"S"S/ 26°58'54.86"E.

Figure 2-1 – Route for Durban Harbour to site

6.2 Construction Period and Trip Generation

The GRID construction period of 2 months generates the most vehicle trips and is expected to generate on average less than 1 trip to site per day.

The trip generation and average daily trips to site are insignificant, as detailed below:

Construction:

- The construction period has the highest trip generation with approximately 1 trip to site per day.
- The transformer will be transported as abnormal load.
- An abnormal load mobile crane will be transported to site.

Note, the information provided is an informed estimate. Construction related traffic may however vary and be different from the information provided above due to suppliers' delivery schedule updates/changes, etc.

6.3 Potential Impacts

6.3.1 Construction Period

The site access is located close to a horizontal curve but has clear sight lines in both directions.

Proposed site access position

View right of proposed access (towards D114)

View to left of proposed site access showing horizontal curve.

Traffic flow on the gravel road is very low and no mitigation measures are proposed for the site access.

» **Pedestrian safety on site:** The GRID vehicles use the same access as the Boshoek Solar PV1 construction that has a high trip generation and worker/staff component. This increases the risk of vehicle/pedestrian conflict and crashes on site.

This can be mitigated by ensuring that GRID construction traffic is separated from the Boshoek Solar PV 1 worker/staff parking areas.

» **Abnormal load transport**: Transport loads exceeding spatial and /or mass limitations on public roads pose a traffic danger to motorists.

This can be mitigated by the transport of abnormal loads under permit. (Section 81 of the National Road Traffic Act 93 of 1996 and National Road Traffic Regulations, 2000).

» **Crossing D114**: The GRID crossing over D114 has potential for vehicle crashes resulting in death, disability, or injury.

The GRID crossing can be mitigated by obtaining wayleaves for the crossing and exercise of appropriate traffic control involving advance warning / notification of the intended road closure, closing D114 when erecting the GRID crossing during low traffic flow conditions and providing a deviation/alternate bypass route, where feasible.

6.3.2 Operations Period

The GRID site will be operational all hours except during maintenance, breakdowns or interruption of the connection to the Eskom grid.

Regular maintenance will be minimal with negligible number of vehicles. No issues are identified for mitigation in the phase.

6.3.3 Decommissioning Period

The GRID is expected to be operational for 25 years with the possibility of extending operations for a further 25 years.

Trip generation at the decommissioning stage is likely to be outside commuter peak hours.

Decommissioning will entail very low vehicle trips (less traffic than the construction phase), and recyclable components would be transported to appropriate recycling facilities. Other materials would be transported to the local dump if not recyclable or sold to local scrap merchants or other buyers if the items have salvage value.

Decommissioning should be in accordance with the agreement reached with the affected landowners.

Daily trips for the decommissioning period are expected to be low and will typically comprise dump trucks or low-bed vehicles, with equipment and components cut to size on site.

No issues are identified for this phase.

6.4 Impact Assessment

The following impacts are identified for the GRID project lifecycle.

- **Construction:**
  - Pedestrian safety on-site
  - Abnormal load transport
  - Crossing D114

- **Operations**
  - None

- **Decommissioning:**
  - None

- **Cumulative:**
  - None

The Impact Assessment ratings for the proposed GRID are shown in the Tables below.

6.4.1 Construction

Impact Phase: Construction							
Potential impact description: Pedestrian safety on-site The GRID vehicles use the same access as the Boshoek Solar PV 1 construction that has a high trip generation and worker/staff component. This increases the risk of vehicle/pedestrian conflict and crashes on site with possible death, disability, or injury.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Low	Low	Negative	High	Medium	Medium
With Mitigation	High	Low	Low	Negative	Low	Low	High
Can the impact be reversed?			Yes. This is temporary during Construction				
Will the impact cause irreplaceable loss of resources?			Yes, possible death or disability				
Can the impact be avoided, managed or mitigated?			Yes, impacts can be managed and mitigated				
Mitigation measures to reduce risk or enhance opportunities: This can be mitigated by: * Ensuring that the GRID construction vehicles are separated from the Boshoek Solar PV 1 worker/staff parking area.							

Rationale for scoring as shown in the table above.

Severity: High: Likelihood of vehicle crashes with possible disability and or injury

Spatial Extent: Low: On-site

Duration: Low: Quickly Construction Phase, short-term,

Probability: High: Probable
Low: Low possibility

Confidence: Medium: Increase in construction vehicle traffic increases likelihood of vehicle/pedestrian conflicts on-site
High: Separate construction vehicle and pedestrian areas on site will increase pedestrian safety

Impact Phase: Construction							
Potential impact description: Abnormal load transport Transport loads exceeding spatial and /or mass limitations on public roads pose a traffic danger to motorists.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	High	Low	Negative	High	High	High
With Mitigation	High	High	Low	Negative	Low	Medium	High
Can the impact be reversed?			Yes. This is temporary during Construction				
Will the impact cause irreplaceable loss of resources?			Yes, possible death or disability				
Can the impact be avoided, managed or mitigated?			Yes, impacts can be managed and mitigated				
Mitigation measures to reduce risk or enhance opportunities: This can be mitigated by: * Transport of abnormal loads under permit. (Section 81 of the National Road Traffic Act 93 of 1996 and National Road Traffic Regulations, 2000).							

Rationale for scoring as shown in the table above.

Severity: High: Vehicle crashes with possible disability and or injury

Spatial Extent: High: From Durban Harbour

Duration: Low: Quickly Construction Phase, short-term,

Probability: High: Probable
Low: Low possibility

Confidence: High: Abnormal loads transported on public roads pose a traffic congestion and traffic safety concern, with likely vehicle crashes and possible death, disability, or injury.
High: Abnormal load Well-planned measures to separate vehicle and pedestrian conflicts on site will aid traffic safety.

Impact Phase: Construction							
Potential impact description: Crossing D114 The GRID 132KV powerline will need to be erected over the D114, which could cause traffic delay and poses a danger to motorists.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	High	Medium	Low	Negative	Medium	Medium	Medium
With Mitigation	High	Medium	Low	Negative	Low	Low	Medium
Can the impact be reversed?			Yes. This is temporary during Construction				
Will the impact cause irreplaceable loss of resources?			Yes, possible death or disability				
Can the impact be avoided, managed or mitigated?			Yes, impacts can be managed and mitigated				
Mitigation measures to reduce risk or enhance opportunities: This can be mitigated by: * Obtaining wayleaves for the road crossing. * Issuing advance warning / notification of the intended road closure. * Closing D114 when erecting the GRID over the D114 during low traffic flow conditions. * Providing a deviation/alternate bypass route, where feasible.							

Rationale for scoring as shown in the table above.

Severity: High: Vehicle crashes with possible disability and or injury

Spatial Extent: Medium: In D114 road reserve

Duration: Low: Construction Phase, a few hours

Probability: Medium: Probable
Low: Low possibility

Confidence: Medium: Traffic flow is low but will be impacted by the proposed GRID road crossing, with possible vehicle crashes resulting in death, disability or injury if not handled correctly.
High: Wayleaves and erection of powerlines over the D114 with proper traffic control will ensure traffic safety.

6.4.2 Operations

Impact Phase: Operations							
Potential impact description: NONE							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation							
With Mitigation							
Can the impact be reversed?							
Will the impact cause irreplaceable loss of resources?							
Can the impact be avoided, managed or mitigated?							
Mitigation measures to reduce risk or enhance opportunities: • This can be mitigated by the following:							

Rationale for scoring as shown in the table above.

No impact identified for this phase.

6.4.3 Decommissioning

Impact Phase: Decommissioning							
Potential impact description: Road Safety at site access The site access is located on the outside of a bend however motorists sight lines are compromised by vegetation, which could result in vehicle crashes.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation							
With Mitigation							
Can the impact be reversed?							
Will the impact cause irreplaceable loss of resources?							
Can the impact be avoided, managed or mitigated?							
Mitigation measures to reduce risk or enhance opportunities: • This can be mitigated by the following:							

Rationale for scoring as shown in the table above.

No impact identified for this phase.

6.4.4 GRID Cumulative Impacts

The Table below shows a list of similar projects within 35 km radius of the Boshoek 1 GRID.

It is pointed out that these facilities are within 5 km of the subject site.

Table 6-1: Similar developments within 35 km from site (Cumulative development)

#	Project Title	Application Received	Applicant	EAP	Local Mun	Technology	Megawatt	Project Status
1	Proposed Boshoek GRID 2	NA	Atlantic Renewable Energy Partners (PTY) Ltd	ERM Southern Africa (Pty) Ltd	Rustenburg Local Municipality	GRID	A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3 km north of the site.	Pre-submission
2	Proposed Boshoek GRID 3	NA	Atlantic Renewable Energy Partners (PTY) Ltd	ERM Southern Africa (Pty) Ltd	Rustenburg Local Municipality	GRID	A single or double circuit 132 kV power line from the switching station to the proposed Boshoek Main Transmission Station ~1 km north of the site. A new 132 /400 kV MTS ("Boshoek MTS"). A ~2km 400 kV LILO powerline from the existing Eskom Powerline (Midas/Ngwedi 2 400 kV) to the proposed Boshoek MTS.	Pre-submission

These projects are by the same developer, and as a worst-case scenario, they could be completed within the same timeline of the subject project.

Assuming that all developments are built simultaneously and to similar project programme the cumulative GRID sites would on average generate approximately 3 vehicle trips to site per day. These are single directional trips (to site in AM / from site in PM). The trip generation is insignificant and no mitigation is required.

Impact Phase: Cumulative							
Potential impact description: NONE							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation							
With Mitigation							
Can the impact be reversed?							
Will the impact cause irreplaceable loss of resources?							
Can the impact be avoided, managed or mitigated?							
Mitigation measures to reduce risk or enhance opportunities: • This can be mitigated by the following:							

Rationale for scoring as shown in the table above.

No impacts are identified for the cumulative GRID development.

7. CONCLUSIONS

It is concluded that:

Construction Phase:

- The proposed GRID is expected to be built over a period of 2 months.
- The GRID should generate insignificant traffic volumes on the road network.
- The GRID uses the same access as the Boshoek Solar PV 1. High number of pedestrians with light vehicles, buses associated with the Boshoek Solar PV 1 construction and heavy and delivery vehicles on-site carries increased potential for serious pedestrian/vehicles crashes. This can be mitigated by separating delivery/construction vehicles from buses and light vehicles in a well-designed parking area with safe vehicle/pedestrian paths.
- Transport loads exceeding spatial and /or mass limitations, such as transformer and abnormal load crane, travelling on public roads pose a traffic danger to motorists. This can be mitigated by abnormal load transport vehicles operating under permit obtained by the transport carrier.
- The GRID crossing over D114 has potential for vehicle crashes resulting in death, disability, or injury. The GRID crossing can be mitigated by obtaining wayleaves for the crossing and exercise of appropriate traffic control involving advance warning / notification of the intended road closure, closing D114 during low traffic flow conditions when erecting GRID powerlines over D114 and providing a deviation/alternate bypass route, where feasible.

Operations Phase:

- The GRID will have a low trip generation over the 25 years operations phase and no impacts are identified for this phase.

Decommissioning Phase:

- The GRID will have a low trip generation over the decommissioning phase and no impacts are identified for this phase.

Cumulative Impact

- The cumulative traffic impact of planned construction of various GRID's within 35 km (within 5 km from the site) could coincide with the Boshoek GRID 1 construction. The cumulative trips are insignificant, and no mitigation impacts are identified for the cumulative development impact.

8. RECOMMENDATIONS

It is recommended that:

The traffic and transport related impacts of the proposed GRID construction, operations and decommissioning be mitigated as set out in this report.

9. SPECIALIST STATEMENT

Taking the above findings into consideration it can be concluded that the development of the Boshoek GRID 1 and associated infrastructure should not have undue detrimental impact on traffic and that identified impacts can be suitable mitigated.

It is the reasoned opinion of the specialist that the development of the Boshoek GRID 1 can be approved, from a traffic and transport engineering perspective, subject to the specific requirements / mitigation measures included within this report.

10.REFERENCES

1. TMH 16 Vol 1 & 2 South African Traffic Impact and Site Traffic Assessment Manual, August 2012, compiled by the Committee of Transport Officials (COTO)
2. South African Trip Generation Rates, Second Edition, Department of Transport – June 1995
3. Institute of Transport Engineers Trip Generation Manual 8th Edition
4. Committee of Transport Officials (COTO) TRH 11 - Dimensional and Mass Limitations and Other Requirements for Abnormal Load Vehicles (8th Edition 2010) as published by South African Department of Transport
5. An Innovative Approach to Structuring Environmental Impact Assessment Reports Part 2: Ranking the Significance of Environmental Aspects and Impacts By: T. Hacking Anglo American plc (Currently Environmental Manager at Konkola Copper Mines plc, Zambia)

ANNEXURE A – Curriculum Vitae

S Fautley
Abbreviated Curriculum Vitae

Profession
Traffic & Transportation Engineer

Current Position
Western Cape
Senior Transportation Engineer

Date and Place of Birth:
15 July 1961, Cape Town

Joined Techso:
2008

Nationality
South African

Academic Qualifications
NHD in Civil Engineering, Cape Technikon 1989

Professional Associations
The Engineering Council of South African (ECSA)

Specialisation
Traffic Engineering and Transportation Planning

Languages
Afrikaans, English

Appointments
- 1986– 1992: Principal Industrial and (1986 - 1991) Industrial Technician: Geometric Design: Provincial Administration: Western Cape
- 1993– 1994: Chief Industrial Technician: Mapping and Proclamations: Provincial Government: Western Cape
- 1994 – 1995: Chief Industrial Technician Regional Services: Provincial Government: Western Cape
- 1995 - 1996: Chief Industrial Technician, Urban Transportation: Provincial Government: Western Cape
- 1997 – 1998: Senior Technician, Kantey and Templer
- 1998 - 2006: Principal Technician: Traffic Engineering, City of Cape Town
- 2006 – 2008: Regional Head, Traffic Impact Assessments and Development Control, City of Cape Town
- 2008 - Senior Transportation Engineer, Techso

Contact Details
Phone: +27 (0) 21 5577730
Mobile: +27 (0) 84 300 7722
E-mail: steve@techso.co.za

Key Experience

Stephen is a traffic engineering technologist with 30 years of experience in traffic and transportation engineering. He has completed the Transportation Planning and Study Methodology course and the Highway Capacity course at the University of Stellenbosch. Stephen has been involved with civil, traffic and transportation engineering for ten (10) years at Provincial Government of the Western Cape, 1,5 years with Kantey and Templer Consulting Engineers and 10 yrs at local authority/city level and joined Techso in August 2008.

Traffic & Transportation:
- Transportation Planning
- Traffic Engineering
- Road Safety Audits

Projects:
- Local Traffic Engineering and Transportation Plans, such as Traffic Signal Design, Traffic Calming, Parking, Road Safety Audits, Road Design, Road Signs and Lane Marking for City of Cape Town.
- Developed Structure Parking Ramp Design Guidelines for the City of Cape Town.
- Project Management: Blaauwberg Road and Diep River Bridge Design, Milnerton
- Transport Systems Management Project Design and Implementation (City of Tygerberg & City of Cape Town)
- Technical Input to the City of Cape Town Kerbside Adjudication Bid Evaluation Committee.
- Project Management sub-consultant: City of Cape Town - Integrated Rapid Transport intersection and traffic signal design.
- Traffic Engineer sub-consultant: City of Cape Town - Conceptual design of Eastern Region non-motorised transport project
- Transport Impact Assessments – Commercial and Residential Developments, Schools, Gym, Hospital, Service Stations, Building lines, Sand-mines, Road Closures, Extensive housing development and road improvements
- Transportation Modelling – TIA for Windhoek Prime Ministers Offices
- Rustenburg Municipality – Integrated Rapid Transport System – AFC
- Ekhurleni Municipality – Integrated Rapid Public Transport Network – AFC and APTMS
- Nelson Mandela Bay Municipality – Integrated Public Transport System – AFC and APTMS
- Assessment of Road Safety Risk and Enforcement Measures -Various Municipal Area
- Traffic Management Plans - R21/2 in Gauteng – SANRAL
- Road Safety Audits – City of Cape Town - Integrated Rapid Transit Phase 1B, and R27 Reversible Bus lane, SANRAL- N1 in Polokwane
- Transport Studies – Input to Various Environmental Impact Assessment and Land Use Applications (residential developments, renewable energy plants, power stations, mines, industrial sites)
- **RESIDENTIAL / HOUSING:**
    - TIA – Erf 2900 Lotus River (58 Unit housing development - flats)
    - TIA – Rhodes square student accommodation Erf 31990 in Mowbray (600 units – for UCT students)
    - TIA – Campuskey Student Residence Erf 41665 in Rondebosch (536 units - for UCT students)
    - TIA – The Nest Student Residence and commercial development Erf 31993 in Rondebosch (for 610 units - for UCT students)
    - TIS Erf 309 – 44 Units flats Milnerton

ANNEXURE B – Specialist Declaration of Interest

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Proposed Construction of the Boshoek GRID 1 and associated infrastructure, near the town of Boshoek in the Northwest Province.

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Techso (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement recognition	18
Specialist name:	Stephen Mark Fautley			
Specialist Qualifications:	Civil Engineering Technologist			
Professional affiliation/registration:	Civil Engineering Council of South Africa (ECSA) Registration Number 200270171 South African Institute of Civil Engineers (SAICE) Registration Number 201500599 South African Road Federation (SARF) Membership Number 29			
Physical address:	13 Riverside Drive, Milnerton, Cape Town			
Postal address:	13 Riverside Drive, Milnerton, Cape Town			
Postal code:	7441	Cell:	0843007722	
Telephone:	NA	Fax:	NA	
E-mail:	steve@techso.co.za			

2. DECLARATION BY THE SPECIALIST

I, ___Stephen Mark Fautley________________________________, 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Techso (Pty) Ltd

Name of Company:

2024/02/29

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, ____Stephen Mark Fautley________________________________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Techso (Pty) Ltd

Name of Company

2024/02/29

Date

7165392-9
D. MTSOKOBA

Signature of the Commissioner of Oaths

2024 · 02 · 29

Date

SUID-AFRIKAANSE POLISIEDIENS
SAPS BRACKENFELL
29 FEB 2024
BRACKENFELL
SOUTH AFRICAN POLICE SERVICE

ANNEXURE C – Site Verification Report

Head Office, Pretoria
Tel: +27 (0)12 844 0008
info@techso.co.za
Box 35, Mark Shuttleworth Street, The Innovation Hub, 0087, South Africa
Suite L11, The Enterprise Building
Mark Shuttleworth Street, The Innovation Hub,
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Cape Town
Tel: +27 (0)21 557 7730
info@techso.co.za
PostNet Suite #21, Private Bag X3, Bloubergrant, 7443, South Africa
3 Aruma Road
Brackenfell
Cape Town, Western Cape, South Africa

smart solutions

My Ref: TJ2311
11 October 2023

ERM Southern Africa (PTY) LTD
1st Floor
Great Westerford
240 Main Road
Rondebosch
7700
South Africa

Attention: Anathi Manyakanyaka

Dear Madam

SITE SENSITIVITY VERIFICATION REPORT – PROPOSED CONSTRUCTION OF THE BOSHOEK GRID 1 AND ASSOCIATED INFRASTRUCTURE, NEAR THE TOWN OF BOSHOEK IN THE NORTHWEST PROVINCE

1. SITE SENSITIVITY VERIFICATION AND MINIMUM REPORT CONTENT REQUIREMENTS

In conducting the specialist assessment, the current use of the land and the environmental sensitivity of the site under consideration identified by the national web based environmental screening tool (screening tool), was confirmed by undertaking a site sensitivity verification, with reference to the screening tool (https://screening.environment.gov.za/screeningtool) with relevant information as provided by the Environmental Practitioner for the project.

It is confirmed that:

a) there is no specific environmental theme protocol prescribed for traffic engineering specialist assessments,
b) the required level of assessment based on the findings of the site sensitivity verification are in compliance with Regulation GNR 326 of 4 December, as amended 1 April 2017, Appendix 6
c) a site visit was conducted on 12 September 2023 to assess the site, road accesses and surrounding road network from a transport perspective.

2. SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS

The site sensitivity was assessed through the following:

a) desktop analysis, using satellite imagery (Google Earth), was undertaken prior to visiting the site.

Directors: Dr SJ Andersen Ms. MJ Mfeleng
Registration No [illegible]

b) a site visit was conducted on 2023/09/12 to assess the current farming operations and to consider environmental issues.

The outcome of the above is contained in this report, that:

a) confirms the current farming activity and the environmental sensitivity of the proposed Solar PV energy facility, from a traffic and transportation perspective is low.
b) contains a motivation and evidence (map, photographs) of the current and proposed renewable energy and environmental sensitivity (environmental impact risk assessment); and
c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations1 (EIA Regulations).

Yours faithfully

Stephen Fautley (Pr Tech Eng)
for Techso (Pty) Ltd
https://techsosmartsolutions-my.sharepoint.com/personal/steve_techso_co_za/Documents/TECHSO/Projects/Projects 2023/Rustenberg Solar/Boshoek 1 GRID/Boshoek 1 GRID - Site Verification - 20231011.docx

Directors: Dr SJ Andersen Ms. NJ Nilsberg
Registration No 2005/007820/07

ANNEXURE D – Contents of Specialist Report - Checklist

CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	**Section 4 & Annexure A**
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	**Annexure B**
(c) an indication of the scope of, and the purpose for which, the report was prepared;	**Sections 1 & 3**
(cA) an indication of the quality and age of base data used for the specialist report;	**Section 2 (see site visits)**
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	**Sections 2, Section 6.1, Section 6.2 Section 6.4.4**
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	**Section 2**
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	**Section 5**
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	**Section 5**
(g) an identification of any areas to be avoided, including buffers;	**NONE**
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	**Section 2 Fig 2.1**
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	**Section 6.2**
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	**Section 6.4**
(k) any mitigation measures for inclusion in the EMPr;	**Section 6.4**
(l) any conditions for inclusion in the environmental authorisation;	**Section 6.4 and Section 7 and Section 9**
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	**NA**
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	**Section 10**
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	**NA**
(p) any other information requested by the competent authority	**NA**
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	**NA**

forestry, fisheries
& the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002 Tel: +27 12 399 9000, Fax: +27 86 625 1042

SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE

Proposed Construction of the Boshoek GRID 1 and associated infrastructure, near the town of Boshoek in the Northwest Province.

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Traffic Assessment
Specialist Company Name	Techso (Pty) Ltd
Specialist Name	Stephen Mark Fautley
Specialist Identity Number	6107155175083
Specialist Qualifications:	Pr. Tech Eng.
Professional affiliation/registration:	ECSA 200270171
Physical address:	13 Riverside Drive, Milnerton, 7441
Postal address:	13 Riverside Drive, Milnerton, 7441
Postal address	Click or tap here to enter text.
Telephone	021 557 7730
Cell phone	084 300 7722
E-mail	steve@techso.co.za

SPECIALIST DECLARATION FORM – AUGUST 2023

2. DECLARATION BY THE SPECIALIST

I, Stephen Fautley declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

Techso (Pty) Ltd

Name of Company:

19 Aug 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Stephen Fautley_________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Click or tap here to enter text. Techso (Pty) Ltd

Name of Company

Click or tap here to enter text. 2024/08/19

Date

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Click or tap here to enter text.

Signature of the Commissioner of Oaths

Click or tap to enter a date.

Date

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Nkurenkuru

ECOLOGY & BIODIVERSITY

THE PROPOSED BOSHOEK SOLAR 1 ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE NEAR BOSHOEK, NORTH WEST PROVINCE

EIA:

TERRESTRIAL ECOLOGY (FAUNA, FLORA AND TERRESTRIAL BIODIVERSITY) STUDY AND IMPACT ASSESSMENT

Version: 1.0

Date: 28 June 2024

Authors:

Gerhard Botha
&
Jan-Hendrik Keet

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Authors: Mr. Gerhard Botha and Dr. Jan-Hendrik Keet

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I. DECLARATION OF CONSULTANT INDEPENDENCE

The consultants hereby declare that they:

» Are independent specialists in this application;
» Regard the information contained in this report as it relates to specialist input/study to be true and correct at the time of publication;
» Do not, and will not, have any financial interest(s) in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA Environmental Impact Assessment Regulations, 2014, and any specific environmental management Act;
» Do not, and will not, have any vested interest(s) in the proceedings of the proposed activities;
» Have disclosed, to the applicant, EAP, and competent authority(-ies), any information that have, or may have, the potential to influence the decision of the competent authority(-ies) or the objectivity of any report, plan, or document required in terms of the NEMA Environmental Impact Assessment Regulations 2014, and any specific environmental management Act;
» Are fully aware of, and meet, the responsibilities in terms of the NEMA Environmental Impact Assessment Regulations 2014 (specifically in terms of regulation 13 of GN No. R. 326), and any specific environmental management Act, and that failure to comply with these requirements may result in disqualification;
» Have provided the competent authority(-ies) with access to all necessary information at their disposal at the time of publication regarding the application, whether such information is favourable to the applicant or not; and
» Are aware that a false declaration is an offense in terms of regulation 48 of GN No. R. 326.

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June 2024

II. LIST OF ABBREVIATIONS

CARA:	Conservation of Agricultural Resources Act (Act 43 of 1983)
CBA:	Critical Biodiversity Area
CITES:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CR:	Critically Endangered (threat status)
DAFF:	Department of Agriculture, Forestry, and Fisheries (Now DFFE, *see below*)
DDD:	Data Deficient — Insufficient Information (threat status)
DDT:	Data Deficient — Taxonomically Problematic (threat status)
DEA:	Department of Environmental Affairs (Now DFFE, *see below*)
DFFE:	Department of Forestry, Fisheries, and the Environment
EIA:	Environmental Impact Assessment: EIA regulations promulgated under section 24(5) of NEMA and published in Government Notice R. 543 in Government Gazette 33306 of 18 June 2010
EN:	Endangered (threat status)
EO:	Environmental Officer
ESA:	Ecological Support Area
EW:	Extinct in the Wild (threat status)
EX:	Extinct (threat status)
FEPA:	Freshwater Ecosystem Priority Area
IAPs:	Invasive Alien Plant species
IUCN:	International Union for Conservation of Nature
LC:	Least Concern (threat status)
MAL:	Maximum Acceptable Loss
MAP:	Mean Annual Precipitation
MAT:	Mean Annual Temperature
NE:	Not Evaluated (threat status)
NEM:BA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEMA:	National Environmental Management Act (Act 107 of 1998)
NFA:	National Forest Act 1998 (No. 84 of 1998)
NFEPA:	National Freshwater Ecosystem Priority Areas; identified to meet national freshwater conservation targets (CSIR, 2011)
NT:	Near Threatened (threat status)
POSA:	Plants of southern Africa (online database)
QDGC:	Quarter Degree Grid Cell
RE:	Regionally Extinct (threat status)
RLE:	Red List of Ecosystems for South Africa

SANBI: South African National Biodiversity Institute

SoCC: Species of Conservation Concern

VegMap: National Vegetation Map of Southern Africa, Lesotho, and Swaziland (as per Mucina and Rutherford, 2006, with subsequent updates, e.g., 2018).

VU: Vulnerable (threat status)

III. LIST OF DEFINITIONS

Alien (also called "exotic"): A species occurring outside its natural distribution range. Often originating from another country or continent, the term is commonly used to describe plants not indigenous to South Africa, and which have become problematic (e.g., spreading rapidly and threatening existing biodiversity). Note that this concept is, however, based on political, rather than ecological bounders. The latter is preferred. "Alien" is used interchangeably with "exotic.

Bare soil: Soil surface devoid of vegetation and unaltered by humans.

Biodiversity: The diversity (richness and abundance) of plant and animal species occurring in their natural environment (habitats). The term encompasses different ecosystems, landscapes, communities, populations, and genes, as well as the ecological processes that allow these elements to persist over time.

Biome: A broad ecological spatial unit representing major life zones of large natural areas, and defined mainly by vegetation structure, climate, and major large-scale disturbance factors (e.g., fire) (Mucina and Rutherford, 2006).

Climax: The vegetation type or plant community structure at the end of the seral cycle. Climax communities may, or may not, be the final endpoint of succession: frequent or even rare events, such as fire, frost, harvesting, or hurricanes, may indefinitely hold communities in a stable subclimax.

Conservation: The safeguarding of biodiversity and its processes (often referred to as "Biodiversity Conservation").

Connectivity: The measure of how connected or spatially continuous a corridor, network, or matrix is. For example, a forested landscape (the matrix) with fewer gaps in forest cover (open patches) will have higher connectivity

Corridors: Have important functions as strips of a landscape differing from adjacent land on both sides. Habitat, ecosystems or undeveloped areas that physically connect habitat patches. Smaller, intervening patches of surviving habitat can also serve as "steppingstones" that link fragmented ecosystems by ensuring that certain ecological processes are maintained within and between groups of habitat fragments.

Cumulative Impacts: The total impact arising from the project (under the control of the developer), other activities (that may be under the control of others, including other developers, local communities, government) and other background pressures and trends which may be unregulated. The project's impact is therefore one part of the total cumulative impact on the environment. The analysis of a project's incremental impacts combined with the effects of other projects can often give a more accurate understanding of the likely results of the project's presence than just considering its impacts in isolation (BBOP).

Degraded Habitat/Land: Land that has been impacted upon by human activities (including introduction of invasive alien plants, light to moderate overgrazing, accelerated soil erosion, dumping of waste), but still retains a degree of its original structure and species composition (although some species loss would have occurred) and where ecological processes still occur (albeit in an altered way). Degraded land is capable of being restored to a near-natural state with appropriate ecological management.

Disturbance: An event that significantly alters the pattern of variation in the structure or function of a system, while fragmentation is the breaking up of a habitat, ecosystem, or land-use type into smaller parcels. Disturbance is generally considered a natural process.

Ecosystem: The combination of biota within a given area, together with a suitable environment that sustains the biota and their interactions. It can have a spatial unit of any size, but shows some degree of homogeneity as far as structure, function, and species composition is concerned. Small-scale ecosystems typically link up to large-scale ecosystems, and both contribute to ecosystem functioning and services at the landscape-scale.

Ecological Function: How each of the elements in the landscape interacts based on its life cycle events [Producers, Consumers, Decomposers Transformers]. Includes the capacity of natural processes and components to provide goods and services that satisfy human needs, either directly or indirectly.

Ecosystem Goods and Services: The goods and benefits mankind obtains from natural ecosystems. Various ecosystem types provide a range of ecosystem goods and services. For example, aquatic ecosystems, such as rivers and wetlands, provide forage for livestock, grazing or sedges for craft production, and services such as pollutant trapping and flood attenuation. They also provide a habitat for a range of aquatic biota.

Ecological Pattern: The contents and internal order of the landscape, or its spatial (and temporal) components. May be homogenous or heterogenous. Result from the ecological processes that produce them.

Ecological Process: Includes Physical processes [Climate (precipitation, insolation), hydrology, geomorphology]; Biological processes [Photosynthesis, respiration, reproduction]; Ecological processes [Competition, predator-prey interactions, environmental gradients, life histories].

Ecological Processes: Ecological processes typically only function well where natural vegetation remains, and where the remaining vegetation is well-connected with other nearby patches of natural vegetation. Loss and fragmentation of natural habitat severely threatens the integrity of ecological processes. Where basic processes are intact, ecosystems are likely to recover more easily from disturbances or inappropriate actions if the actions themselves are not permanent. Conversely, the more interference there has been with basic processes, the greater the severity (and longevity) of effects. Natural processes are complex and interdependent, and it is not possible to predict all the consequences of loss of biodiversity or ecosystem integrity. When a region's natural or historic level of diversity and integrity is maintained, higher levels of system productivity are supported in the long run and the overall effects of disturbances may be dampened.

Ecological Rehabilitation: The process of assisting the recovery of a degraded or damaged ecosystem in a trajectory that aims to render the ecosystem fully functional, stable, and able to develop further, but not necessarily returning to the original, historical state.

Ecological Restoration: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed, in a trajectory that ultimately returns the ecosystem to its natural successional stage.

Ecological Structure: The composition, or configuration, and the proportion of different patches across the landscape. Relates to species diversity, the greater the diversity, the more complex the structure. A description of the organisms and physical features of environment including nutrients and climatic conditions.

Endemic: Refers to a species, or a specific vegetation type, that is naturally restricted to a particular, usually small, region (not to be confused with indigenous). A plant or animal species may, for example, be endemic to South Africa, in which case it occurs naturally anywhere in the country, or endemic only to a specific geographical area within the country, and is then restricted only to that area.

Ephemeral: Refers to the life-form of an annual plant that makes occasional appearances in favourable seasons.

Exotic: See Alien.

Forb: A plant without secondary xylem/thickening (i.e., non-woody or herbaceous), usually living for only one or two seasons.

Function/functioning/functional: Used here to describe natural ecosystems working or operating in a healthy way, as opposed to being dysfunctional and working poorly or in an unhealthy way.

Geophyte/-ic: Pertaining to a plant with underground storage organs such as bulbs, corms, tubers, or rhizomes, and which resprouts during the growing season, while completely dying back aboveground during the dormant season.

Graminoid: Pertaining to a herbaceous growth form characterised by a "grass-like" appearance (e.g., tufted growth, usually long and narrow leaves, secondary root system). Examples include grasses (Poaceae), restios (Restionaceae), sedges (Cyperaceae), and rushes (Juncaceae).

Habitat: The general features of an area, inhabited by animals and/or plants, which are essential to their survival (i.e., the natural "home" of a plant or animal species).

Indigenous: Refers to a species that occurs naturally within a specific, though generally large, area. "Indigenous" is used interchangeably with "native".

Infrastructure: This can either specifically or generally refer to any developmental processes, whether permanent or temporary. Examples include, but are not limited to, buildings, roads, wind turbines, solar panels, batching plants, bridges, parking areas for vehicles, storage areas for equipment, and fences, among other things.

Intact: Used here to describe a natural environment that is not seriously damaged, and which functions properly.

Invasive Plant: A plant which has been declared as invasive under NEM:BA, and includes all propagules of the plant (seeds and any vegetative parts capable of reproducing asexually).

Land Type: Map unit denoting land over which a marked uniformity of climate, terrain form, soil, and vegetation exists. These are usually mapped based upon satellite imagery.

Landscape: Consists of a mosaic of two or more ecosystems that exchange organisms, energy, water, and nutrients.

Mitigate/Mitigation: Mitigating impacts refers to reactive practical actions that minimize or reduce *in situ* impacts. Examples of mitigation include "changes to the scale, design, location, siting, process, sequencing, phasing, and management and/or monitoring of the proposed activity, as well as restoration or rehabilitation of sites". Mitigation actions can take place anywhere, as long as it reduces site effects where a change in ecological character is likely, or the values of the site are affected by those changes (Ramsar Convention, 2012).

Rehabilitation: in an EIA context, repairing a habitat/ecosystem for functional processes and productivity maintenance. The original habitat/ecosystem condition might not necessarily be fully restored (in contrast to "restoration"). Rehabilitation is easier than restoration — especially if the pre-impacted ecological state was pristine — since the aim is not necessarily reversion to the pre-impacted ecological state. Compare with "restoration".

Risk: A prediction of the likelihood and impact of an outcome; usually referring to the likelihood of a variation from the intended or desired outcome.

Restoration: in an EIA context, recovering/restoring a degraded or destroyed habitat/ecosystem to its pre-impacted ecological state, that is, prior to the activity/action that caused the degradation or destruction. This is more difficult to achieve than "rehabilitation", especially if the pre-impacted ecological state was pristine. Compare with "rehabilitation".

Soil Erosion: A natural process whereby the ground level is lowered by wind or water action, and may occur as a result of, among other things, chemical processes and/or physical transport on the land surface.

Species Richness: The number of species occurring within a delimited area, for example, a plot or vegetation/land type. Species richness does not include individual abundance.

Succession: A series of stages in which different plants and animals colonise an area following some kind of disturbance. The final stage of succession is called the "climax", but various disturbances may prevent the vegetation from attaining its potential climax.

Threat Status: Threat status (of a species or community type) is a simple but highly integrated indicator of vulnerability. It contains information about past loss (of numbers and/or habitat), the number and intensity of threats, and current prospects as indicated by recent population growth or decline. Any one of these metrics could be used to measure vulnerability. One much-used example of a threat status classification system is the IUCN Red List of Threatened Species (BBOP, 2009).

Threatened Ecosystem: In the context of this document, this refers to Critically Endangered, Endangered, or Vulnerable ecosystems.

Topsoil: Uppermost soil layer; in natural vegetation maximally 30 cm deep; in cultivated landscapes the total depth of cultivation, containing a layer of humus, seeds, and nutrients. Topsoil applied to landscapes requiring rehabilitation must be free of refuse, large roots and branches, stones, alien weeds, and/or any other agents that would adversely affect the topsoil's suitability for revegetation.

Transformation: The conversion of a specific ecosystem or land use type to a different ecosystem or land use type.

Turnover: Turnover related to the concept of "unique species", or species unique to specific areas/types/plots, and is a measure of community compositional change — that is, beta diversity. Specifically, the beta diversity of specific areas can differ between each other in the components of turnover and nestedness (Baselga, 2013, 2010a, 2010b). A high species turnover indicates that species are replaced on going from one area to another (high number of unique biodiversity), whereas a low turnover (also termed high nestedness) indicates that species form subsets of a larger community when going from one area to another (low number of unique biodiversity).

Watercourse: A river or spring, or a natural channel in which water flows regularly or intermittently, or a wetland, lake, or dam into which, or from which, water flows; any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks (National Water Act, 1998).

Weed: A plant that grows where it is unwanted; it can, therefore, be either indigenous or alien.

Wetland: Refers to land which is transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports, or would support, vegetation typically adapted to life in water saturated soil (National Water Act, 1998).

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1. INTRODUCTION

1.1. Applicant

Boshoek Solar 1 (Pty) Ltd.

1.2. Project

The project will be known as Boshoek Solar 1, and the entire study area with its collection of sites will generally be referred to either as the "study area" or the "study site".

1.3. Proposed Activity

Boshoek Solar 1 (Pty) Ltd proposes the establishment of a solar photovoltaic (PV) cluster (including associated grid connection and infrastructure) near Boshoek, in the North West Province (Figure 1 and **Error! Reference source not found.**).

The facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 150 MW. The development area is situated approximately 33 km north west of Rustenburg within the Rustenburg Local Municipality and the Bojanala District Municipality, in the North West Province.

The development area for the PV facility and associated infrastructure will be located on the following properties:

Farm Name	Farm No.	Portion No.
Boshoek Solar 1 PV Facility		
Farm Rhenosterdoorns	531	0
Farm Zwaarverdiend	234	1
Boshoek Solar 1 PV Grid Connection		
Zwaarverdiend 234 JP	234	18
Paul Bodenstein Landgoed 571 JG	571	RE
Elandsfontein 102 JG	102	1
Onderstepoort 98 JG	98	RE

The project is planned as part of a larger cluster, which includes two additional PV facilities (Boshoek Solar 2 and Boshoek Solar 3) up to 150 MW and 50 MW respectively.

An assessment area of approximately 290 ha is being assessed as part of this EIA process and the infrastructure associated with the 150 MW facility includes:

- PV modules (mono- or bifacial) and mounting structures;
- Inverters and transformers;
- Battery Energy Storage System (BESS);
- Site access road;
- Internal access roads;
- Auxiliary buildings (switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Temporary and permanent laydown area; and
- Grid connection infrastructure, including:
    - Underground medium-voltage cabling between the project components and the facility substation;
    - Up to 132kV facility substation;
    - Switching station;
    - A single circuit 132 kV power line from the switching station to the future planned Eskom collector switching station ~3.5 km north-east of the site.

The EA applications for the solar facility and grid connection infrastructure are being undertaken simultaneously as the proposed infrastructure is co-dependent, i.e., one will not be developed without the other.

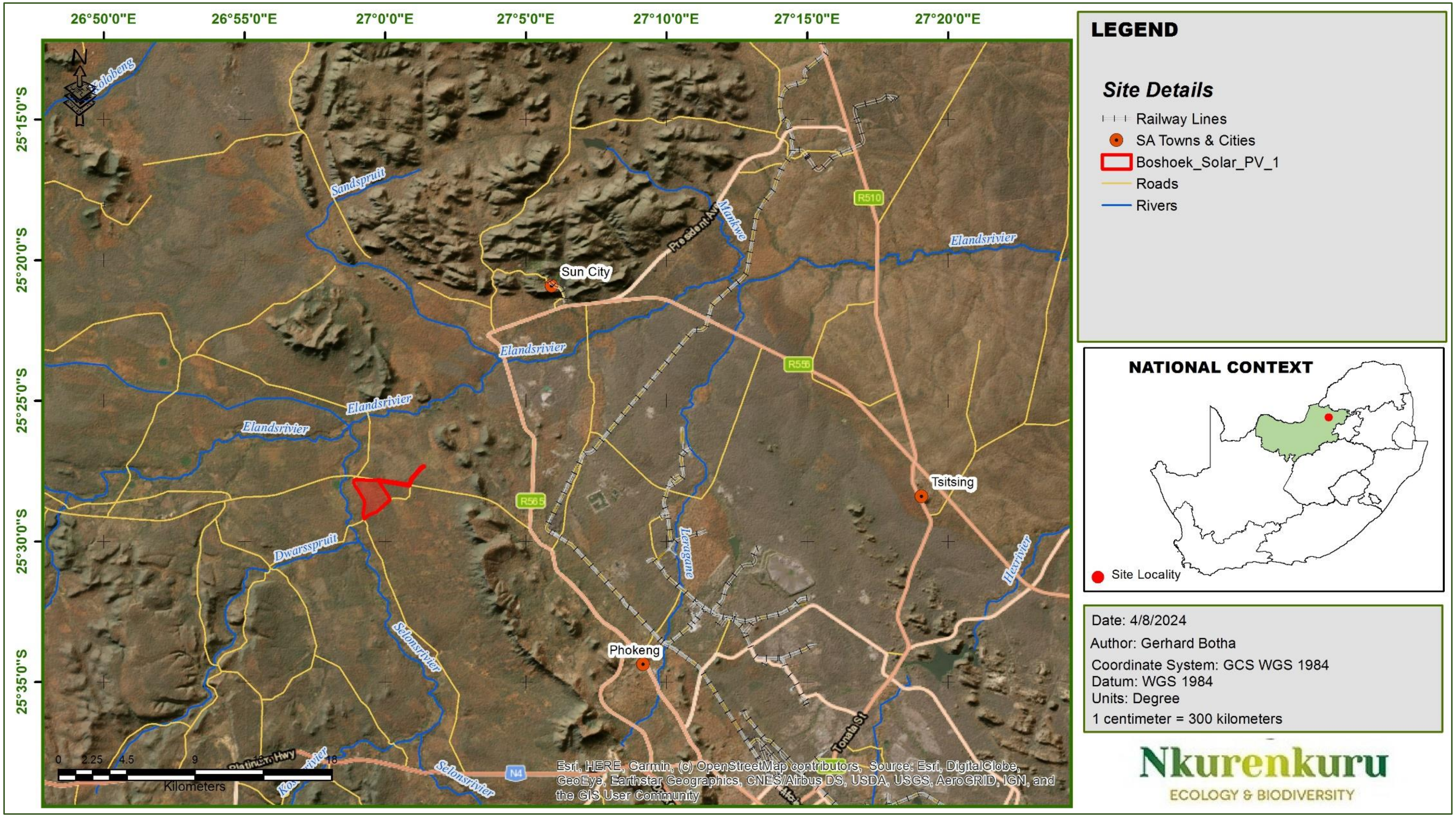

Figure 1: Locality of the project site earmarked for the development of the Boshoek Solar 1 facility, west of Boshoek and north-west of Phokeng in the North West Province.

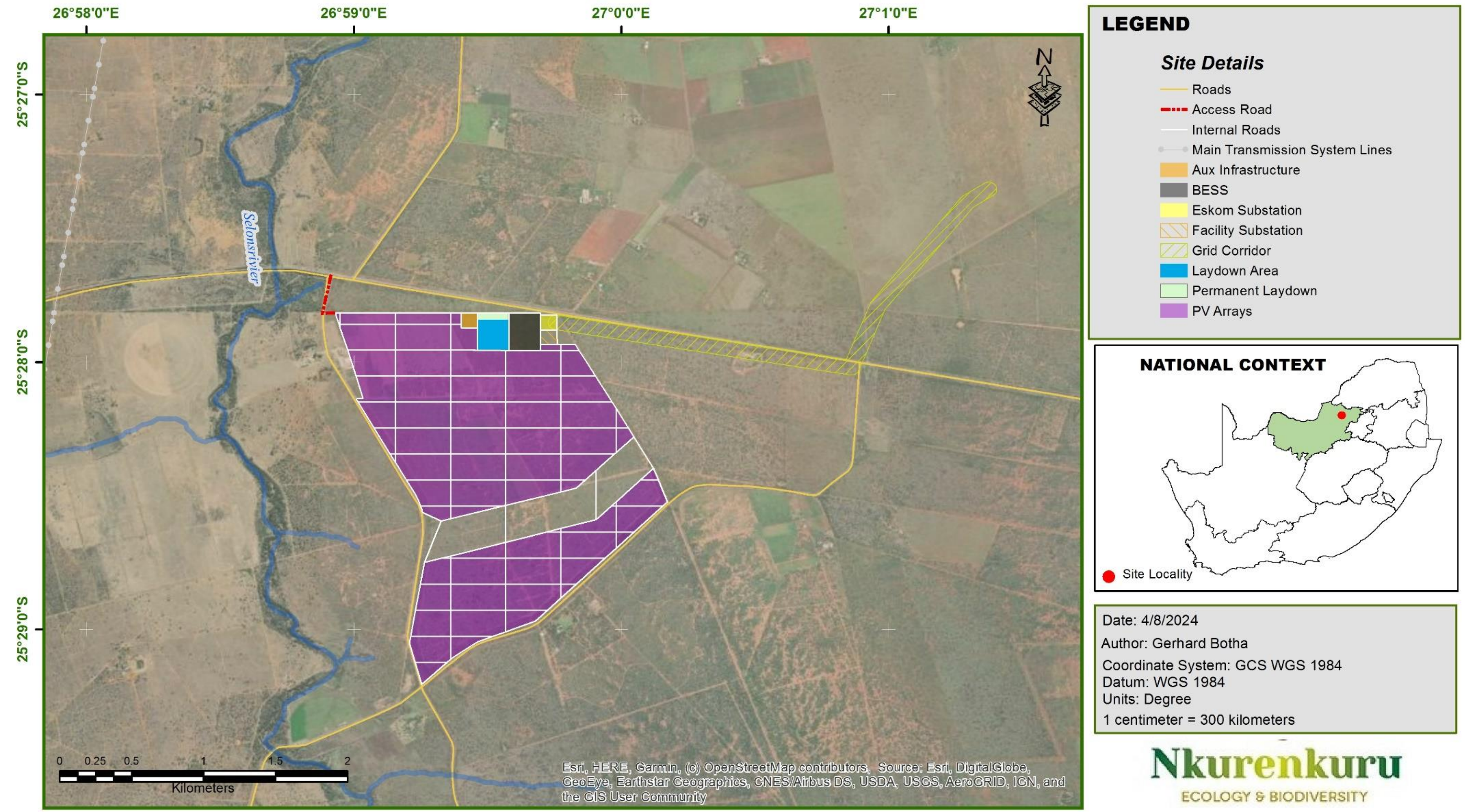

Figure 2: Locality of the project site earmarked for the development of the Boshoek Solar 1 facility, west of Boshoek and north-west of Phokeng in the North West Province. This map is specifically zoomed in to give a higher resolution.

1.4. Terms of Reference (ToR)

To conduct a detailed site terrestrial biodiversity sensitivity and impact assessment, including the following:

- » Desktop analysis;
- » On-site investigation;
- » Detailed compilation of a terrestrial ecological impact assessment report which adheres to the following (this list is not exhaustive):
    - The report will be compiled to fulfil the requirement for a Terrestrial Biodiversity Assessment as per the Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of NEMA (GNR 320), as gazetted on 20 March 2020.
    - This report is undertaken as supporting information as part of a greater environmental application process and is compliant in terms of the requirements in the above regulations in terms of Terrestrial Biodiversity.
    - In terms of the Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of sections 24(5)(a) and (h) and 44 of NEMA, gazetted on 30 October 2020, relating to requirements relating specifically to the Terrestrial Plant and Animal (species) themes, this report includes these requirements.
    - Identification of any discrepancies with the environmental sensitivity as identified on the national web based environmental screening tool;
    - Refine / confirm the delineation of CBAs;
    - Identification of sensitive areas to be avoided (including corresponding spatial data);
    - Identification of sensitive species (Species of Conservation Concern and Protected Species) that occur on site;
    - An assessment of all potential impacts associated with the development, including impact significance ratings;
    - Recommendations regarding potential development areas for solar PV within the project site (including acceptable footprint limit); and
    - Recommendations regarding the scope and timeframe for further assessment.

1.5. Conditions of this Report

All findings, recommendations, and conclusions provided in this report are based on the author(s) best scientific and professional knowledge, as well as information available at the time of compilation. This report, or any part or form thereof, may not be amended or extended in any way without the prior written consent of the author(s). Any recommendations, statements, or conclusions drawn from, or based on, this report, must clearly cite or make reference to this report. Whenever such recommendations, statements, or conclusions form part of another report, whether main or other, relating to the current investigation, this report must be included in its entirety.

1.6. Relevant Legislation

The following legislation was taken into account whilst compiling this report:

1.6.1. Provincial

The Transvaal Nature Conservation Ordinance (No. 12 of 1983) in its entirety, with special reference to:

- Schedule 2: Protected Game
- Schedule 3: Specially Protected Game
- Schedule 4: Protected Wild Animals
- Schedule 5: Wild Animals
- Schedule 7: Invertebrates
- Schedule 11: Protected Plants
- Schedule 12: Specially Protected Plants

The Bophuthatswana Nature Conservation Act (Act 3 of 1973) in its entirety, with special reference to:

- Schedule 1: Protected Game
- Schedule 1A: Specially Protected Game
- Schedule 2: Ordinary Game
- Schedule 3: Wild Animals in Respect Of Which The Provision Of Section 3 (a) (ii) Apply
- Schedule 4: Wild Animals To Which The Provisions Of Section 4 (1) (b) Do Not Apply
- Schedule 7: Protected Plants
- Schedule 7: Specially Protected Plants

The above-mentioned Nature Conservation Acts are regarded by North West Provincial Legislature, as the legally binding provincial document, providing regulations, guidelines, and procedures for the sustainable utilisation of wild animals, aquatic biota and plants, the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, and also, the general conservation of flora and fauna, and the destruction of problematic (vermin and invasive) species.

1.6.2. National

» National Environmental Management Act / NEMA (Act No 107 of 1998), and all amendments and supplementary listings and/or regulations.

- Environmental Conservation Act (ECA) (No 73 of 1989) and amendments.
- National Environmental Management: Biodiversity Act / NEM:BA (Act No. 10 of 2004) and amendments.
- National Forest Act 1998 / NFA (No 84 of 1998).
- National Veld and Forest Fire Act (Act No. 101 of 1998).
- Conservation of Agricultural Resources Act / CARA (Act No. 43 of 1983) and amendments.

1.6.3. International

- Convention on International Trade in Endangered Species of Fauna and Flora (CITES; https://cites.org/eng).
- The Convention on Biological Diversity (CBD; https://www.cbd.int/).
- The Convention on the Conservation of Migratory Species of Wild Animals (CMS; https://www.cms.int/).

2. METHODOLOGY

2.1. Terrestrial Potential Area of Influence (PAOI)

The proposal is to develop a solar PV facility on site, along with associated infrastructure. Anticipated impacts will mostly occur during the construction phase, with few discernible effects anticipated during operation. These impacts are not expected to extend beyond the boundaries of the infrastructure footprint within the study area. The PAOI for terrestrial biodiversity is therefore treated here as the development footprint within which direct impacts will occur (Figure 2). For the powerline, a corridor approximately 100 m wide is assumed, but real impacts will only occur at the footprint of each tower structure, as well as within any service road that is established.

One impact that could possibly extend beyond the study area boundary is water runoff, which usually results in hydrological changes to drainage areas and their associated habitats. Due to the dense vegetation coverage, especially graminoids, as well as the flat topography of the area (slope <1%), it is unlikely that a change in runoff will impact an extensive area outside of the development footprint, and as such the potential area of influence for this impact are thus the development footprint as well as a buffer area of 200m, downslope of the development footprint.

2.2. Assessment Approach and Philosophy

This terrestrial biodiversity assessment and report has been undertaken as per the requirements of the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation (GN 320, 20 March 2020). It also follows the most up to date *Guidelines for* *the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa* (South African National Biodiversity Institute, 2020), as well as the *Ecosystem Environmental Assessment Guideline: Draft* (http://opus.sanbi.org/jspui/handle/20.500.12143/7624).

The assessment was furthermore conducted according to the 2014 EIA Regulations, as amended on 7 April 2017.

This includes adherence to the following broad principles:

» That a precautionary and risk-averse approach be adopted towards projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas, namely: Critical Biodiversity Areas (as identified by systematic conservation plans, Biodiversity Sector Plans, or Bioregional Plans) and Freshwater Ecosystem Priority Areas.
» Demonstrate how the proponent intends on complying with the principles contained in section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), which, amongst other things, indicates that environmental management should, in order of priority, aim to:
  - Avoid, minimise, or remedy disturbance of ecosystems and loss of biodiversity;
  - Avoid environmental degradation;
  - Avoid jeopardising ecosystem integrity;
  - Pursue the best practical environmental option by means of integrated environmental management;
  - Protect the environment as the people’s common heritage;
  - Control and minimise environmental damage; and
  - Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic, or stressed ecosystems.

These principles serve as guidelines for all decision-making concerning matters that may affect the environment. As such, it is incumbent upon the proponent(s) to show how proposed activities would comply with these principles and thereby contribute towards the achievement of sustainable development as defined by NEMA.

To adhere to the above principles and best-practice guidelines, the basis for the study approach and assessment philosophy included baseline data collection, desktop studies, and site walkovers/field surveys of the property, describing:

» The broad botanical characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of patterns, the following were studied:

Community and ecosystem level:

- The main vegetation types and plant communities (Dayaram et al., 2018; Mucina and Rutherford, 2006), their aerial extents, and interaction with neighbouring types, soils, or topography.
- Threatened or Vulnerable ecosystems (cf. new South African vegetation map/National Spatial Biodiversity Assessment1, fine-scale systematic conservation plans, etc.) (South African National Biodiversity Institute, 2019).

Species-level:

- Species of Conservation Concern (SoCC: Red List and protected species), giving GPS location, if possible (Raimondo et al., 2009).
- Estimated population sizes and viabilities of SoCC present on site (including, if possible, the degree of confidence in prediction based on availability of information and specialist knowledge; i.e., High = 70 – 100% confident, Medium = 40 – 70% confident, Low = 0 – 40% confident).
- Probability of other SoCC occurring in the region of the site (include degree of confidence).

Other pattern issues:

- Any significant landscape features, or rare or important vegetation associations, such as seasonal wetlands, alluviums, seeps, sandstone outcroppings, steep southern aspects, drainage lines, etc., in the vicinity.
- The extent of alien plant cover within the site, and whether any infestations are the result of prior disturbance, for example ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than an infestation of undisturbed sites).
- The condition of the site in terms of current or previous land uses.

In terms of process, the following was studied:

- The key ecological “drivers” of ecosystems in the study area and its vicinity.
- Any mapped spatial components of ecological processes that may occur in the study area or its vicinity (i.e., corridors such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and vegetation boundaries such as edaphic interfaces, upland-lowland interfaces, or biome boundaries).
- Any possible changes in key processes e.g., increased fire frequency or drainage/artificial recharge of aquatic systems.

If any further studies may be required during or after the EIA process, they will be outlined, together with all relevant legislation, permits, and standards that would apply to the development.

The opportunities and constraints for development is described and shown graphically on an aerial photograph, satellite image, or map delineated at an appropriate level of spatial accuracy.

2.3. Data Exploration and Review

Data sources from the literature and GIS spatial information were consulted and used where necessary, and include the following (see Figure 3 for the area used to compile a plant species list, and

Table 1 for a summary):

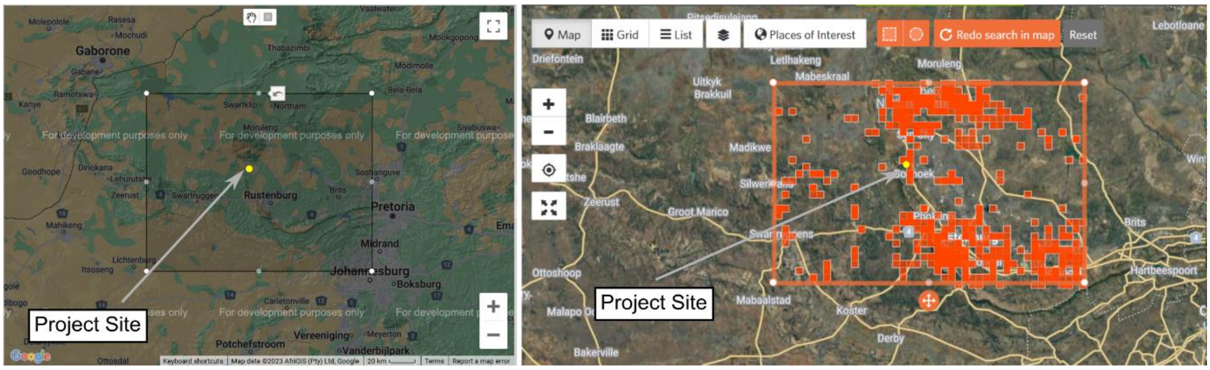

Figure 3: The area used to extract data from POSA (left) and iNaturalist (right). Extracted data was used to compile a list of plant species that may potentially occur within the study area, as well as the surrounding area, and provide an indication of potential Species of Conservation Concern that may be found within this area.

Vegetation:

- South African National Vegetation Map (Mucina and Rutherford, 2006) and National List of Threatened Ecosystems (2011): vegetation types and their respective conservation statuses. The latest version of the National Vegetation Map was also consulted to check for any updates of the respective regions (Dayaram et al., 2018; South African National Biodiversity Institute, 2018).
- Botanical Database of Southern Africa (BODATSA), hosted by the South African National Biodiversity Institute (SANBI; https://posa.sanbi.org; also referred as POSA: Plants of Southern Africa). The area used is a much larger area than required and is a conservative approach ensuring that all species possibly occurring within the study area have been represented. It also accounts for the fact that the study area itself might not be well represented in national databases.
- Threatened Species Programme, Red List of South African Plants (Version 2017.1; http://redlist.sanbi.org/): The IUCN conservation statuses of all listed species were extracted from this database.
- iNaturalist: this is a comprehensive online platform (https://www.inaturalist.org/) to which numerous citizen scientists contribute distribution records of biodiversity, mostly in the form of photos. Although many of the users are not professional botanists, various recognized botanical experts from across the globe assist in accurate species identification, and the platform is therefore an invaluable source of information regarding biodiversity. Nevertheless, to ensure a higher data reliability (i.e., only relevant/accurate records), the following parameters were used to extract records for this project: Quality Grade = "Research"; Identifications = "most agree"; Captive / Cultivated = "no". Records were specifically extracted from a very large area surrounding the actual proposed development site.

Ecosystem:

- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment (NFEPA; Nel et al., 2011). This includes rivers, wetlands, and catchments defined in the study area.

- » Important catchments and protected area expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES; Government of South Africa, 2008).
- » Critical Biodiversity Areas for the site and surroundings (obtained from SANBI Biodiversity GIS (BGIS).

Fauna:

The list of mammal and herpetofauna species predicted to occur in the region, and their respective likelihood of occurrence within the study area, was generated based on known distributions and habitat suitability from online and literature sources such as MammalMap, ReptileMap, FrogMap, and the ReptileAtlas, as well as field guides such as, Skinner & Chimimba (2005), Apps (ed. 2012), Stuart & Stuart (1998), Bates *et al* (2014), Minter *et al*. (2004), Branch (2009), and Du Preez and Carruthers (2009). The literature study focussed on querying online databases to generate species lists for the relevant Quarter Degree Squares (QDS).

The predicted list is typically heavily influenced by factors other than distribution or biome type. Factors such as habitat suitability, current land use, current levels of disturbance, and structural integrity of the habitats all influence the potential for predicted species to occur in the vicinity of the study area. A high likelihood thus exists that not all mammal species known to occur within the region will be located within the study area and surrounding areas. Therefore, a 'Likelihood of Occurrence' (LOO) and a 'Species of Conservation Concern' review will be applied to any potential omissions in the data set. For the LOO analysis, a full summary of Red List faunal species (IUCN, 2021); (SANBI, 2021), as well as other SCC will be tabulated, with a LOO applied.

LOO will be based upon available spatial imagery, and more specifically:

- » Habitat suitability;
- » Overlap with known distributions;
- » Rarity of the species; and
- » Current Impacts.

Mammal distribution data were obtained from the following sources:

- » The Mammals of the Southern African Subregion (Skinner & Chimimba, 2005);
- » The 2016 Red List of Mammals of South Africa, Lesotho and Swaziland (www.ewt.org.za) (EWT, 2016);
- » Animal Demography Unit (ADU) - MammalMap Category (MammalMap, 2017) (mammalmap.adu.org.za);
- » Stuarts' Field Guide to Mammals of Southern Africa – Including Angola, Zambia & Malawi (Suart & Stuart, 2015)
- » A Field Guide to the Tracks and Signs of Southern, Central and East African Wildlife (Stuart & Stuart, 2013).

» Smither's Mammals of Southern Africa (Apps, ed. 2012)

Herpetofauna distribution and species data were obtained from the following sources:

» South African Reptile Conservation Assessment (SARCA) (sarca.adu.org);
» A Guide to the Reptiles of Southern Africa (Alexander & Marais, 2007);
» Field guide to Snakes and other Reptiles of Southern Africa (Branch, 1998);
» Atlas and Red list of Reptiles of South Africa, Lesotho and Swaziland (Bates et al.,
» 2014);
» A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009);
» Animal Demography Unit (ADU) - FrogMAP (frogmap.adu.org.za);
» Atlas and Red Data Book of Frogs of South Africa, Lesotho and Swaziland (Mintner et
» al., 2004); and
» Ensuring a future for South Africa's frogs (Measey, 2011).

Table 1: Information and data coverages used to inform the ecological assessment.

	Data/Coverage Type	Relevance	Source
Biophysical Context	**Colour Aerial Photography**	Desktop mapping of habitat/ecological features	National Geo-Spatial Information (NGI)
	Latest Google Earth™ imagery	To supplement available aerial photography	Google Earth™ On-line
	1:50 000 River Line (GIS Coverage)	Highlight potential on-site and local rivers and wetlands and map local drainage network.	CSIR (2011)
	National Land-Cover	Shows the land-use and disturbances/transformations within and around the impacted zone.	DEA (2015)
	South African Vegetation Map (GIS Coverage)	Classify vegetation types and determination of reference primary vegetation	Mucina & Rutherford (2012; 2018); Dayaram et al., 2018
	NFEPA: river and wetland inventories (GIS Coverage)	Highlight potential on-site and local rivers and wetlands	CSIR (2011)
Conservation and Distribution Context	**National Biodiversity Assessment – Threatened Ecosystems** (GIS Coverage)	Determination of national threat status of local vegetation types	SANBI (2011)
	North West Biodiversity Sector Plan: Critical Biodiversity Areas (GIS Coverage)	Determination of provincial terrestrial/freshwater conservation priorities and biodiversity buffers	SANBI (2016)
	SANBI's PRECIS (National Herbarium Pretoria Computerized Information System) electronic database	Determination of plant species composition within the region as well as potential conservation important plants.	http://posa.sanbi.org
	Red Data Books (Red Data Lists of Plants)	Determination of endangered and threatened plants,	Red List of South African Plants (2011); http://redlist.sanbi.org/
	Animal Demography Unit	Compilation of a species list.	Apps (ed.) 2012
	Smither's Mammals of Southern Africa	Compilation of a species list.	Skinner & Chimimba (2005)
	The Mammals of the Southern African Subregion	Compilation of a species list.	Branch (1998)
	Field guide to snakes and other reptiles of southern Africa	Compilation of a species list.	Apps (ed.) 2012

2.4. Botany: Methods Followed during Assessment

The survey periods occurred from 27th to the 29th of March 2023 (early autumn) and from 23rd to 24th of January 2024 (summer) (refer to Figure 5 for GPS Tracks). During the site visits the vegetation was in optimal survey conditions; and the majority of plants were easily identifiable. According to the BRAHMS online database, the optimal botanical survey period for the savanna biome is between October and April and may even slightly extend into May (Figure 4), and as such these surveys occurred within the suggested optimal survey period and the current condition of the vegetation surveyed did not pose a limitation that would influence the outcome of this study.

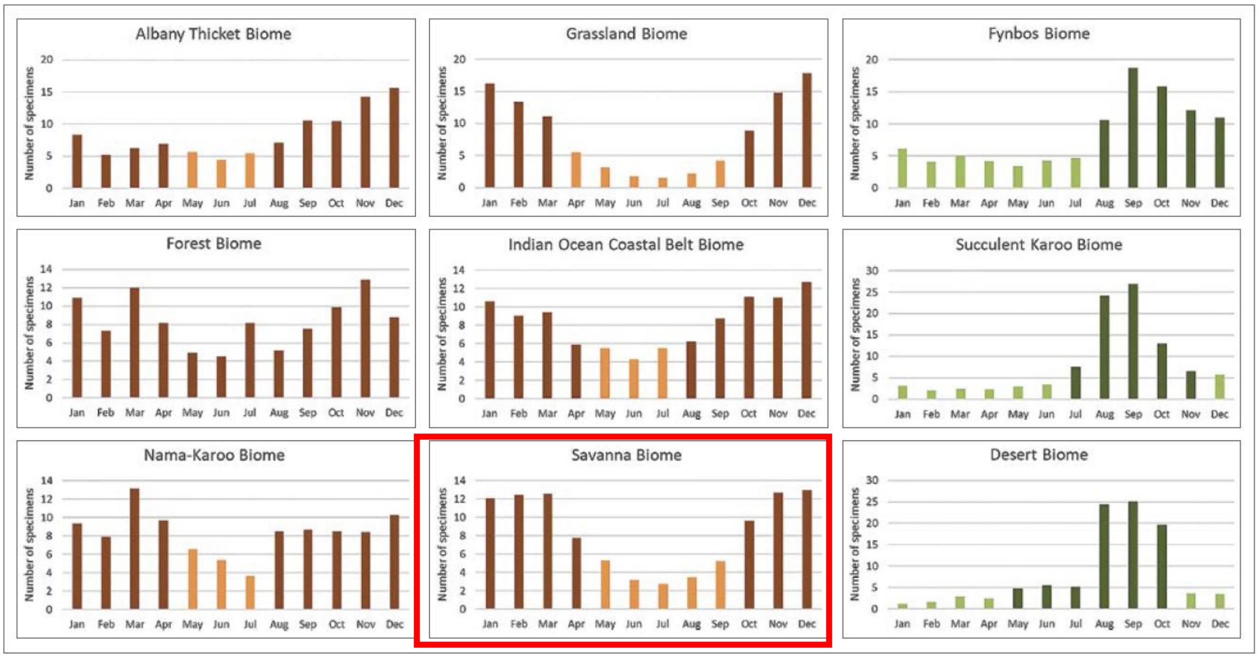

Figure 4: Recommended survey periods for different biomes (Species Environmental Assessment Guidelines). The site is within the Grassland Biome.

A Garmin eTrex Touch 35 GPS was used to log the tracks and are illustrated in Figure 5.

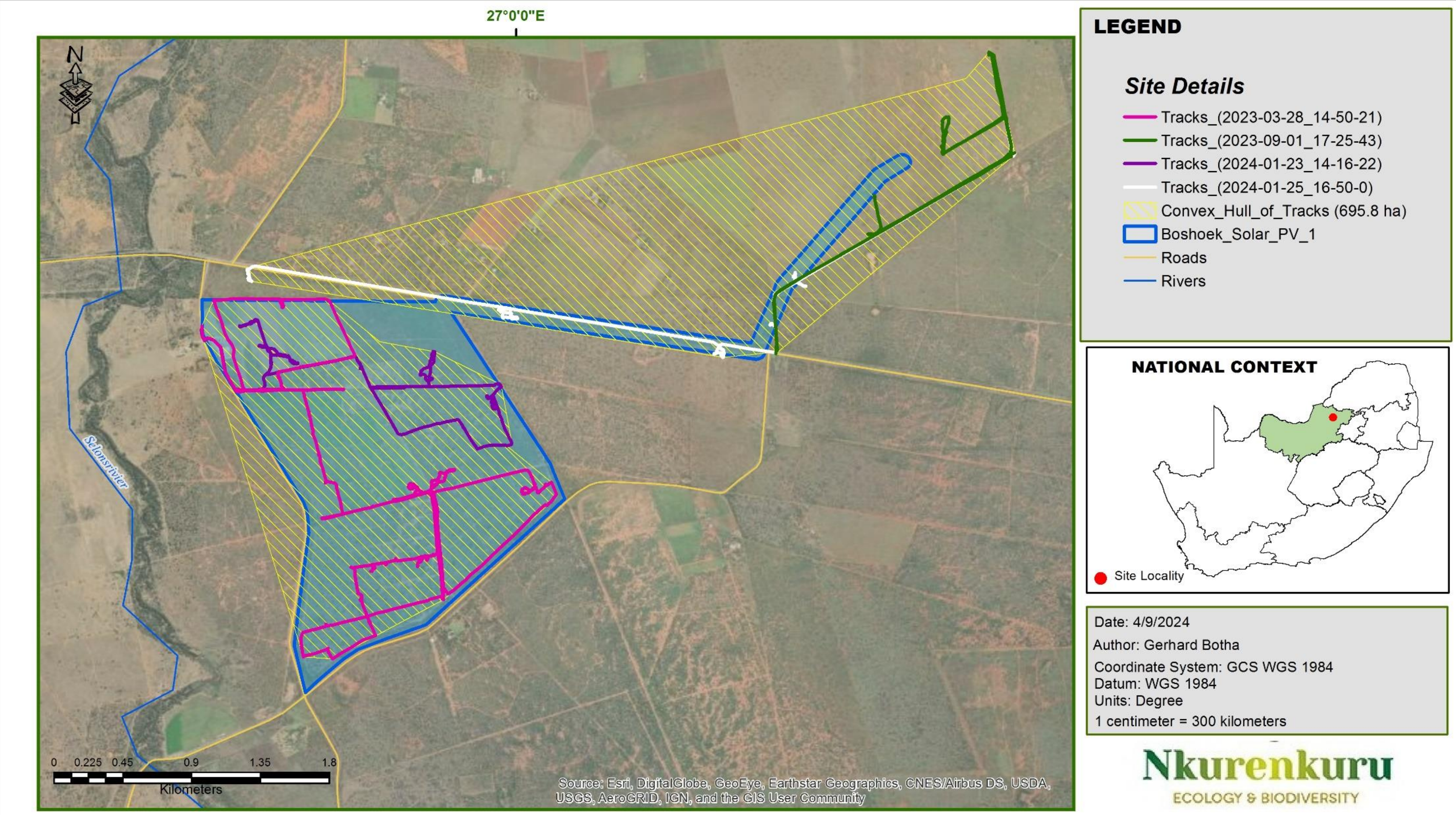

Figure 5: Tracks (relative to the project site) that were recorded during the various site visits.

Surveying was done within specifically targeted areas that were perceived as ecologically distinct and/or sensitive based on the results obtained from the desktop assessment of plant community types. This was to optimize coverage and to perform a rapid, but efficient, vegetation and ecological assessment at each survey area.

The botanical assessment was conducted by surveying fixed-point plots of sufficient size within each community type, which were also supplemented with timed meanders within the respective community types. The combination of single fixed-point plots, supplemented with timed random meanders, are highly efficient for conducting floristic analyses. This allows plant species coverages and SoCC occurrences to be rapidly estimated, as well as the compilation of adequate plant species lists, thereby giving a prompt indication of botanical diversity. Other useful observations were also recorded within each community type, examples of which include ecological condition and current impacts (examples of which could include the presence of invasive alien plant species, livestock grazing, degree of erosion, etc.), general vegetation density and physiognomic characteristics, habitat notes, and the presence of any sensitive features (e.g., wetlands, seepages, and drainage lines) where applicable. Finally, any opportunistic observations were also made while surveying.

The equipment used during surveying included a Canon EOS D7 MarkII DSLR camera with an EFS Canon 18-55mm lens (as well as a Canon EFS 150 – 300mm zoom lens), a Garmin E-Trex Touch GPS (accuracy: 4 - 5 m), Leica 10x42 Ultravid HD-Plus Binoculars to scan for any useful observations.

The inspection was conducted by a combination of vehicle surveying (with regular stops) and walking to assess the plant communities present. A Garmin® GPS was used to log any special features, SoCC, or other important observations. All plants observed at the various stops were recorded, with attention given to observing the potential presence of SoCC.

The aims were to:

- Inspect the various habitats, vegetation, and landscapes present at the study area, and to correlate such observations with the results of the desktop study.
- Identify all observed species recorded within the study area.
- Provide a list of Species of Conservation Concern (SoCC; i.e., protected and Red List species).
- Note the presence of sensitive habitats, for example drainage lines and unique edaphic environments.

Aspects of biodiversity used to guide the interpretation and assessment of the study area are summarized in Table 2.

Table 2: Summary of the different aspects of biodiversity considered in the assessment of the study area.

Intrinsic / Ecological Values
Species-Level Aspects of Biodiversity
» Protected plant species; » Threatened plant species (Red List); » Keystone species performing a key ecological role; » Large or congregatory species populations; » Endemic species or species with restricted ranges; » Previously unknown species.
Community and Ecosystem-Level Aspects of Biodiversity
» Distinct or diverse communities or ecosystems; » Unique ecosystems; » Locally adapted communities or assemblages; » Species-rich or diverse ecosystems; » Communities with a high proportion of endemic species or species with restricted ranges; » Communities with a high proportion of threatened and/or declining species; » The main uses and users of the area and its ecosystem goods and services: important ecosystem services, valued ecosystem goods, valued cultural areas.
Landscape-Level Aspects of Biodiversity
» Key ecological processes (e.g., seed dispersal, pollination, primary production, carbon sequestration); » Areas with large congregations or species and/or breeding grounds; » Migration routes/corridors; » Importance as a link or corridor to other fragments of the same habitat, to protected, or threatened, or valued biodiversity areas; » Importance and role in the landscape with regards to arrangement of spatial components of ecological processes, comprising processes tied to fixed physical features (e.g., soil or vegetation interfaces, river or sand movement corridors, upland-lowland interfaces) and flexible processes (e.g., upland-lowland gradients and macro-climatic gradients), as well as important movement or migration corridor for species.

2.5. Fauna: Methods followed during Field Sampling and Assessment

The survey periods occurred from 27th to the 29th of March 2023 (early autumn) and from 23rd to 24th of January (summer) (refer to Figure 5 for GPS Tracks). Conditions for the faunal survey were regarded as acceptable.

For faunal habitat surveying, surveys were done within specifically targeted areas that were perceived as ecologically distinct and/or sensitive based on the results obtained from the desktop assessment of plant community- and distinct landscape/geomorphological types. This was to optimize coverage and to perform a rapid, but efficient, faunal habitat and ecological assessment at each survey area.

The equipment used during surveying included a Canon EOS D7 MarkII DSLR camera with an EFS Canon 18-55mm lens (as well as a Canon EFS 150 – 300mm zoom lens), a Garmin E-Trex Touch GPS (accuracy: 4 - 5 m), Leica 10x42 Ultravid HD-Plus Binoculars to scan for any useful observations, thirty 24MP Prime Low Glow Bushnell CameraTraps/FieldCamers.

Likelihood of Occurrence

There is a high likelihood that not all mammal species known to occur within the study area and surrounding areas will be located during the survey. Therefore, a 'Likelihood of Occurrence' (LOO) and a 'Species of Conservation Consideration (SCC)' review was applied to any potential omissions in the data set. For the LOO analysis, a full summary of Red List mammals (IUCN, 2017), as well as other SCC was tabulated, with a LOO applied. The relevant species of special consideration were addressed separately based on the data collected during fieldwork, in the context of development and the effects on the species (both ecologically and spatially).

Likelihood of Occurrences are based upon:

- Habitat suitability;
- Overlap with known distributions;
- Rarity of the species; and
- Current Impacts.

Spoor Tracking

Spoor tracking enabled detailed sampling of mammalian species without the need for trapping or direct observation. All spoor, including footprints, den sites, burrows, hairs, scrapings, and diggings were recorded and documented by detailed geo-referenced photography. Spoor tracking was performed during general fieldwork, during specific timed spoor tracking drives/transects, and at carefully chosen locations such as roads and other areas with highly trackable substrates. In addition, all camera trap sites (see below) were subjected to spoor tracking.

Scat (animal faecal matter) and Pellets (carnivore regurgitations)

Scats and pellets, namely those from small predators and owls, have proven highly efficacious for the identification of rodent populations inhabiting a designated research site. This methodology hinges upon the examination of intact or regurgitated jawbones, which are subsequently cross-referenced against established reference specimens housed at the University of Pretoria for precise species determination. Notably, this approach offers a valuable adjunct to traditional Sherman trapping methods. During routine fieldwork, a total of two jackal scats were opportunistically collected.

Direct Observations (Daytime)

All mammals observed during the sampling period, their geographic coordinates and the surrounding habitat were recorded. This data was used to supplement the overall habitat analysis to give context to the area. Animals were encountered through driving, normal routine movement through the study area and active searching of refugia.

Roadkill

All mammals observed dead on the roads were examined, geo-referenced and catalogued. Dead mammals were only recorded either on the farm itself or within major road arteries in the area of influence (i.e., R59).

Herpetofaunal Assessment:

Due to the limited time available for the field survey, no trapping was performed in order to maximise prime active searching time by eliminating the need to install, service, and dismantle the traps. Instead, the survey aimed to focus on intensive active searching.

Active Searching

Herpetofauna were searched for on foot within the study area. Specific habitat types were selected, beforehand, where active sampling was intentionally focused (point samples). The habitats of these point samples were also described and photographed. Active searching for reptiles occurred for approximately 30 minutes per point sample and involved:

» Photographing active reptiles from a distance with a telephoto lens (300 m telephoto lens);
» Lifting up and searching under debris, rocks, or logs (rocks and logs were always returned to their original positions);
» Scanning for any signs of reptiles such as shed skins, the positive identification of which was taken as an observation of that species; and
» Catching observed reptiles by hand. All captured reptiles were photographed and released unharmed.

For amphibian species, positive identification of acoustic signals (males call to attract females) were also used as a means of identifying amphibians.

Opportunistic Sampling

Reptiles, especially snakes, are incredibly elusive and difficult to observe. Consequently, all possible opportunities to observe reptiles were taken in order to augment the standard sampling procedures described above. As a result, other participating biodiversity specialists assisted through opportunistically taking photographs of reptiles and amphibians within the study area. These images were copied for proper identification and added to the list of random observations unless a specific location of the observation was provided.

2.6. Assessing Species of Conservation Concern

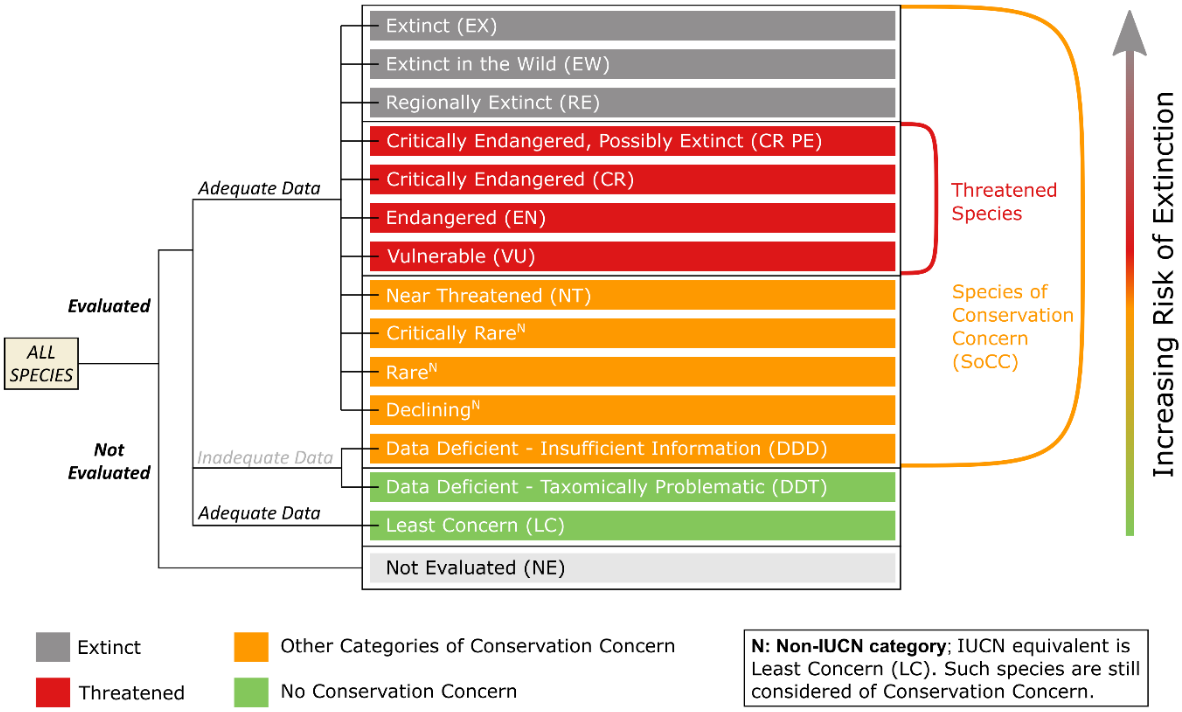

Figure 6: Red List categories used in this report as delineated according to SANBI's Red List of South African Plants (version 2020; http://redlist.sanbi.org/redcat.php).

Species of Conservation Concern (SoCC) are taxa (plants or animals) that have a significant conservation importance in terms of preserving South Africa's high biological diversity.

SoCC[1] have a high conservation importance in terms of preserving South Africa's high floristic diversity, and include threatened species (CR, EN, and VU), as well as NT or DD, and also includes range-restricted species which are not declining and are nationally listed as "Rare" or "Extremely Rare" (also referred to in some Red Lists as Critically Rare; see Figure 6) (South African National Biodiversity Institute, 2020). Note that SANBI divides the IUCN category DD into "Data Deficient: Insufficient Information (DDD)", and "Data Deficient: Taxonomically Problematic (DDT)". When SoCC occur in a proposed development site or PAOI, the proposed activities could impact them and result in significant biodiversity loss — the loss of SoCC populations might either increase the extinction risk of the respective species, or might even contribute toward their extinction.

[1] Note that all South African plants have been assessed (i.e., assigned a red list category, or "redlisted") by the Red List of South African Plants. Therefore, using the terms "redlist" or "red list" specifically for Threatened or other conservation concern species is not accurate (even though it remains popular). The term "Species of Conservation Concern" (or SoCC) is preferable, or "Threatened" where applicable.

As such, it is very important to note that a permit must be obtained from the relevant local authorities to destroy or relocate any SoCC (or even protected species).

A population of an SoCC occurring on a proposed development area serves to indicate that the proposed activities could result in significant biodiversity loss. The loss of such subpopulations will either increase the species' extinction risk, or may even contribute to its extinction. A description of the different SANBI Red List categories (http://redlist.sanbi.org/) is provided by Table 3.

Table 3: South African Red List Categories for Species of Conservation Concern (adapted from http://redlist.sanbi.org/redcat.php).

Present State			
Species of Conservation Concern (SoCC)		Extinct (EX)	A species is Extinct when there is no reasonable doubt that the last individual has died. Species are classified as Extinct only after exhaustive surveys throughout the species' known range have failed to record an individual.
		Extinct in the Wild (EW)	A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside of its natural and historical range.
		Regionally Extinct (RE)	A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
	Threatened Species	Critically Endangered, Possibly Extinct (CR PE)	Possibly Extinct is a special tag associated with the category Critically Endangered, for species that are highly likely to be extinct, but exhaustive surveys required for classifying the species as Extinct have not yet been completed. A small chance remains that such species may still be rediscovered.
		Critically Endangered (CR)	A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
		Endangered (EN)	A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
		Vulnerable (VU)	A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
		Near Threatened (NT)	A species is Near Threatened when available evidence indicates that it almost meets any one of the IUCN criteria for Vulnerable, and is, therefore, likely to become at risk of extinction in the near future.
		Critically Rare [non-IUCN]	A species is Critically Rare when it is known to occur at a single site, but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
		Rare [non-IUCN]	A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat, and does not qualify for a category of threat according to one of the five IUCN criteria.
		Declining	A species is Declining when it does not meet or almost meet any one of the five IUCN criteria, and does not qualify for Critically Endangered, Endangered, Vulnerable, or Near Threatened, but there are threatening processes causing a continuing decline of the species.
		Data Deficient – Insufficient Information	A species is DDD when there is inadequate information to make an assessment of its extinction risk, but the species is well defined. Listing of species in this category indicates that more information is required and that future research

		(DDD) [non-IUCN]	could show that a threatened classification is appropriate.
Other		Data Deficient – Taxonomically Problematic (DDT) [non-IUCN]	A species is DDT when taxonomic problems hinder its distribution range and habitat from being well defined so that an assessment of risk of extinction is not possible.
		Least Concern (LC)	A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.
		Not Evaluated (NE)	A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed and given a national Red List status. However, some species included in Plants of southern Africa: an Online Checklist, are species that do not qualify for national listing because they are naturalized aliens, hybrids (natural or cultivated), or synonyms. These species are given the status Not Evaluated and the reasons why they have not been assessed are included in the assessment justification.

SoCC likely to occur in the various habitats of the study area were assessed at a desktop level using the outputs of POSA and iNaturalist. This information was used to identify potential habitats in the study area that could support these SoCC. Special attention was given to the identification of any Threatened species, as well as suitable habitats for Threatened species, observed during field investigations.

2.7. Ecological Mapping

Mapping was done via available Google-Earth Satellite Imagery. Due to the intricate mosaics and often gradual mergers of vegetation units, generalisations were made and delineations are therefore approximate. Mapped units thus indicate potential dominant vegetation, but smaller vegetation types invariably exist within dominant units, and could not be mapped separately. The latter would require a supervised classification of georeferenced raw SPOT or similar satellite imagery (with full reflectance data), which was not available for this project due to a limited budget. Although supervised classification of georeferenced raw SPOT or similar satellite imagery was not conducted due to budget constraints, it's essential to highlight that the analysis and classification methods employed within this study maintain a high standard. The conducted analyses are comprehensive, detailed, and robust enough to yield informed findings, make sound decisions, and provide reliable recommendations. The absence of supervised classification does not compromise the quality or integrity of the study's outcomes. Maps were created with QGIS (version 3.20).

2.8. Terrestrial Site Ecological Importance (SEI)

The most current site sensitivity methodology, namely the Site Ecological Importance (SEI), was also followed here, as proposed by the *Guidelines for the implementation of* *the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa* (South African National Biodiversity Institute, 2020).

The different plant community types within the study area were delineated and identified based on field observations and satellite imagery. These plant community types were assigned SEI categories based on various factors, such as ecological integrity, conservation value, functionality, ecosystem processes, and the presence/absence of SCC, among other things.

Specifically, SEI is a function of two factors (Figure 7):

» The Biodiversity Importance (BI) of the receptor (e.g., SoCC, the vegetation/fauna community, or habitat type) and
» Receptor Resilience (RR; the resilience of the receptor to impacts).

BI is in turn a function of Conservation Importance (CI; the importance of a site for supporting biodiversity features of conservation concern that are present) and the Functional Integrity (FI; the receptors' current ability to maintain its structure and functions, compared to its known or predicted state under ideal conditions) of the receptor.

BI and SEI are both calculated using respective risk matrices. BI, FI, and RR categories are all circumscribed by various criteria (see Table 4, Table 5, and Table 6). The various criteria per category may be applied in combination or in isolation. See Figure 7 for guidelines on interpreting the resulting SEI categories. SEI is usually evaluated per plant community type / vegetation type.

Step 1 Functional Integrity (FI) + Conservation Importance (CI) = Biodiversity Importance (BI)

Conservation Importance (CI)

Functional Integrity (FI)	Very High	High	Medium	Low	Very Low
Very High	Very High	Very High	High	Medium	Low
High	Very High	High	Medium	Medium	Low
Medium	High	Medium	Medium	Low	Very Low
Low	Medium	Medium	Low	Low	Very Low
Very Low	Medium	Low	Very Low	Very Low	Very Low

Step 2 Receptor Resilience (RR) + Biodiversity Importance (BI) = Site Ecological Importance (SEI)

Biodiversity Importance (BI)

Receptor Resilience (RR)	Very High	High	Medium	Low	Very Low
Very Low	Very High	Very High	High	Medium	Low
Low	Very High	Very High	High	Medium	Very Low
Medium	Very High	High	Medium	Low	Very Low
High	High	Medium	Low	Very Low	Very Low
Very High	Medium	Low	Very Low	Very Low	Very Low

Site Ecological Importance (SEI): Very High, High, Medium, Low, Very Low

Step 3

SEI	Interpretation in Relation to Proposed Development Activities
Very High	Avoidance mitigation — no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation — changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation — development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation — development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation — development activities of medium to high impact acceptable and restoration activities may not be required.

Figure 7: Calculations, scores, process, and guidelines for calculating and interpreting Site Ecological Importance (SEI) categories (South African National Biodiversity Institute, 2020).

Table 4: Details regarding Conservation importance (CI) categories (South African National Biodiversity Institute, 2020).

Conservation Importance	Fulfilling criteria
Very high	• Confirmed or highly likely occurrence of CR, EN, VU, or Extremely Rare or Critically Rare species that have a global EOO of < 10 km^2. • Any area of natural habitat of a CR ecosystem type or large area or > 0.1% of the total ecosystem type extent of natural habitat of EN ecosystem type. • Globally significant populations of congregatory species (> 10% of global population).
High	• Confirmed or highly likely occurrence of CR, EN, or VU species that have a global EOO of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. • Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type. • Presence of Rare species. • Globally significant populations of congregatory species (> 1% but < 10% of global population).
Medium	• Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals. • Any area of natural habitat of threatened ecosystem type with status of VU. • Presence of range-restricted species. • > 50% of receptor contains natural habitat with potential to support SCC.
Low	• No confirmed or highly likely populations of SCC. • No confirmed or highly likely populations of range-restricted species. • < 50% of receptor contains natural habitat with limited potential to support SCC.
Very Low	• No confirmed and highly unlikely populations of SCC. • No confirmed and highly unlikely populations of range-restricted species. • No natural habitat remaining.

Table 5: Details regarding Functional Integrity (FI) categories (South African National Biodiversity Institute, 2020).

Functional Integrity	Fulfilling criteria
Very high	• Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. • High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. • No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing).
High	• Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. • Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. • Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g., ploughing) and good rehabilitation potential.
Medium	• Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. • Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. • Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	• Small (> 1 ha but < 5 ha) area. • Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. • Several minor and major current negative ecological impacts.
Very Low	• Very small (< 1 ha) area. • No habitat connectivity except for flying species or flora with wind-dispersed seeds. • Several major current negative ecological impacts.

Table 6: Details regarding Receptor Resilience (RR) categories (South African National Biodiversity Institute, 2020).

Receptor Resilience	Fulfilling criteria
Very high	• Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	• Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	• Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	• Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very Low	• Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

2.9. Impact Assessment Methodology

The impact assessment methodology is in accordance with the recently revised 2014 EIA regulations (as specified within the protocols for the applicable themes) and is based on the significance ranking approach as described by Hacking. The significance of environmental impacts is a function of the present environmental aspects that are to be impacted on, the probability of an impact occurring, and the consequence of such an impact occurring before, and after, implementation of proposed mitigation measures.

The determination and ranking of the importance of environmental factors can be achieved by evaluating the criteria outlined in Table 7. In certain instances, conducting an impact assessment may be required to establish the significance of a specific factor. Consequently, a reasonable amount of iteration is an integral part of the assessment procedure.

The process of identifying and prioritizing aspects primarily serves as a screening procedure, aiming to exclude aspects with minimal potential for causing significant impacts. Aspects categorized as "high" or "moderate" are considered significant, necessitating a thorough assessment of their potential impacts. On the other hand, aspects rated as "low" are not deemed worthy of further scrutiny.

When determining the significance of these aspects, it's crucial to base the ranking on the assumption that the recommended management practices outlined in the Environmental Impact Assessment (EIA) will be in place. This assumption reflects the scenario the project proponent intends to have considered for approval. Additionally, it's essential to identify the environmental aspects linked to the proposed project activities across various phases, such as construction, operation, and closure where applicable. The assessment should also consider how different project alternatives might influence the significance of these aspects.

While it may be advantageous to conduct a ranking exercise without assuming any management practices, as it highlights the sensitivity of key risk areas to management decisions and priorities, it presents a dilemma. Deciding on the extent of management to include in this scenario is challenging. For instance, in the case of a mining project, should one assume the complete absence of a tailings dam or merely poor operation? A general guideline is to presume that all the management required for operational purposes will be in place, while any management specifically dedicated to environmental control will be absent. However, it's important to note that presenting a ranking scenario without any management in an EIA report may not align with the scenario the project proponent seeks approval for.

Table 7: Criteria used to determine the significance of environmental aspects.

Significance Ranking	Negative Aspects	Positive Aspects
H **(High)**	Will always/often exceed legislation or standards. Has characteristics that could cause significant negative impacts.	Compliance with all legislation and standards. Has characteristics that could cause significant positive impacts.
M **(Moderate)**	Has characteristics that could cause negative impacts.	Has characteristics that could cause positive impacts.
L **(Low)**	Will never exceed legislation or standards. Unlikely to cause significant negative impacts.	Will always comply with all legislation and standards. Unlikely to cause significant positive impacts.

The significance of environmental impacts is to be assessed by means of the criteria of nature (descriptive), extent (scale), duration, magnitude (severity), probability (certainty), and direction (negative, neutral, or positive). Summarized briefly:

NATURE (IMPACT DESCRIPTION)		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced[2].		
Low	Localised	The impact will only affect the area within the site boundary.
Medium	Local/district	Will affect a fairly widespread area (local) beyond the site boundary.
High	Province/regional/national	Will affect the entire province or region. Widespread, far beyond the site boundary.
PROBABILITY		
This describes the chance of occurrence of an impact.		
Low	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
Medium	Possible to Probable	The impact may or will likely occur (Between a 25% to 70% chance of occurrence).
High	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).

[2] Where the severity of an impact varies with distance, the severity should be determined at the point of compliance or the point at which sensitive receptors will be encountered. This position corresponds to the spatial extent of the impact.

DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
Low	Short term	Quickly reversible. The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for a period less than the project life (typically for a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years)).
Medium	Medium term	Reversible over time. The impact will continue for the duration of the project life.
High	Long term	The impact and its effects will last beyond site closure or even risk being permanent.
SEVERITY		
The severity of an environmental impact refers to the extent and degree of harm or adverse changes that a particular activity, project, or event can cause to the environment. It encompasses the magnitude of the negative effects on ecosystems, natural resources, human health, and overall environmental quality. Assessing the severity helps in understanding and prioritizing the potential consequences and determining appropriate mitigation measures to minimize harm and promote sustainable practices.[3]		
Bio-physical Environment (Ecology and Biodiversity)	Low	Disturbance of areas that are degraded, have little conservation value or are unimportant to humans as a resource. Minor change in species variety or prevalence.
	Medium	Disturbance of areas that have some conservation value or are of some potential use to humans. Complete change in species variety or prevalence.
	High	Disturbance of areas that are pristine, have conservation value or are an important resource to humans. Destruction of rare or endangered species.
CONSEQUENCE		
The consequence of impacts can be described by considering the severity, spatial extent and duration of the impact. Having ranked the severity, duration and spatial extent, the overall consequence of impacts can be determined using the following qualitative guidelines:		

[3] Only the severity of impacts on the biophysical environment, and more specifically the ecological and biodiversity aspects pertaining to the biophysical environment, will be addressed during this assessment. The severity of impacts on aquatic/wetland drivers, functions and services will be addressed within a separate assessment.

Severity			Low (L)			Medium (M)			High (H)		
Spatial Scale			L	M	H	L	M	H	L	M	H
Duration	Long Term	H	M	M	M	M	H	H	H	H	H
	Medium Term	M	L	L	M	M	M	H	M	M	H
	Short Term	L	L	L	M	L	M	M	M	M	H

Significance
The significance of the impacts associated with the significant aspects can be determined by considering the risk: Significance of Environmental Impact (Risk) = Probability x Consequence Subsequently, the overall significance of impacts can be determined using the following qualitative guidelines:

CONSEQUENCE			Low (L)	Medium (M)	High (H)
PROBABILITY	Definite/Continuous	H	M	M	H
	Possible/Frequent	M	M	M	H
	Unlikely/Seldom	L	L	L	M

1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

2.10. Assumptions and Limitations

This report deals exclusively with a specifically defined area (the potential area of influence or the "study area"), and the impacts upon plant and animal biodiversity and natural ecosystems in that area. As such:

- All relevant project information provided by the applicant and/or Environmental Impact Assessment practitioner(s) to the biodiversity specialist(s) was assumed to be correct and valid at the time that it was provided.
- Probably the most significant potential limitation associated with the methodology is the narrow temporal window of sampling.

Temporal variation plays an important role in the structure and patterns of plant biodiversity, communities, and species occurrences. One site visit might, therefore, not fully catalogue plant species diversity in an area (for example, due to seasonal vegetation variation). The site was surveyed in a dry period, and outside of the peak flowering season. However, most plants were easily identifiable. Thus, the vegetation of the area was likely reasonably well documented.

Nevertheless, some annual, short-lived, ephemeral (plants surviving unfavourable conditions as seeds), geophytic (species with underground storage organs), or other cryptic species might not have been observed/detected. For example, some plant species of the families Amaryllidaceae, Colchicaceae, Eriospermaceae, Hyacinthaceae, Hypoxidaceae, Iridaceae, and Orchidaceae, among others, are known to completely die back during certain times of the year, depending on respective life strategies. Thus, during these times such species remain unobservable/undetectable and survive only as dormant bulbs, corms, tubers, or rhizomes below the soil surface. Together with this, rare and threatened plant species are generally uncommon and/or localised, and can easily be overlooked. Even multiple site visits might therefore fail to locate such species.

Furthermore, flowers and fruits are crucial for the complete and accurate identification of plant species, and any absence of such flowers and fruits might prevent the complete and accurate identification of such plant species. Flowering and fruiting times are species specific, and there are invariably always some plant species not flowering and/or fruiting during surveying. This not only impacts identifiability, but also detectability/visibility.

Finally, in principle, it is impossible to survey any area to its full extent, both physically and temporally. The total number of plant species recorded in any area is, therefore, almost always an underestimate of the potential number of species that could occur in such an area.

Considering all of the aforementioned, the author(s) declare a gap in knowledge as to: the potential presence of plant species that might not have been observed/detected on site during the time of surveying, as a result of their potential annual, short-lived, dormant, cryptic, or ephemeral nature, their rare and localised distributions on site, or the incomplete and inaccurate identification of plant species which lacked flowers and/or fruits and/or other characteristic features. A list of SoCC known to occur in the study area (as per SANBI online databases) was used to supplement the list of species recorded during the survey(s). This final combined list is likely sufficiently conservative and cautious to account for the aforementioned study limitations.

3. THE IMPORTANCE OF BIODIVERSITY AND CONSERVATION

The term "biodiversity" is used to describe the wide variety (richness and abundance) of plant and animal species occurring in their natural environment or "habitat". Biodiversity not only encompasses all living things, but also the series of interactions that sustain them, which are termed "ecological processes".

South Africa's biodiversity provides an important basis for economic growth and development; keeping biodiversity intact is thus vital for ensuring the on-going provision of ecosystem services, for example the production of clean water through comprehensive catchment management practices. The role of biodiversity in combating climate change is also well recognised and further emphasises the key role that biodiversity management plays on a global scale (South African National Biodiversity Institute, 2019).

Typical pressures that natural ecosystems face from human activities include the loss and degradation of natural habitat, invasive alien species, pollution and waste, and climate change (South African National Biodiversity Institute, 2019). High levels of infrastructural and agricultural development typically restrict the connectivity of natural ecosystems, and maintaining connectivity is considered critical for the long-term persistence of both ecosystems and species, in the face of human development and global climate change.

Biodiversity loss places aspects of South Africa's economy and quality of life at risk, and reduces socioeconomic options for future generations. In essence, then, sustainable development is not possible without a healthy biodiversity.

4. STUDY AREA

4.1. Land Use

The affected properties are almost entirely used for game ranching with very limited infrastructure, mainly restricted to access roads, bomas, kraals, water and feeding points for game and livestock, and the occasional homestead. Land-use within the surrounding properties are also similarly and predominantly utilized for game ranching.

Livestock farming was historically the main land use practise within the area, with varying stocking rates and grazing regimes implemented. It however appears that the farms were historically fairly small and utilized as grazing for predominantly cattle and occasionally a mixture between cattle and sheep. Stocking rates appears to have varied between moderate to high rates with continuous grazing to rotational grazing systems utilized, with the exclusion of fire (natural or as a management tool). This has likely resulted in the current overgrazed and transformed situation observed on certain properties, with bare, exposed soils locally present and subjected to soil capping and sheet erosion. These historical management practices have also resulted in the encroachment of small to shrubby, thorny bushes, which have been occasionally cleared and thinned out over the last 30 – 50 years (these management practices are present within almost all of the properties). However, since the transition to game breeding, large areas have been subjected to significant modifications, with the areas being cordoned off in small game breeding camps, with large scale bush clearing and in some areas the ripping, tilling and planting of palatable grasses such as Cenchrus ciliaris, *Urochloa mosambicensis, Digitaria argyrograpta* and *Dichanthium annulatum.* These areas should rather be regarded as pastures than natural grazing lands.

Based on the results obtained from the site visit, only 4% of the project site resembles near natural Zeerust Thornveld (vegetation type within which the project site is located) whilst 60% of the project site have been subjected to moderate levels of modifications, most notable bush clearance and overgrazing. A total of 31% of the project site have been subjected to significant levels of modifications and include extensive bush clearance and the planting of palatable grazing grass species (pastures) (Figure 8).

The Google Images below also illustrates how the vegetation structure and compositions have changed over time.

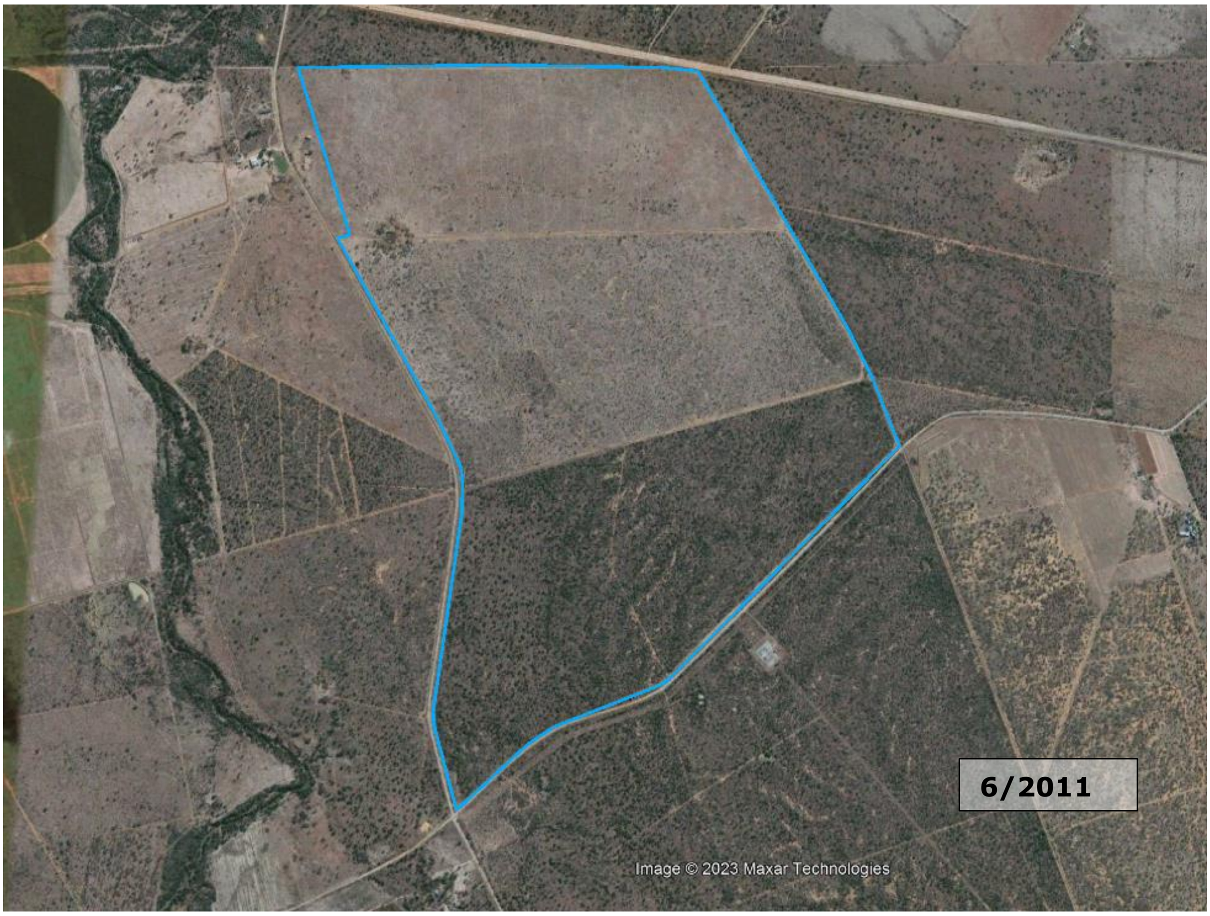
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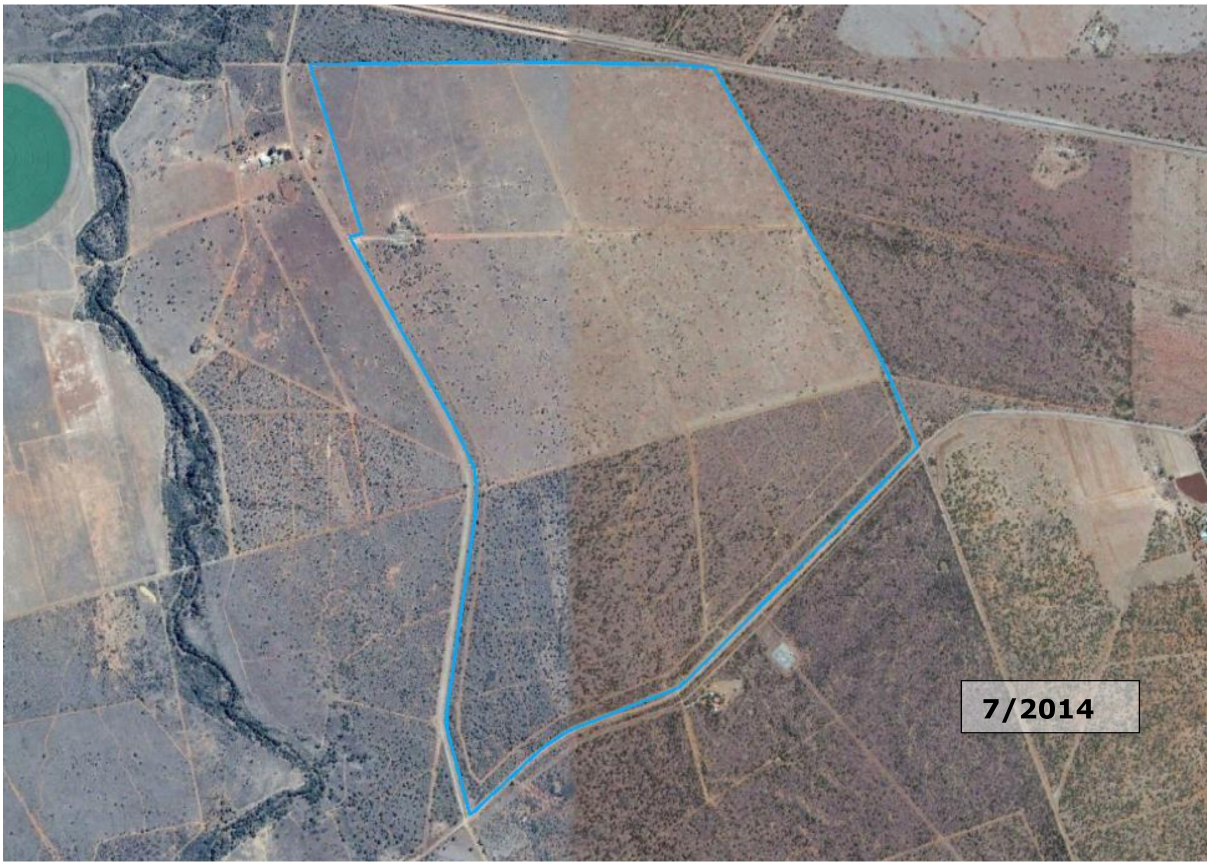
Image © 2023 Maxar Technologies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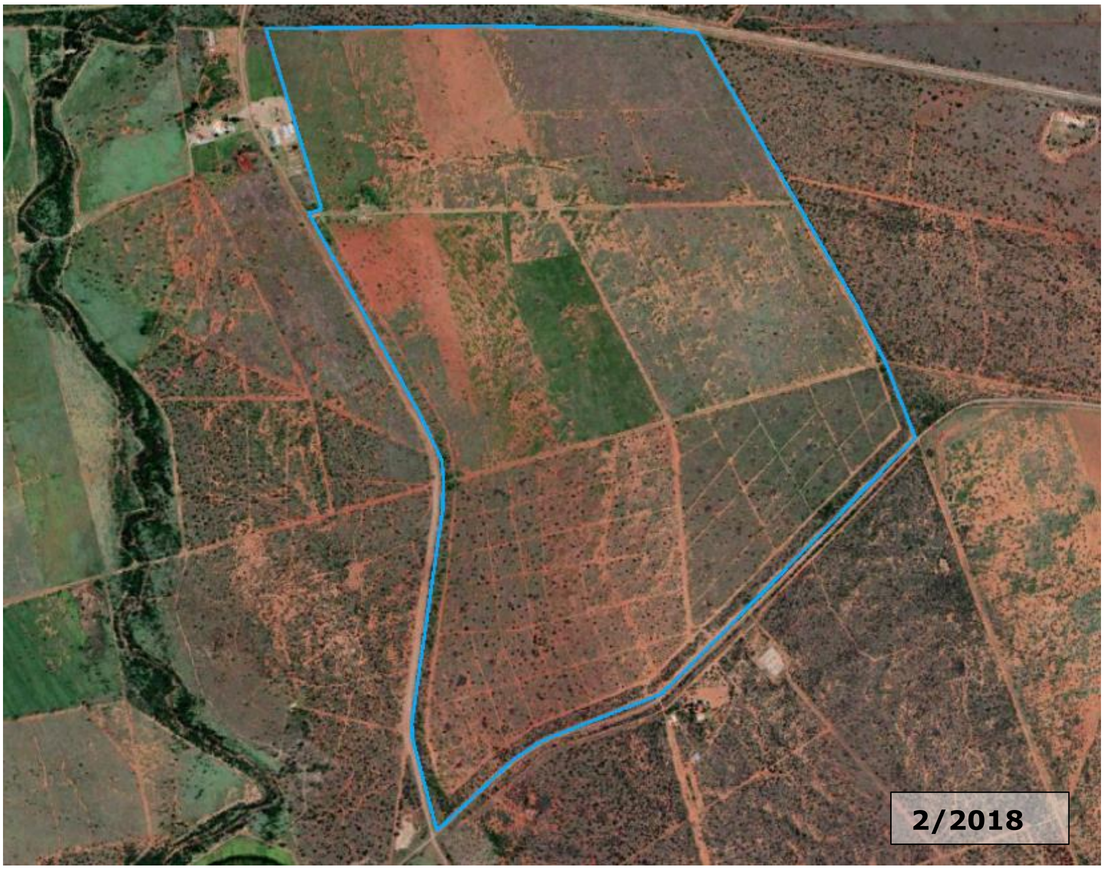
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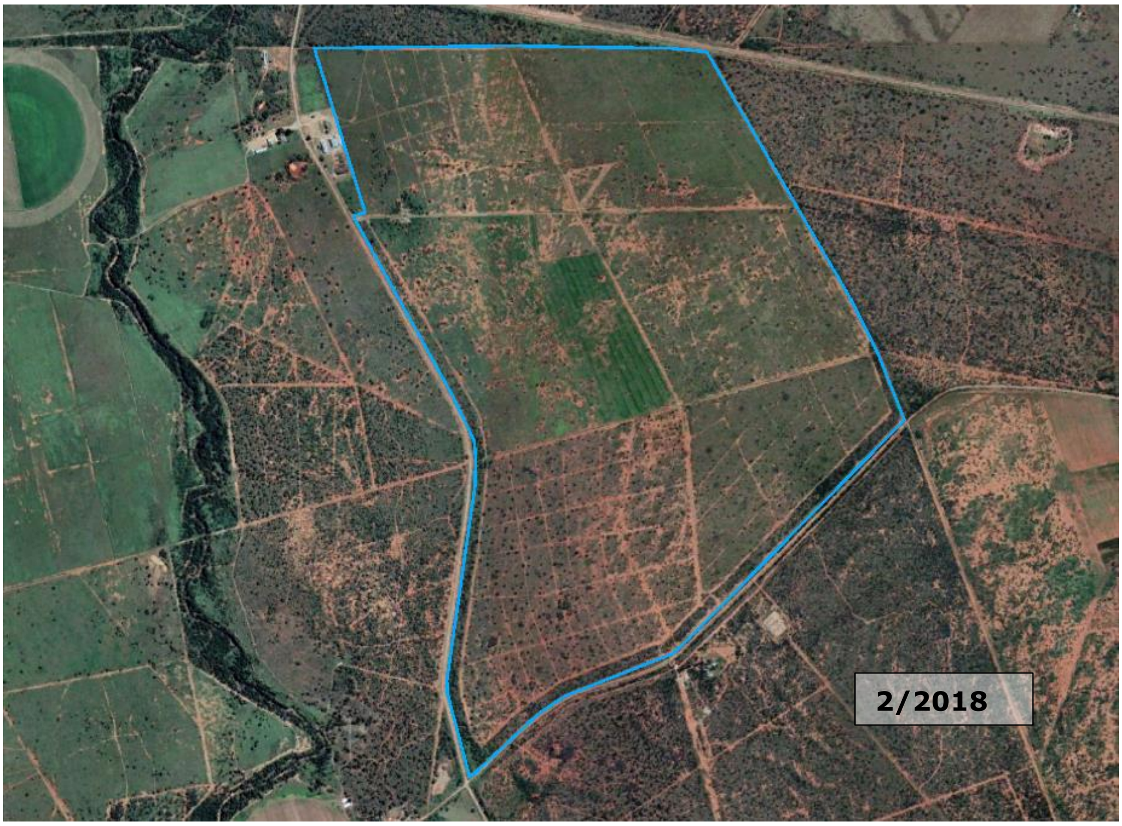
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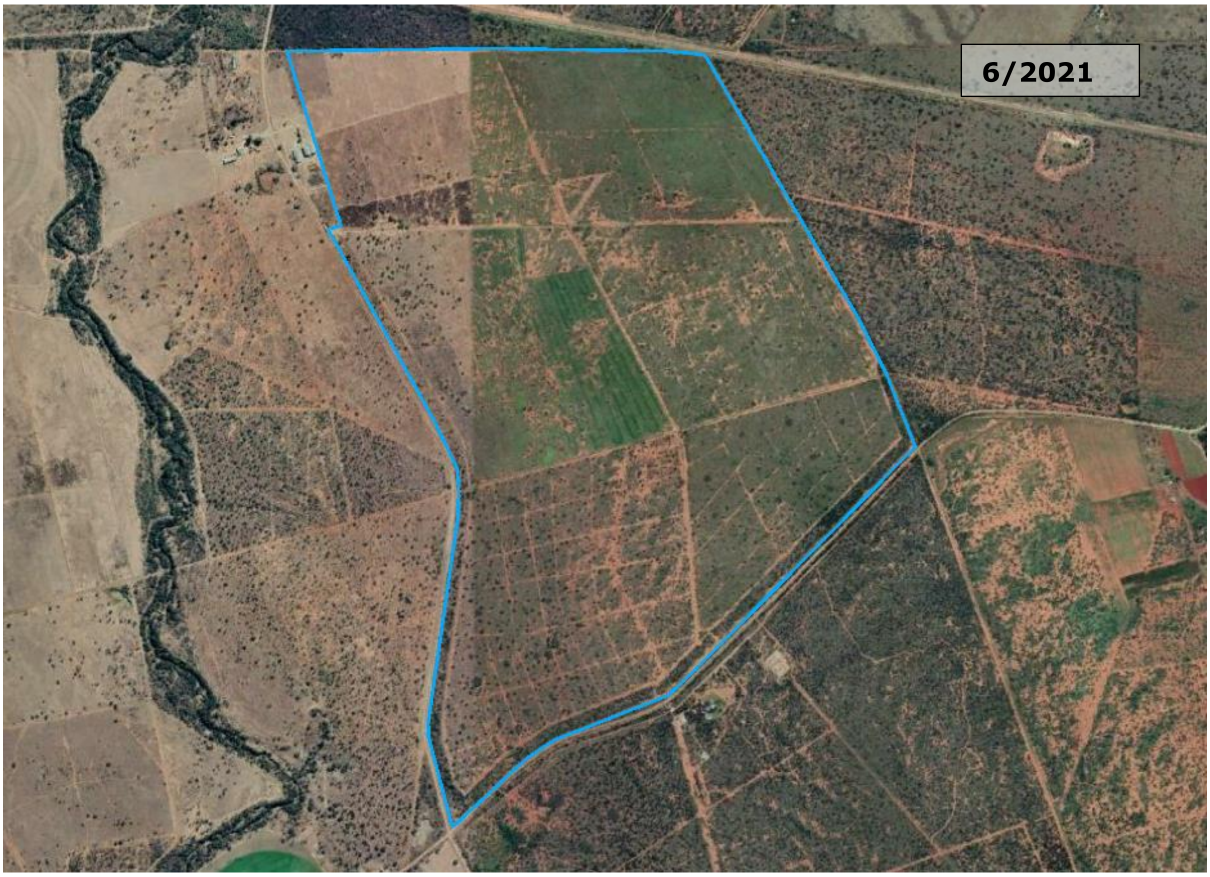
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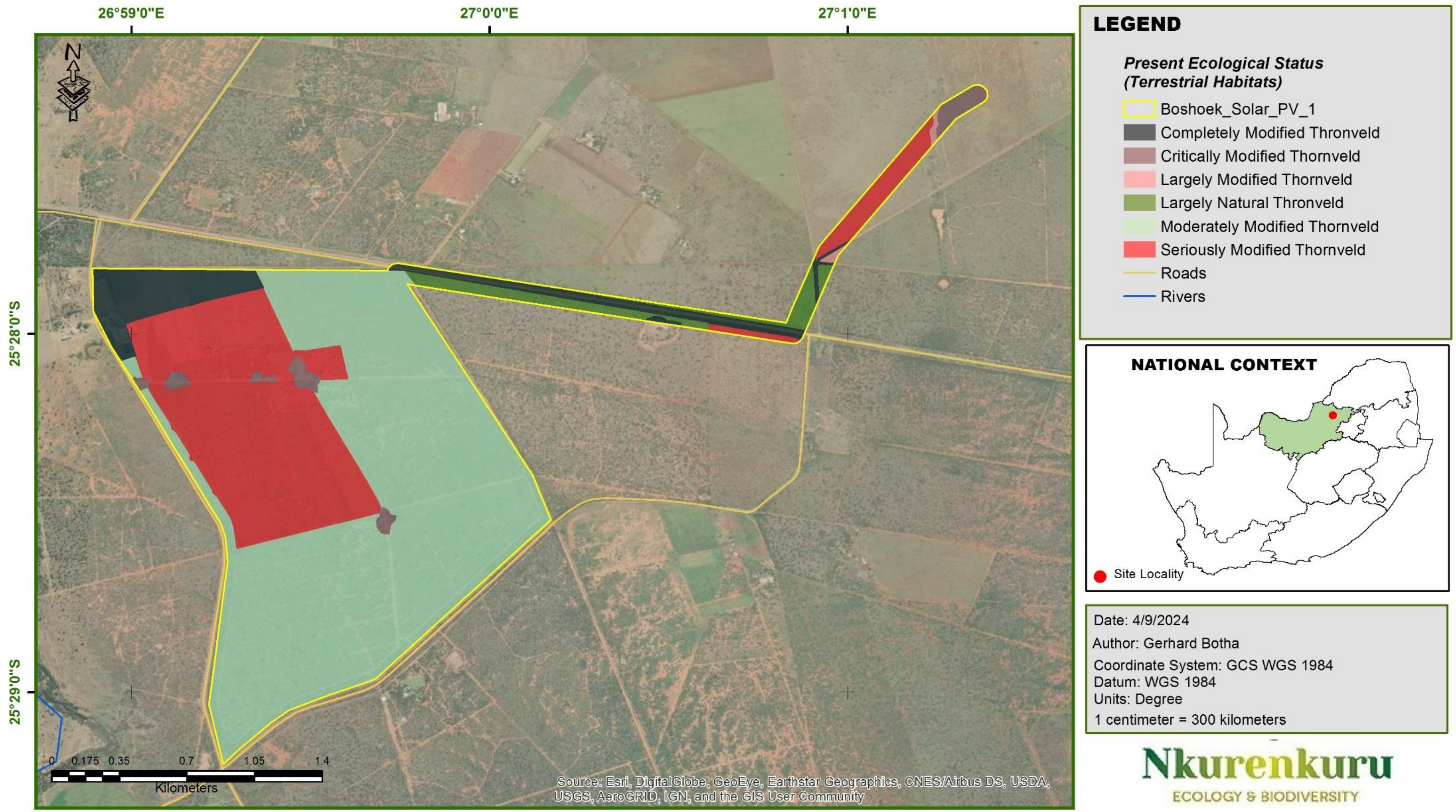

Figure 8: Present Ecological Status of terrestrial habitats as identified during the site survey.

4.2. Conservation Planning / Context

Understanding the conservation context and importance of the study area and surroundings is important to inform decision making regarding the management of the aquatic resources in the area. In this regard, available national, provincial, and regional conservation planning information was used to obtain an overview of the study site (Table 8).

Table 8: Information and data coverages used to inform the ecological assessment.

Conservation Planning Dataset		Relevant Conservation Feature	Location in Relationship to Project Site	Conservation Planning Status
NATIONAL LEVEL CONSERVATION PLANNING	**National Protected Areas Expansion Strategy**	Focus Area	Small portion of PAOI included as part of a NPAES Focus Area (0.086 ha).	NPAES Focus Area
	Protected Areas and Conservation Areas (PACA) Database	South African Conservation Area (SACA) and South African Protected Area (SAPA)	Well outside of any SACA and SAPA: » Nearest SAPA (Pilanesberg Nature Reserve) located approximately 11.8 km to the north-east. » Nearest SACA (Magaliesberg Biosphere Reserve) located approximately 21.8 km to the sout-east.	Not Classified
	Vegetation Types	Zeerust Thornveld	» Entire project site	Least Threatened
	Threatened Ecosystems	Not listed	» N/A: the entire project footprint overlaps with LC ecosystems according to RLE 2021 Spatial Data.	N/A
Conservation and Distribution Context	**NWBSP 2015: Critical Biodiversity Areas**	Terrestrial Critical Biodiversity Areas CBA1 and CBA2	Critical Biodiversity Areas 2 (CBA2) » T9 (Biodiversity Node) 4.6 ha (1%) of PAOI	CBA 2
		Terrestrial Ecological Support Areas ESA1 and ESA 2	Ecological Support Areas 1 (ESA1) » T7 (Natural Corridor) ○ 267.3 ha (78%) of PAOI.	ESA 1
			Ecological Support Areas 2 (ESA2) » T7 (Non-Natural Corridor) ○ 70.6 ha of PAOI. » T11 (Corridor – Cultivated areas) ○ 7.2 ha of PAOI.	ESA 2

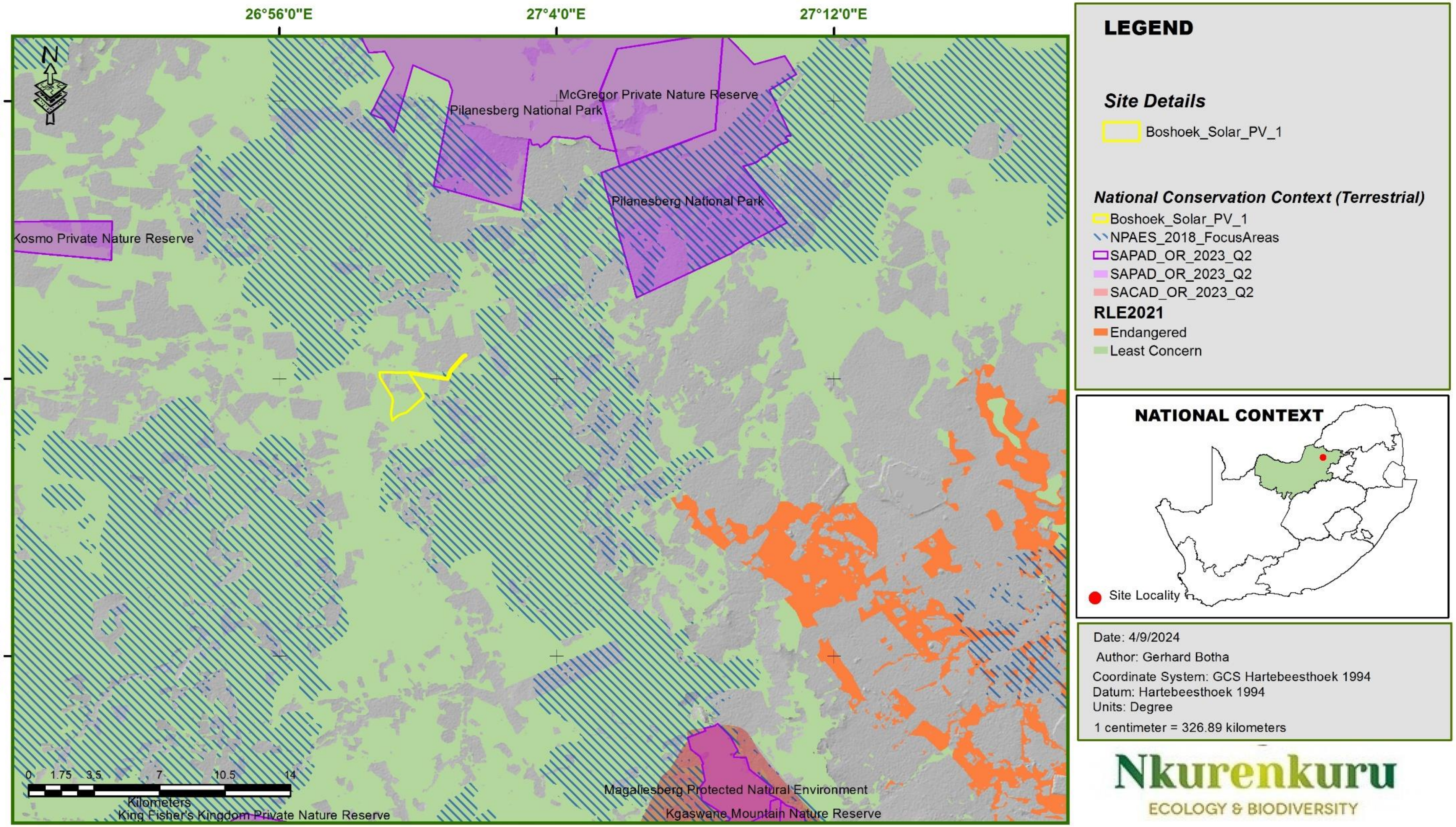

Figure 9: Nationally identified terrestrial conservation priority areas found within the greater surroundings of the project site.

National Protected Areas Expansion Strategy

The goal of the NPAES is to achieve cost effective protected area expansion for improved ecosystem representation, ecological sustainability and resilience to climate change. It sets protected area targets, maps priority areas for protected area expansion, and makes recommendations on mechanisms to achieve this (DEA, 2018)

Such protected areas are vital for ecological sustainability and climate change adaptation, serving as nodes in our ecological infrastructure network, protected the ecosystems that deliver important ecosystem services to people.

Land-based protected area expansion targets include large, intact, and unfragmented areas of high importance for biodiversity representation and ecological persistence, which are suitable for the creation or expansion of large protected areas. Such areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy 2008 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES, and were designed with a strong emphasis on climate change resilience and requirements for protecting terrestrial and freshwater ecosystems (FEPA: Freshwater Ecosystem Priority Areas). These areas should not be seen as future boundaries of protected areas, since in many cases only a portion of a particular focus area would be required to meet the protected area targets set in NPAES. They are also not a replacement for fine-scale planning, which may identify a range of different priority sites based on local requirements, constraints, and opportunities (DEA, 2018).

Within the North West Province, the identification of priority areas is largely based on the province's conservation plan, where identified Critical Biodiversity Areas, in particular priority areas such as corridors and priority corridor nodes have been selected as the spatial priorities. The proposed project site is located within such a corridor linkage, primarily (directly) linking the Pilanesberg Nature Reserve with the Magaliesberg Biosphere Reserve and indirectly with the Marico Biosphere Reserve via a corridor between the two biosphere reserves. In addition, some important finer scale corridors are prioritised through the few remaining intact linkages in the centre of the province (DEA, 2018).

Key pressures on these priority areas include commercial dryland agriculture (dominant pressure in the province), mining pressures and subsistence farming (DEA, 2018).

A very small portion of the project site (along the eastern boundary of the project site) falls within a NPAES Focus Area (0.086 ha or 0.03% of project site) (**Error! Reference source not found.**). In terms of this small area being classified as a NPAES Focus Area, this is rather due to an error that occurred during the processing of the spatial data used to generate the Focus Area map. This Focus Area is associated with the adjacent property to the east but has slightly extended to areas outside of this property. However, none the less, a loss of an area this small will not have any bearing on future conservation targets and thus the loss of this area is deemed expectable.

Furthermore, the extent and significance of any impacts can be significantly reduced to acceptable levels with the implementation of relevant mitigation measures.

The following management plans and mitigation measures should be considered;

- Storm Water and Erosion Management Plan;
- A Plant Rehabilitation and Invasive Alien Plant Management Plan;
- Mitigation measures that allow/maintain landscape connectivity.

In terms of Protected (SAPA) and Conservation (SACA) Areas, the site is not located within any SACAs and SAPAs. The project site is located approximately 11.8 km south of the northern reserve portion (main conservation area) of the Pilanesberg Nature Reserve, and 12.8 km south-west of the McGregor Private Nature Reserve. The project site is located well away from any SACA, with the closest SACAs being the Magaliesberg- and Marico Biosphere Reserves, located 21.8 km south of the proposed project site.

The proposed development won't have any impact on any protected- and/or conservation areas. Subsequently, the development is regarded, in terms of this systematic planning framework, as acceptable.

National Level of Conservation Priorities (Threatened Ecosystems)

South Africa's vegetation types have been assigned a conservation status according to their respective degrees of transformation and rates of conservation. The conservation status of a habitat or vegetation type is based on the amount of its original area that currently remains intact relative to various thresholds. On a national scale, these thresholds are arranged from Least Threatened to Critically Endangered (Figure 10), as determined by the best available scientific approaches (Driver et al., 2005; South African National Biodiversity Institute, 2019). The level at which an ecosystem becomes Critically Endangered depends on biodiversity targets, and therefore differs from one ecosystem to another, varying from 16% to 36%.

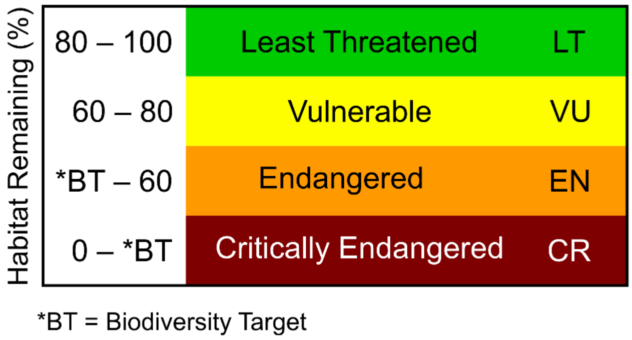

Figure 10: Ecosystem threat status categories (Driver et al., 2005). The biodiversity target represents the minimum conservation requirement.

Nationally, threatened ecosystems that are currently under threat of being transformed by other land uses have been identified and listed. The first national list of threatened terrestrial ecosystems for South Africa was gazetted on 9 December 2011 (NEM:BA National list of ecosystems that are threatened and in need of protection, G 34809, GoN 1002, 9 December 2011). The primary purpose of listing threatened ecosystems is to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function, and composition of threatened ecosystems (SANBI, 2011). NEM:BA lists threatened or protected ecosystems in one of five categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or protected; Least Threatened ecosystems are not listed. There are four main implications of listing ecosystems:

- Planning related implications which are linked to the requirement in the Biodiversity Act (Act 10 of 2004) for listed ecosystems to be taken into account in municipal IDPs and SDFs;
- Environmental authorisation implications in terms of NEMA and the EIA regulations;
- Proactive management implications in terms of the National Biodiversity Act;
- Monitoring and reporting implications in terms of the Biodiversity Act.

The proposed development site includes one vegetation type (Zeerust Thornveld - SVcb3) and is located in close proximity to a second vegetation type (Gold Reef Mountain Bushveld - SVcb9), as currently mapped by the National Vegetation Map 2018 (see section 5.1.1 as well as Figure 13), namely;

Both of these vegetation types are listed as Least Threatened (**Error! Reference source not found.**), and thus no listed ecosystems occur on site.

<u>Zeerust Thornveld (SVcb3)</u>: Conservation: LC according to RLE. Target: 19% according to NBA 2018. Less than 4% is statutorily conserved, and is spread between four reserves, including the Pienaar and Marico Bushveld Nature Reserves. Some 16% is transformed mainly by cultivation, with some constructed area in between. A few areas have scattered plants of the alien *Cereus jamacaru*, and several other alien species occur very scattered elsewhere. Erosion is mainly very low to low (Mucina & Rutherford, 2006). The unit is

currently mapped to cover an extensive area size of approximately 4136.5 km^2 (SANBI, 2018).

<u>Gold Reef Mountain Bushveld (SVcb9)</u>: Conservation: LC according to RLE. Target: 24% according to NBA 2018. About 22% of this unit is statutorily conserved, mainly in the Magaliesberg Nature Area, and smaller proportions in the Rustenberg, Wonderboom, and Suikerbosrand Nature Reserves. At least an additional 1% is conserved in other reserves. The total conserved area is therefore close to the target. About 15% is transformed mainly by cultivation and constructed areas. Some areas have dense stands of alien *Melia azedarach*, but which is often associated with drainage lines or alluvia (i.e., azonal vegetation) embedded within this unit. Erosion is very low to low. A few small ridges of this unit in the Pretoria area have not yet been mapped (Mucina & Rutherford, 2006). The unit is currently mapped to cover an extensive area size of approximately 2034.7 km^2 (SANBI, 2018).

Table 9: Conservation status of the vegetation type occurring in and around the study area.

Vegetation Type	Target (%)	Transformed (%)	Conserved (Statutorily & other reserves)	Conservation Status	
				National Vegetation Map (2018)	National Ecosystem List (NEMA:BA)
Zeerust Thornveld (SVcb3)	19%	16%	4%	LC	LC
Gold Reef Mountain Bushveld (SVcb9)	24%	15%	22%	LC	LC

The proposed project site, as mentioned is solely located within the Zeerust Thornveld. However, based on the results obtained from the site visits, only 4% of the project site resembles near natural Zeerust Thornveld whilst 60% of the project site have been subjected to moderate levels of modifications, most notable bush clearance and overgrazing. A total of 31% of the project site have been subjected to significant levels of modifications and include extensive bush clearance and the planting of palatable grazing grass species (pastures) (Figure 8).

Thus, it is highly unlikely that this development will have an impact on the functionality, ecological integrity and conservation targets set out for the Ecosystems as well as Vegetation Types:

- Due to the vast extent of intact, natural vegetation, resembling Zeerust Thornveld, still present within the area;
- Due to the small extent of remaining natural vegetation within the project site that will be impacted, compared to the vast extent of modified and degraded areas that will be impacted.

Critical Biodiversity Areas and Broad Scale Ecological Processes

Critical Biodiversity Areas (CBA) have been identified for all municipal areas of the North West Province and are published by SANBI (http://bgis.sanbi.org/). This biodiversity assessment identifies CBAs representing biodiversity priority areas that should be maintained in a natural to near-natural state. CBA maps show the most efficient selection and classification of land portions to be safeguarded so that ecosystem functioning is maintained and national biodiversity objectives are met (see Table 10 for CBA land management objectives)

- According to the North West Biodiversity Conservation Plan (2018), Critical Biodiversity Areas (CBAs) are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (READ, 2015).
- Ecological Support Areas (ESAs) are terrestrial and aquatic areas that are not essential for meeting biodiversity representation targets (thresholds), but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree or extent of restriction on land use and resource use in these areas may be lower than that recommended for CBAs (READ, 2015).

From a land use planning perspective, it is useful to think of the difference between CBAs and ESAs in terms of where in the landscape the biodiversity impact of any land use activity action is most significant:

- In CBAs where a change in land use results in a change from the desired ecological state, the impact on biodiversity as a result of this change is most significant locally at the point of impact through the direct loss of a biodiversity feature (e.g. loss of a populations or habitat).
- In ESAs, however, a change from the desired ecological state is most significant elsewhere in the landscape through the indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway. For example, removing a corridor results in a population going extinct elsewhere in the landscape due to loss of connectivity, or a new plantation locally results in a reduction in stream flow at the exit to the catchment, which affects downstream biodiversity.

Other categories included in the CBA Map are:

- Protected Areas are declared and formally protected under the Protected Areas Act, such as National Parks, legally declared Nature Reserves, World Heritage Sites and Protected Environments that are secured by appropriate legal mechanisms.

- Other Natural Areas are areas that still contain natural habitat but that are not required to meet biodiversity targets.
- No Natural Habitat Remaining includes areas without intact habitat remaining.

Table 10: Relationship between Critical Biodiversity Areas categories (CBAs) and land management objectives.

CBA category	Land Management Objective
Protected Areas (PA) & CBA 1	***Natural landscapes:*** » Ecosystems and species are fully intact and undisturbed. » Areas with high irreplaceability or low flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost then targets will not be met. » Landscapes that are at or past their limits of acceptable change. ***Maintain in a natural or near-natural state that maximises the retention of biodiversity pattern and ecological process.***
CBA 2	***Near-natural landscapes:*** » Ecosystems and species largely intact and undisturbed. » Areas with intermediate irreplaceability or some flexibility in terms of the area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve targets. » Landscapes that are approaching but have not passed their limits of acceptable change. ***Maintain in a natural or near-natural state that maximises the retention of biodiversity pattern and ecological process.***
ESA 1	***Functional landscapes:*** » Ecosystem still in a natural, near-natural state or semi-natural state, and has not been previously developed. » Ecosystem moderately to significantly disturbed but still able to maintain basic functionality. » Individual species or other biodiversity indicators may be severely disturbed or reduced. » Areas with low irreplaceability with respect to biodiversity pattern targets only. ***Maintain in at least a semi-natural state as ecologically functional landscapes that retain basic natural attributes.***
ESA 2	***Functional landscapes***: » Maintain current land use or restore area to a natural state. » Ecosystem NOT in a natural or near-natural state, and has been previously developed (e.g. ploughed). » Ecosystems significantly disturbed but still able to maintain some ecological functionality. » Individual species or other biodiversity indicators are severely disturbed or reduced. » These are areas with low irreplaceability with respect to biodiversity pattern targets only.

	» These areas are required to maintain ecological processes especially landscape connectivity. ***Maintain as much ecological functionality as possible (generally these areas have been substantially modified):***
ONA (Other Natural Areas) and Transformed	***Production landscapes***: » Manage land to optimise sustainable utilisation of natural resources.

In terms of terrestrial CBAs the project site spans a combination of CBA2, ESA1, and ESA2 areas (Figure 11). A description of the biodiversity categories located within the project site as well as the features underlying these categories and remarks, are provided below.

4.2.1.1. Biological Corridors (Selected planning units and cultivated areas):

Provincial-level biodiversity network aimed at retaining connectivity between all geographic areas in the province.

- At 'n broad geographical scale this corridor, along with other corridors connects (directly) the Pilanesberg Nature Reserve with the Magaliesberg Biosphere Reserve, and indirectly with the Marico Biosphere Reserve (indirectly via a corridor between the two Biosphere Reserves) and furthermore, these corridors insure connectivity between these conservation/protected areas and important geographical features such as the Selons and Elands River valleys as well as the Crocodile River valley (the Elands River is an important tributary of the Crocodile River) (**Error! Reference source not found.**).

- At a smaller geographical scale this corridor ensures;

    - Longitudinal connectivity along the length of the Selons River;
    - Lateral connectivity between the Selons River and its associated wetlands.
    - Lateral connectivity between the Selons River and the surrounding terrestrial habitats; and
    - Connectivity between the Selons River and associated larger tributaries, as well, as mentioned, connectivity between this river and the Elands River and eventually with the Crocodile River.

All natural areas within this corridor are regarded as ESA1, whilst all non-natural areas are regarded as ESA2.

- T7 Corridors (selected planning units)

    - ESA 1 (Natural areas within Corridor): Approximately 271.9 ha (79%) ha of the Project Site (Figure 12).

- ESA 2 (Non-Natural areas within Corridor): Approximately 70.6 ha (21%) of the Project Site.

» T11 Corridors (cultivated areas within the corridor)
  - ESA 2 (Non-Natural areas within Corridor): Approximately 7.2 ha (2%) of the Project Site.

Direct impact on these ESAs will be unavoidable, however, during the site visit it was found that a much larger extent, than indicated within the CBA map have been modified and/or transformed and subsequently these areas should be downgraded to ESA 2 areas. Based on the findings of the site visit (Figure 8):

» 31% (105.6 ha) of the project site has been seriously to critically modified and should rather be regarded as ESA 2;
» 8% (27.5 ha) of the project site has been completely modified/transformed and cannot be regarded as either ESA1 or ESA2.
» 58% (198.5 ha) of the project site has been moderately modified but is still capable of ecological functions of a natural ESA 1 and should therefore still be regarded as such.
» Only 3% (11.6 ha) of the project site can be regarded as large rely natural thornveld with minimal modifications.

The potential of this area to functions as a biological corridor has been severely impacted through agricultural practices. Due to extensive exotic game farming/breeding within the region, natural movement have been significantly impacted, within this corridor, as most of farms in the area (including the affected property) comprise of small game breeding camps cordoned off with high, impenetrable game fences, which also is regularly electrified. These wildlife breeding activities have resulted in significant fracturing of the landscape. Furthermore, historically, large areas have been subjected to extensive tree and shrub removal, ploughing, and subsequent reseeding with pasture grasses, all aimed at enhancing the grazing potential of the area. Follow-up, ripping and reseeding of localised areas within these pastures, occur at irregular intervals.

Subsequently it can be concluded that the proposed development within the affected area will not significantly impact the integrity, functions and services associated with the natural biodiversity corridors within the area.

4.2.1.2. <u>Biological Corridors Nodes:</u>

A biodiversity corridor node, refers to a specific natural location within a biodiversity corridor that holds particular ecological significance. Biodiversity corridors, are linear strips of habitat that connect two or more larger natural habitat areas. They are designed to facilitate the movement of various species between isolated or fragmented habitats, allowing for gene flow, migration, and access to resources.

A biodiversity corridor node typically has several characteristics:

- High Ecological Value: It is an area within the corridor that exhibits a high level of biodiversity or is particularly important for the survival and reproduction of specific species. This could be due to the presence of critical resources such as food, water, or breeding sites.
- Connectivity Hub: It serves as a key point for connecting different habitat patches. Nodes often link multiple corridors together, enhancing the overall connectivity of the landscape and providing pathways for wildlife movement.
- Restoration and Conservation Focus: Conservation efforts in biodiversity corridor nodes often prioritize habitat restoration and protection. These areas may receive special attention and resources to ensure their ecological integrity.
- Research and Monitoring: Nodes are frequently selected for scientific research and monitoring activities to assess the effectiveness of the corridor in facilitating species movement and conserving biodiversity.
- Conflict Resolution: In some cases, nodes may also be sites where human-wildlife conflicts are addressed and mitigated to ensure the coexistence of wildlife and local communities.

The identification and protection of biodiversity corridor nodes are crucial for the success of corridor conservation initiatives. By focusing on these key locations, conservationists can maximize the benefits of corridors in maintaining genetic diversity, supporting wildlife populations, and ultimately preserving ecosystems in fragmented landscapes.

This biodiversity corridor node is a natural area where several important regional corridors converge, ensuring connectivity, particularly between significant river systems and their adjacent terrestrial areas. These river systems include the Elands River, Sand River, Selons River, Koedoespruit River, and Dwarsspruit River. Furthermore, this node serves as a crucial linkage between the Pilanesberg Nature Reserve to the north and the Magaliesberg Biosphere Reserve to the south, facilitating connectivity between these two reserves.

- T9 Corridor Node
    - CBA 2 (Natural areas within node): Approximately 4.6 ha (1%) of the Project Site (Figure 12).

A very small portion (0.08 ha) of the project site (along the eastern boundary of the project site) falls within this CBA2 Corridor. In terms of this small area being classified as a CBA 2, this is rather due to an error that occurred during the processing of the spatial data used to generate the CBA map. This CBA 2 area is rather associated with the adjacent property to the east but has slightly extended to areas outside of this property and into the effected property. As mentioned above (ESA Corridors), the "naturalness" and connectivity of the affected property, as well as surrounding properties, have been severely impacted through current and historical land use activities, and current land use activities have resulted in the fragmentation of the landscape, with natural areas being isolated from each other.

A very small portion of the proposed grid connection corridor (4.52 ha) will traverse this biodiversity corridor node. Taking into account the small extent of this component of the proposed development and the typical nature of such a linear development, as well as the extent of remaining natural and intact biodiversity surrounding the proposed development footprint, the construction and operation of the grid connection infrastructure should not affect the functions and services associated with this biodiversity corridor node (CBA 2), as well as the conservation targets set out for this area.

Impacts on this Biodiversity Corridor node can furthermore, be significantly reduced with the meticulous and careful implementation of relevant mitigation measures including:

- Minimizing the development footprint as far as possible and rehabilitating disturbed areas that are no longer required by the operational phase of the development.
- Limited vegetation removal around the pylons, as well as the removal of trees underneath the power line (trim only and/or avoid large tree specimens where possible).
- Using existing roads, farm tracks, watercourse crossings and fire breaks as far as possible for access with new access roads being small twin tracks, and only deviating from the existing roads to the pylon locations (shortest distance).
- Apart from using existing watercourse crossings, no other infrastructure may take place within the freshwater resource features as well as their buffer areas (as delineated and recommended within the separate Freshwater Resource Assessment)
- The implementation of best management practices (BMPs) for erosion/sediment control and abatement of pollutant loading will minimizing secondary impacts to adjoining communities and habitats.
- Best management practices and invasive species control measures should be implemented to control and prevent the colonization and spread of terrestrial invasive plants within the project site as well as the surrounding natural habitats.

Text Box 1

What is Ecological Connectivity and why is it important?

The loss of natural habitats leads to fragmented landscapes with isolated habitat "islands." When these islands lose functionality, essential ecological processes are disrupted, and migration becomes impossible. To conserve biodiversity and ecosystem services, we need an ecological continuum to mitigate land use and climate change. Scaling up ecosystem restoration is vital for climate action, food security, water supply, and biodiversity (CMS, 2020).

Ecological Connectivity and Ecosystem Restoration are interdependent. Maintaining or restoring connectivity is crucial for healthy ecosystems, and habitat restoration enhances landscape connectivity. It's essential for ecological functionality, species survival, genetic diversity, and climate adaptation across all biomes and scales (CMS, 2020).

Connectivity conservation responds to habitat destruction and fragmentation. It safeguards habitats, biodiversity, and ecosystem functions, including migration, hydrology, nutrient cycling, and climate resilience (IUCN, 2020).

Migratory species depend on well-connected natural areas for feeding, reproduction, and survival. They connect habitats across countries, facing anthropogenic threats. Maintaining connectivity is vital for their survival (CMS, 2020).

Connectivity is critical for biodiversity's long-term persistence in the face of climate change. Large corridors, like river systems and ridges, act as highways for migration. Sustainability aims to interlink ecological processes, offering the best design for species migrations. Landscape corridors protect river sources, endangered species, and ecosystem services (READ, 2015).

Connectivity is key for planning protected areas and conservation networks to support functional needs (CMS, 2020).

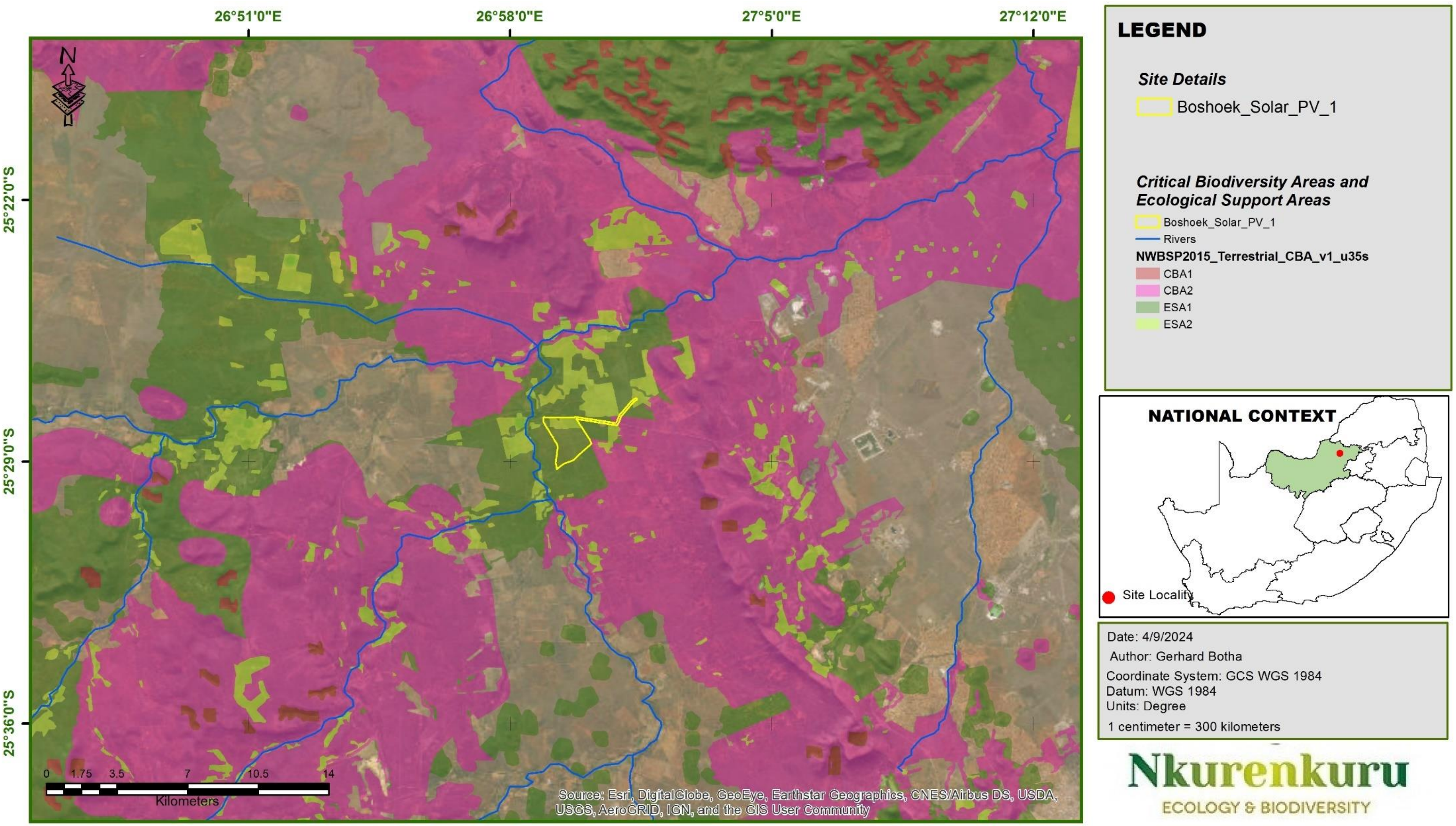

Figure 11: Terrestrial Critical biodiversity areas (CBA) found within the greater surroundings of the Boshoek Solar 1 project site.

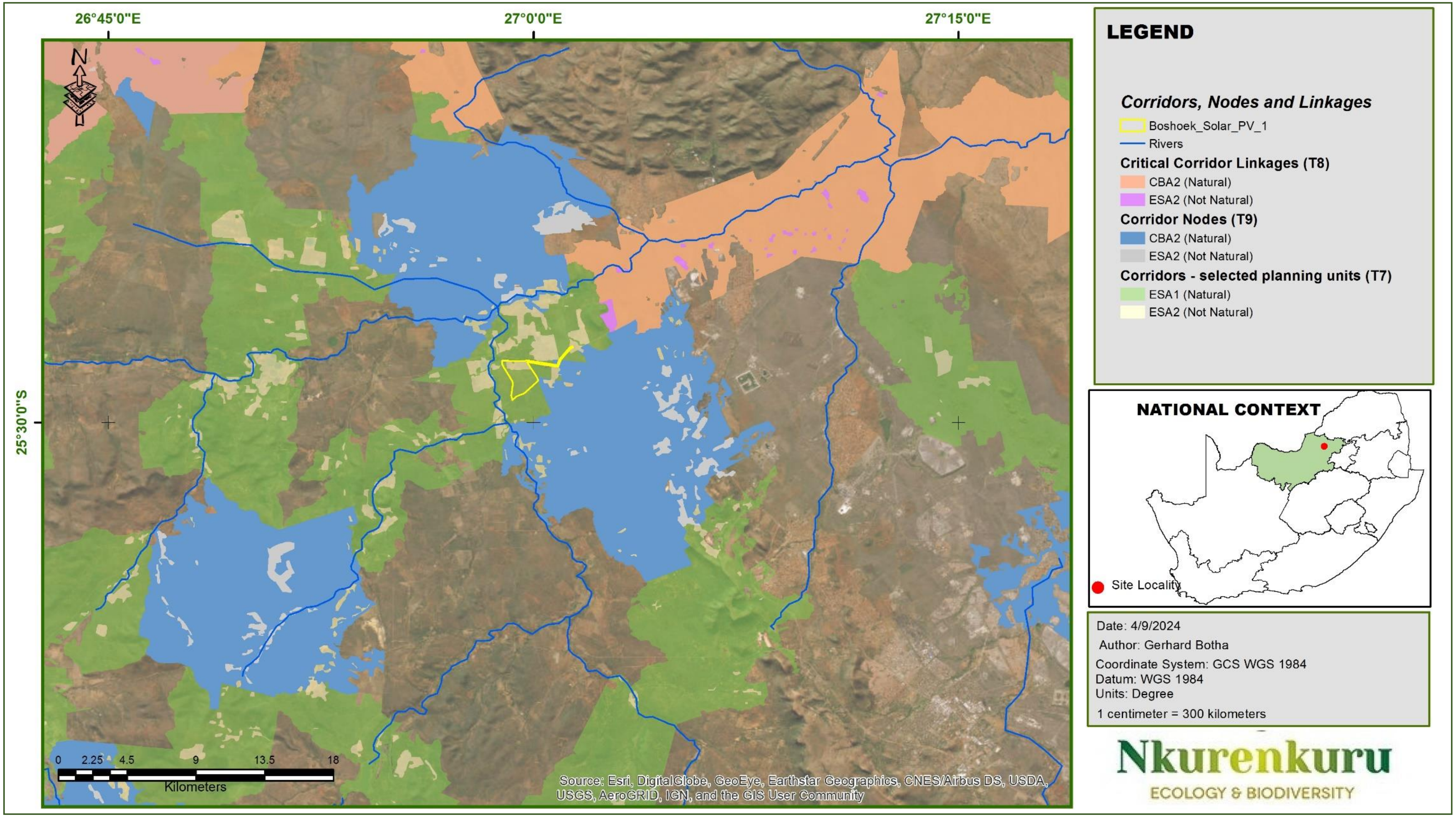

Figure 12: Biodiversity corridors, critical corridor linkages and nodes found within the greater surroundings of the project site.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT – BASELINE

5.1. Broad-Scale Vegetation Patterns

This section deals with vegetation types as described in the National Vegetation Map of Southern Africa, which will be used interchangeably with the term "VegMap" (Dayaram et al., 2018; Mucina and Rutherford, 2006 and 2018).

Note that the latest VegMap was used, namely 2018. Although vegetation descriptions are as per VegMap 2006, these units were cross-validated with VegMap 2018 to ensure their extents remained the same.

The entire study area is mapped as Gold Reef Mountain Bushveld (SVcb9) and Zeerust Thornveld (SVcb3). The only other vegetation type occurring near the proposed development site is Pilanesberg Mountain Bushveld (SVcb5). Since the latter vegetation type is unique, remnants of it will not occur within or near the proposed development site, and as such it is not described here. Only the first two vegetation types are described (Figure 13 and Figure 14). Refer to Table 11 below, for a summary of total area covered by the mapped units as per VegMap).

Table 11: Total area sizes (approximately) for vegetation types occurring within, or near, the study area, as mapped by the National Vegetation Map 2018.

Vegetation Type	Total Area (km^2)	Total Area (ha)	Threat Status
Zeerust Thornveld (SVcb3)	4 136.5	413 653	Least Concerned
Gold Reef Mountain Bushveld (SVcb9)	2 034.7	203 481.4	Least Concerned

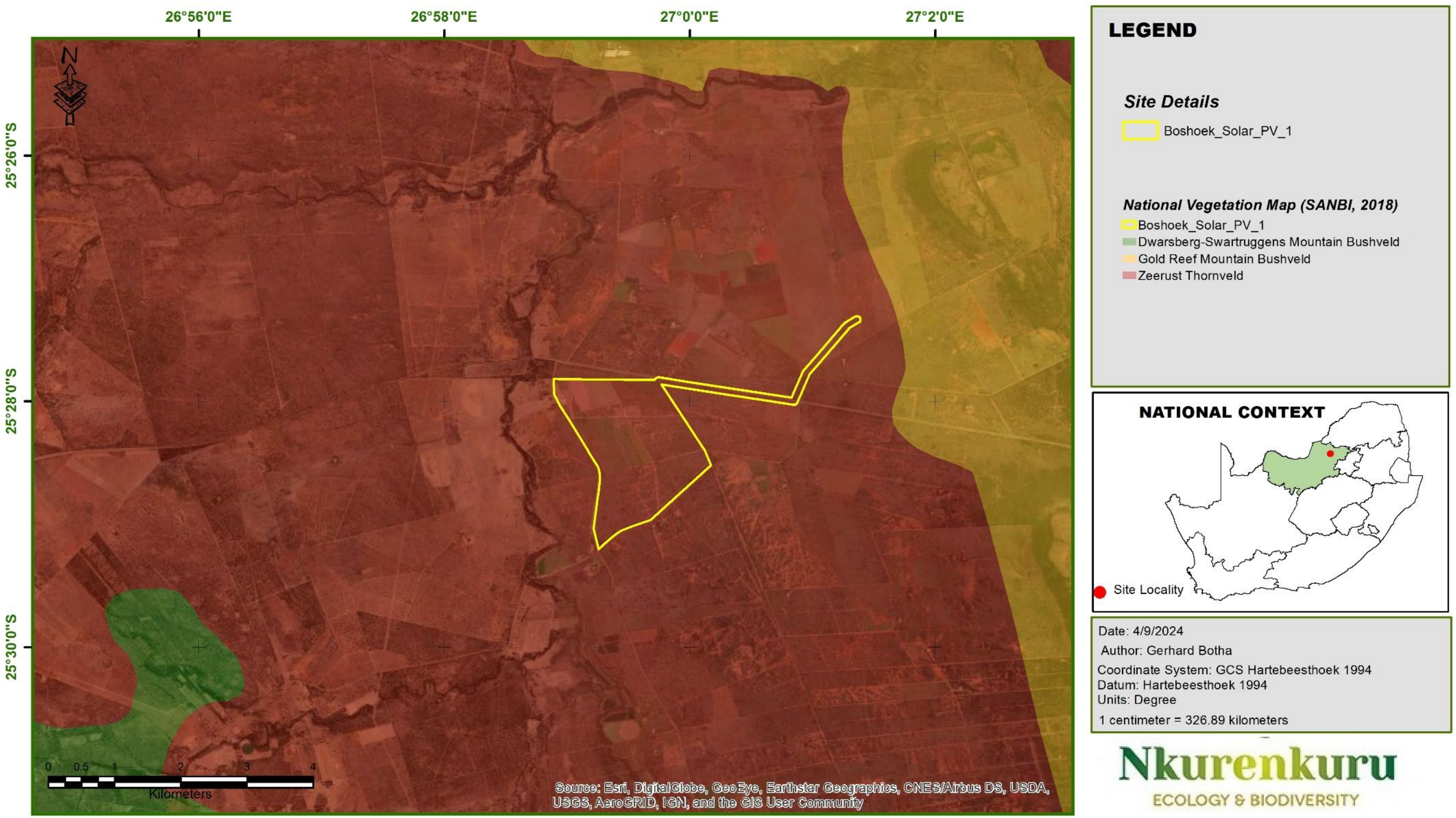

Figure 13: Map illustrating the different vegetation types, according to VegMap 2018, for the study area, as well as the general region.

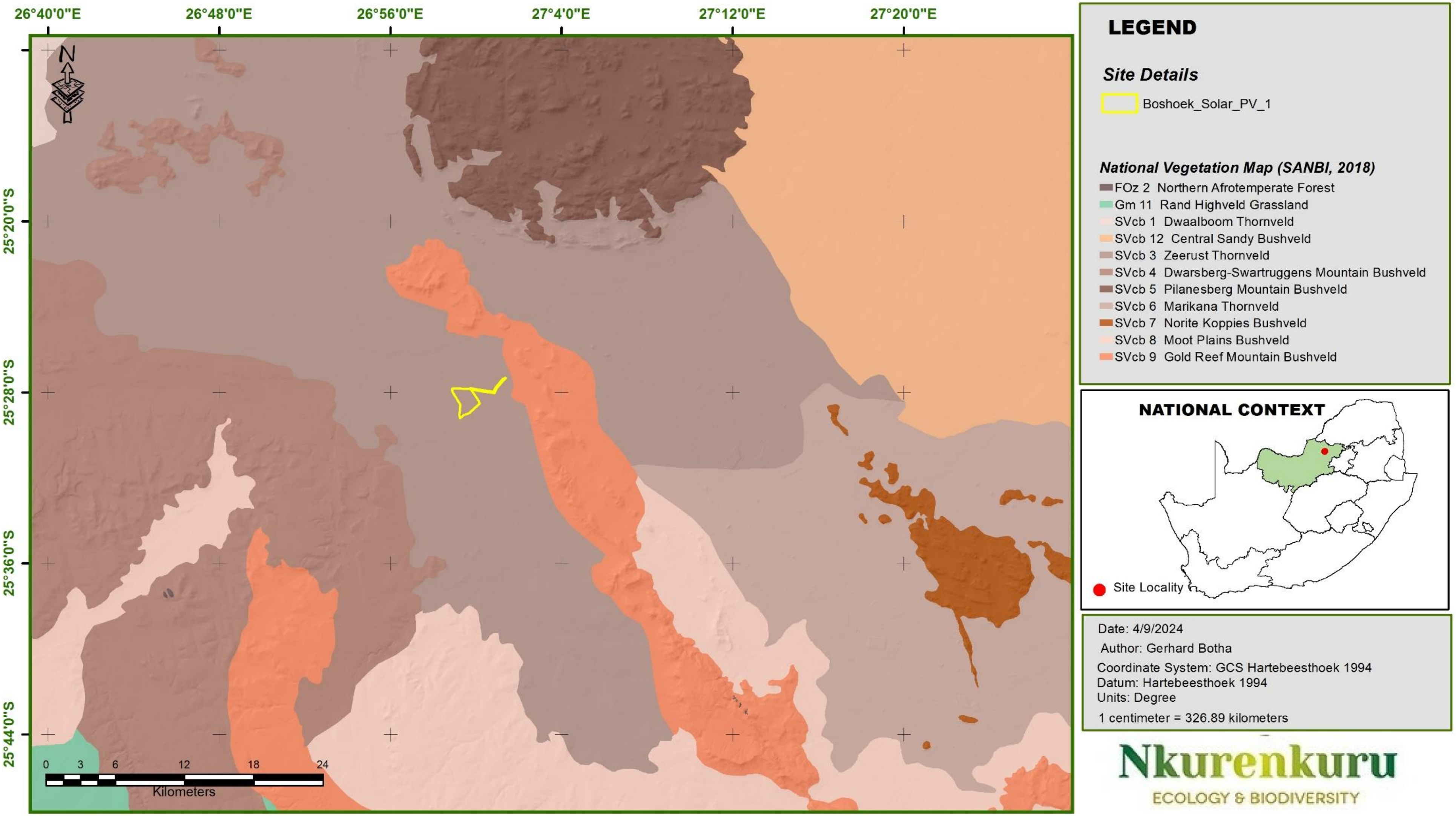

Figure 14: Map illustrating the different vegetation types, according to VegMap 2018, for the study area, as well as the general region. This map is zoomed out to show the larger extents of each of the vegetation types.

5.1.1. Zeerust Thornveld (SVcb 3)

This vegetation type is distributed in the North West Province and extends along the plains from the Lobatsi River in the west via Zeerust, Groot Marico, and Mabaalstad to the flats between the Pilanesberg and western end of the Magaliesberg in the east (including the valley of the lower Selons River).

It is characterized by deciduous, open to dense short thorny woodland, dominated by *Senegalia* and *Vachellia* (synonym *Acacia*) species, with a herbaceous layer of mainly grasses on deep, high base-status and some clay soils on plains and lowlands. It also occurs between rocky ridges of SVcb 4 Dwarsberg Swartruggens Mountain Bushveld. It is also characterized by sediments of the Pretoria Group (Transvaal Supergroup), particularly the Silverton and Rayton Formations, are mostly shale with less quartzite and conglomerate. Carbonates, volcanic rocks, breccias, and diamictites also occur in the Pretoria Group. Bronzite, harzburgite, gabbro, and norite of the Rustenburg Layered Suite (Bushveld Igneous Complex) are also encountered.

Conservation: LC according to RLE. Target: 19% according to NBA 2018. Less than 4% is statutorily conserved, and is spread between four reserves, including the Pienaar and Marico Bushveld Nature Reserves. Some 16% is transformed mainly by cultivation, with some constructed area in between. A few areas have scattered plants of the alien *Cereus jamacaru*, and several other alien species occur very scattered elsewhere. Erosion is mainly very low to low.

Table 12: Key species associated with Zeerust Thornveld (SVcb 3).

IMPORTANT SPECIES	
Growth Form	**Key Species (d = "Dominant")**
Tall Trees	*Senegalia burkei (d), Vachellia erioloba (d)*
Small Trees	*Senegalia mellifera subsp. detinens (d), Vachellia nilotica (d), V. tortilis subsp. heteracantha (d), Searsia lancea (d), Vachellia fleckii, Peltophorum africanum, Terminalia sericea*
Tall Shrubs	*Diospyros lycioides subsp. lycioides, Grewia flava, Mystroxylon aethiopicum subsp. burkeanum*
Low Shrubs	*Agathisanthemum bojeri, Chaetacanthus costatus, Clerodendrum ternatum, Indigofera filipes, Searsia grandidens, Sida Chrysantha, Stylosanthes fruticosa*
Graminoids	*Eragrostis lehmanniana (d), Panicum maximum (d), Aristida congesta, Cymbopogon pospischilii*
Herbs	*Blepharis integrifolia, Chamaecrista absus, C. mimosoides, Cleome maculata, Dicoma anomala, Kyphocarpa angustifolia, Limeum viscosum, Lophiocarpus tenuissimus*
ENDEMIC SPECIES	
Growth Form	**Key Species (d = "Dominant")**
Low Shrub	*Searsia maricoana*

5.1.2. Gold Reef Mountain Bushveld (SVcb 9)

This vegetation type is distributed in the North West, Gauteng, Free State, and Mpumalanga Provinces, and mainly occurs along rocky quartzite ridges of the Magaliesberg and the parallel ridge to the south, from around Boshoek and Koster in the west to near Bronkhorstspruit in the east. It includes the west-east-trending ridge of the Witwatersrand from around Krugersdorp in the west, through Roodepoort and Johannesburg to Bedfordview, as well as inner ridges (e.g. Dwarsberg and Witkop) of the Vredefort Dome on the Vaal River northwest of Parys, and part of the Suikerbosrand and some other hills around Heidelberg.

The unit has an altitudinal range of 1 200 – 1 750 m, and is characterized by rocky hills and ridges, often west-east trending, with more dense woody vegetation often occurring on the south facing slopes associated with distinct floristic differences, for example a preponderance of *Senegalia caffra* on southern slopes. Tree cover can be variable, and the tree and shrub layers are often continuous, whereas the herbaceous layer is dominated by grasses. The geology consists predominantly of quartzites, conglomerates, and some shale horizons of the Magaliesberg, Daspoort, and Silverton Formations (Vaalian Pretoria Group), and the Hospital Hill, Turffontein, and Government Subgroups (Randian Witwatersrand Supergroup). Soils are shallow, gravel lithosols of the Mispah and Glenrosa forms Land types mainly lb and Fb.

Conservation: LC according to RLE. Target: 24% according to NBA 2018. About 22% of this unit is statutorily conserved, mainly in the Magaliesberg Nature Area, and smaller proportions in the Rustenberg, Wonderboom, and Suikerbosrand Nature Reserves. At least an additional 1% is conserved in other reserves. The total conserved area is therefore close to the target. About 15% is transformed mainly by cultivation and constructed areas. Some areas have dense stands of alien *Melia azedarach*, but which is often associated with drainage lines or alluvia (i.e., azonal vegetation) embedded within this unit. Erosion is very low to low. A few small ridges of this unit in the Pretoria area have not yet been mapped.

Table 13: Key species associated with Gold Reef Mountain Bushveld (SVcb 9).

IMPORTANT SPECIES	
Growth Form	**Key Species (d = "Dominant")**
Small Trees	*Senegalia caffra (d), Combretum mole (d), Protea caffra (d), Celtis africana, Dombeya rotundifolia, Englerophytum magalismontanum, Ochna pretoriensis, Searsia leptodictya, Vangueria infausta, V. parvifolia, Ziziphus mucronata*
Tall Shrubs	*Canthium gilfillanii, Ehretia rigida subsp. rigida, Grewia occidentalis, Gymnosporia buxifolia, Mystroxylon aethiopicum subsp. burkeanum*
Low Shrubs	*Athrixia elata, Pearsonia cajanifolia, Searsia magalismontana subsp. magalismontana, S. rigida var. rigida*
Woody Climber	*Ancylobothrys capensis*

Graminoids	*Loudetia simplex (d), Panicum natalense(d), Schizachyrium sanguineum (d), Trachypogon spicatus (d), Alloteropsis semialata subsp. eckloniana, Bewsia biflora, Digitaria tricholaenoides, Diheteropogon amplectens, Sporobolus pectinatus, Tristachya biseriata, T. leucothrix*
Herbs	*Helichrysum nudifolium, H. rugulosum, Pentanisia angustifolia, Senecio venosus, Xerophyta retinervis*
Geophytic Herbs	*Cheilanthes hirta, Hypoxis hemerocallidea, Pellaea calomelanos*
ENDEMIC SPECIES	
Growth Form	**Key Species (d = "Dominant")**
Succulent Shrub	*Aloe peglerae*
Succulent Herb	*Frithia pulchra*

5.2. Botanical (Plant) Screening Assessment

5.2.1. POSA Plant Species Observations

A list was obtained from the SANBI database (POSA — Plants of southern Africa; http://posa.sanbi.org/) containing all plant species that have been recorded to date from the surroundings of the study area (see section 2.3 for the extent of the area used for gathering records). POSA generated species lists also contain updated Red List information according to the Red List of South African Plants (Raimondo et al., 2009; updated online version: http://redlist.sanbi.org/). Species listed as protected were also identified in the list. Therefore, only SoCC that may potentially occur in the study area, and the broader surrounds, have been listed within the baseline study section of this report. The field survey(s) aimed to validate which of these species occur within the study area, and whether any additional species that may not yet have been recorded in official databases, are present.

From the POSA and iNaturalist databases, a combined total of 1955 plant species have been recorded within the broader area. The top three representative families were Poaceae (230 spp.), Asteraceae (193 spp.), and Fabaceae (186 spp.). This list included a total of 35 SCC, (1 CR, 5 EN, 5 VU, 13 NT, 1 Critically Rare, 3 Rare, and 7 DDT) species.

Finally, A total of 221 alien plant species have been recorded within the extracted area, with 84 of them being listed invasive species within the NEM:BA A&IS Regulations, namely:

- *Acacia baileyana* (Bailey's wattle; Category 3)
- *Acacia cyclops* (Red eye; Category 1b)
- *Acacia dealbata* (Silver wattle; Category 2)
- *Acacia decurrens* (Green wattle; Category 2)
- *Acacia elata* (Pepper tree wattle; Category 1b)
- *Acacia longifolia* (Long-leaved wattle; Category 1b)
- *Agave sisalana* (Sisal hemp, Sisal; Category 2)
- *Ageratina adenophora* (Crofton weed; Category 1b)
- *Ageratum houstonianum* (Mexican ageratum; Category Multi)

- *Agrimonia procera* (Scented agrimony; Category 1b)
- *Alisma plantago-aquatica* (Mud plantain, Water alisma; Category 1b)
- *Anredera cordifolia* (Madeira vine, Bridal wreath; Category 1b)
- *Araujia sericifera* (Moth catcher; Category 1b)
- *Arundo donax* (Giant reed, Spanish reed; Category 1b)
- *Azolla filiculoides* (Azolla, Red water fern; Category 1b)
- *Campuloclinium macrocephalum* (Pompom weed; Category 1b)
- *Canna indica* (Indian shot; Category 1b)
- *Casuarina cunninghamiana* (Beefwood; Category Multi)
- *Catharanthus roseus* (Madagascar periwinkle; Category Multi)
- *Cereus jamacaru* (Queen of the night; Category 1b)
- *Cestrum aurantiacum* (Orange cestrum; Category 1b)
- *Cirsium vulgare* (Spear thistle, Scotch thistle; Category 1b)
- *Coreopsis lanceolata* (Tickseed; Category 1b)
- *Cortaderia selloana* (Pampas grass; Category 1b)
- *Cotoneaster pannosus* (Silver leaf cotoneaster; Category 1b)
- *Cuscuta campestris* (Common dodder; Category 1b)
- *Datura ferox* (Large thorn apple; Category 1b)
- *Datura stramonium* (Common thorn apple; Category 1b)
- *Duchesnea indica* (Wild strawberry; Category 1b)
- *Duranta erecta* (Forget-me-not-tree, Pigeon berry; Category Multi)
- *Eichhornia crassipes* (Water hyacinth; Category 1b)
- *Eucalyptus camaldulensis* (River red gum; Category Multi)
- *Eucalyptus grandis* (Saligna gum, Rose gum; Category Multi)
- *Flaveria bidentis* (Smelter's-bush; Category 1b)
- *Gleditsia triacanthos* (Honey locust; Category 1b)
- *Ipomoea indica* (Blue morning glory; Category 1b)
- *Ipomoea purpurea* (Purple morning glory; Category 1b)
- *Jacaranda mimosifolia* (Jacaranda; Category Multi)
- *Jatropha curcas* (Physic nut; Category 2)
- *Leptospermum laevigatum* (Australian myrtle; Category 1b)
- *Ligustrum japonicum* (Japanese wax-leaved privet; Category Multi)
- *Ligustrum sinense* (Chinese privet; Category Multi)
- *Malvastrum coromandelianum* (Prickly malvastrum; Category 1b)
- *Melia azedarach* (Syringa; Category Multi)
- *Mirabilis jalapa* (Four-o'clock, Marvel-of - Peru; Category 1b)
- *Myriophyllum aquaticum* (Parrot's feather; Category 1b)
- *Nasturtium officinale* (Watercress; Category 2)
- *Nerium oleander* (Oleander; Category 1b)
- *Nicandra physalodes* (Apple-of-Peru; Category 1b)
- *Nicotiana glauca* (Wild tobacco; Category 1b)
- *Opuntia ficus-indica* (Mission prickly pear, Sweet prickly pear; Category Multi)
- *Opuntia robusta* (Blue-leaf cactus; Category Multi)
- *Opuntia salmiana* (Bur cactus; Category 1a)
- *Parthenium hysterophorus* (Famine weed; Category 1b)
- *Passiflora edulis* (Purple granadilla, Passion fruit; Category Multi)
- *Pennisetum setaceum* (Fountain grass; Category Multi)
- *Persicaria capitata* (Knotweed; Category 1b)
- *Phytolacca dioica* (Belhambra; Category 3)
- *Phytolacca octandra* (Forest inkberry; Category 1b)
- *Psidium guajava* (Guava; Category Multi)
- *Pyracantha angustifolia* (Yellow firethorn; Category 1b)
- *Pyracantha crenulata* (Himalayan firethorn; Category 1b)
- *Robinia pseudoacacia* (Black locust; Category 1b)
- *Rosa rubiginosa* (Eglantine, Sweetbriar; Category 1b)
- *Rubus cuneifolius* (American bramble; Category 1b)

- *Salsola kali* (Tumbleweed; Category 1b)
- *Salvia tiliifolia* (Lindenleaf sage; Category 1b)
- *Salvinia molesta* (Kariba weed, Salvinia; Category 1b)
- *Senna occidentalis* (Stinking weed, Wild coffee; Category 1b)
- *Senna septemtrionalis* (Arsenic bush, Smooth senna; Category 1b)
- *Sesbania punicea* (Red sesbania; Category 1b)
- *Solanum elaeagnifolium* (Silver-leaf bitter apple; Category 1b)
- *Solanum mauritianum* (Bugweed; Category 1b)
- *Solanum pseudocapsicum* (Jerusalem cherry; Category 1b)
- *Solanum sisymbriifolium* (Wild tomato, Dense- thorned bitter apple; Category 1b)
- *Sorghum halepense* (Johnson grass, Aleppo grass; Category 2)
- *Tamarix ramosissima* (Pink tamarisk; Category 1b)
- *Tithonia diversifolia* (Mexican sunflower; Category 1b)
- *Tithonia rotundifolia* (Red sunflower; Category 1b)
- *Verbena bonariensis* (Wild verbena, Tall verbena, Purple top; Category 1b)
- *Verbena brasiliensis* (Brazilian verbena; Category 1b)
- *Vinca major* (Greater periwinkle; Category 1b)
- *Xanthium spinosum* (Spiny cocklebur; Category 1b)
- *Xanthium strumarium* (Large cocklebur; Category 1b)

5.2.2. Plant Species of Conservation Concern (SCC)

Furthermore, the POSA list included a total of three SoCC, namely two Data Deficient Species (*Acalypha caperonioides var. caperonioides* and *Myrothamnus flabellifolius*) and one Endangered Species (*Sensitive Species 1147*). The initial screening report also revealed the potential presence (Medium Sensitive) of this *Sensitive Species 1147* (for their protection, the identities of these species will not made public).

» *Aloe peglerae* (CR)
» *Ceropegia insignis* (EN; Protected [Provincial Schedule 2])
» *Encephalartos eugene-maraisii* (EN)
» *Habenaria mossii* (EN)
» *Leucospermum saxosum* (EN)
» *Nanobubon hypogaeum* (EN)
» *Anacampseros decapitata* (VU; Protected [Provincial Schedule 2])
» *Cullen holubii* (VU)
» *Indigofera hybrida* (VU)
» *Melolobium subspicatum* (VU)
» *Prunus africana* (VU; Nationally Protected Tree)
» *Adromischus umbraticola subsp. umbraticola* (NT)
» *Cineraria austrotransvaalensis* (NT; Protected [Provincial Schedule 2])
» *Cleome conrathii* (NT; Protected [Provincial Schedule 2])
» *Delosperma leendertziae* (NT; Protected [Provincial Schedule 2])
» *Drimia sanguinea* (NT; Protected [Provincial Schedule 2])
» *Elaeodendron transvaalense* (NT)
» *Habenaria barbertoni* (NT)
» *Habenaria kraenzliniana* (NT)
» *Holothrix randii* (NT)
» *Kniphofia typhoides* (NT; Protected [Provincial Schedule 2])
» *Pearsonia bracteata* (NT)
» *Protea compacta* (NT)
» *Stenostelma umbelluliferum* (NT; Protected [Provincial Schedule 2])
» *Crassula cymbiformis* (Critically Rare)
» *Frithia pulchra* (Rare; Protected [Provincial Schedule 2])
» *Plectranthus oertendahlii* (Rare)
» *Tylophora coddii* (Rare)
» *Acalypha caperonioides var. caperonioides* (DDT)

- *Commelina bella* (DDT; Protected [Provincial Schedule 2])
- *Drimia elata* (DDT)
- *Euphorbia perangusta* (DDT; Protected [Provincial Schedule 2])
- *Indigofera leendertziae* (DDT)
- *Myrothamnus flabellifolius* (DDT)
- *Tragia physocarpa* (DDT)

A total of 12 of these SCC are protected. Apart from these, a further 34 species are also protected (thus yielding a total of 46 protected plant species). The protected species, excluding those already listed under SoCC, were:

- *Barringtonia racemosa* (LC; Nationally Protected Tree)
- *Berchemia zeyheri* (LC; Nationally Protected Tree)
- *Blepharis angusta* (LC; Protected [Provincial Schedule 2])
- *Boscia albitrunca* (LC; Nationally Protected Tree)
- *Brachystelma barberae* (LC; Protected [Provincial Schedule 2])
- *Brachystelma circinatum* (LC; Protected [Provincial Schedule 2])
- *Brachystelma foetidum* (LC; Protected [Provincial Schedule 2])
- *Brachystelma gracile* (LC; Protected [Provincial Schedule 2])
- *Brachystelma oianthum* (LC; Protected [Provincial Schedule 2])
- *Combretum imberbe* (LC; Nationally Protected Tree)
- *Erythrophysa transvaalensis* (LC; Nationally Protected Tree)
- *Euphorbia cooperi* (LC; Protected [Provincial Schedule 2])
- *Euphorbia davyi* (LC; Protected [Provincial Schedule 2])
- *Euphorbia excelsa* (LC; Protected [Provincial Schedule 2])
- *Euphorbia heterophylla* (Not Evaluated; Protected [Provincial Schedule 2])
- *Euphorbia hirta* (Not Evaluated; Protected [Provincial Schedule 2])
- *Euphorbia inaequilatera* (LC; Protected [Provincial Schedule 2])
- *Euphorbia indica* (Not Evaluated; Protected [Provincial Schedule 2])
- *Euphorbia natalensis* (LC; Protected [Provincial Schedule 2])
- *Euphorbia neopolycnemoides* (LC; Protected [Provincial Schedule 2])
- *Euphorbia prostrata* (Not Evaluated; Protected [Provincial Schedule 2])
- *Euphorbia pseudotuberosa* (LC; Protected [Provincial Schedule 2])
- *Euphorbia pubescens* (Not Evaluated; Protected [Provincial Schedule 2])
- *Euphorbia pulcherrima* (Not Evaluated; Protected [Provincial Schedule 2])
- *Euphorbia schinzii* (LC; Protected [Provincial Schedule 2])
- *Euphorbia spartaria* (LC; Protected [Provincial Schedule 2])
- *Euphorbia striata* (LC; Protected [Provincial Schedule 2])
- *Euphorbia tirucalli* (LC; Protected [Provincial Schedule 2])
- *Ledebouria atrobrunnea* (LC; Protected [Provincial Schedule 2])
- *Ledebouria confusa* (LC; Protected [Provincial Schedule 2])
- *Nuxia glomerulata* (LC; Protected [Provincial Schedule 2])
- *Pittosporum viridiflorum* (LC; Nationally Protected Tree)
- *Sclerocarya birrea subsp. caffra* (LC; Nationally Protected Tree)
- *Spirostachys africana* (LC; Protected [Provincial Schedule 2])

Finally, the DFFE Environmental Screening Report also revealed the potential presence (Medium Sensitive) of *Cullen holubii* (Vulnerable and range restricted).

C. holubii, is a range restricted, South African endemic species, known form only eight locations (still extant at only five of these locations). This species preferers savanna/bushveld habitats on sandy plains (major habitats include Zeerust Thornveld and Springbokvlakte Thornveld).

Approximately 60% of this species preferred habitat has been transformed, mainly due to agricultural activities, but also likely due to ongoing habitat loss due to expanding rural settlements, overgrazing and alien invasive encroachment (Mucina & Rutherford, 2006). Subsequently, the populations size is in decline (due to habitat loss and degradation) and warrants its status as a Vulnerable species.

This species was not confirmed during the site visits. Furthermore, the area within the project site that is deemed as medium sensitive for this species, has undergone significant modifications and are not deemed suitable habitat for *C. holubii*. However, small patches of natural, suitable habitat are interspersed between the transformed/modified areas and are regarded as more suitable habitat. Subsequently there is a Moderate Likelihood of Occurrence (LoOC) within these natural sandy-loam areas.

5.3. Faunal Screening Assessment

The IUCN Red List Spatial Data lists a total of 260 invertebrate species that could be expected to occur within the project site, with 28 amphibian- (represented across 10 families), 133 mammal- (represented across 14 families) and 99 reptile species (represented across 24 families) (Table 14). Of these 259 animal species, 24 have been listed as SoCC within the IUCN Red List (1 Critically Endangered-, 2 Endangered-, 9 Near Threatened- and 11 Vulnerable species). According to the Regional Red List (SANBI, 2018), a total of 27 SoCC may occur within the region (1 Critically Endangered-, 1 Data Deficient-, 4 Endangered-, 8 Near Threatened- and 13 Vulnerable species) (Table 14 and Figure 15).

Table 14: Potential faunal (invertebrate) diversity within the region, as well as the amount of species of conservation concern (SoCC) that may occur within the region (Abbreviations: CE = Critically Endangered; EN = Endangered; LC = Least Concern; NT = Near Threatened; VU = Vulnerable and DD = Data Deficient).

Class	Families	Species	IUCN Red List					Regional Red List (SANBI, 2017)					
			CE	EN	LC	NT	VU	CR	DD	EN	LC	NT	VU
AMPHIBIA	10	28			28						28		
MAMMALIA	14	133	1	2	111	9	10	1		4	109	8	11
REPTILIA	24	99			98		1		1		96		2
Grand Total	**48**	**260**	**1**	**2**	**237**	**9**	**11**	**1**	**1**	**4**	**233**	**8**	**13**

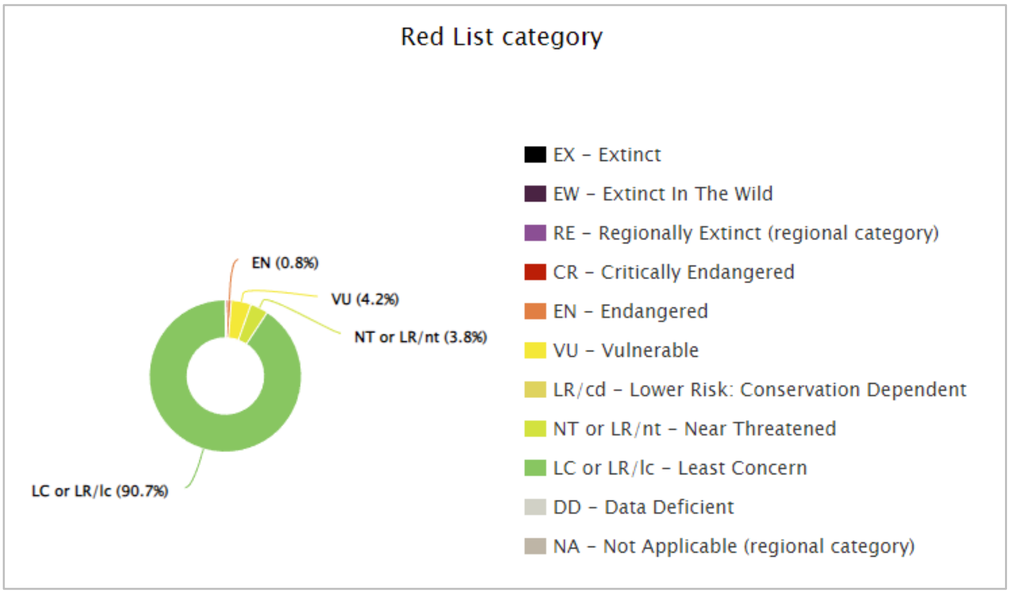

Figure 15: Pie chart showing the various red list categories, and the distribution of the species, found within the region (according to the IUCN Red List database), within these various categories.

Furthermore, in terms of the presence/distribution of various faunal species across the various ecosystems and habitats (according the IUCN Red List data base), within the region, the bulk of the faunal species are associated with terrestrial ecosystems (>74% or 236 species) (Figure 16), especially Dry Savanna (206 species), Subtropical Shrubland (136 species), and Subtropical/Tropical Dry Grassland (122 species) habitats (Figure 17). Faunal diversity within freshwater, aquatic and wetland systems were fairly low (>22% or 72 species), and where associated with Moist Savanna and Seasonal/Intermittent Rivers/Streams. Approximately, 53 faunal species were able to inhabit/utilize Artificial Terrestrial Habitats (arable land and rural gardens) (Figure 16 and Figure 17).

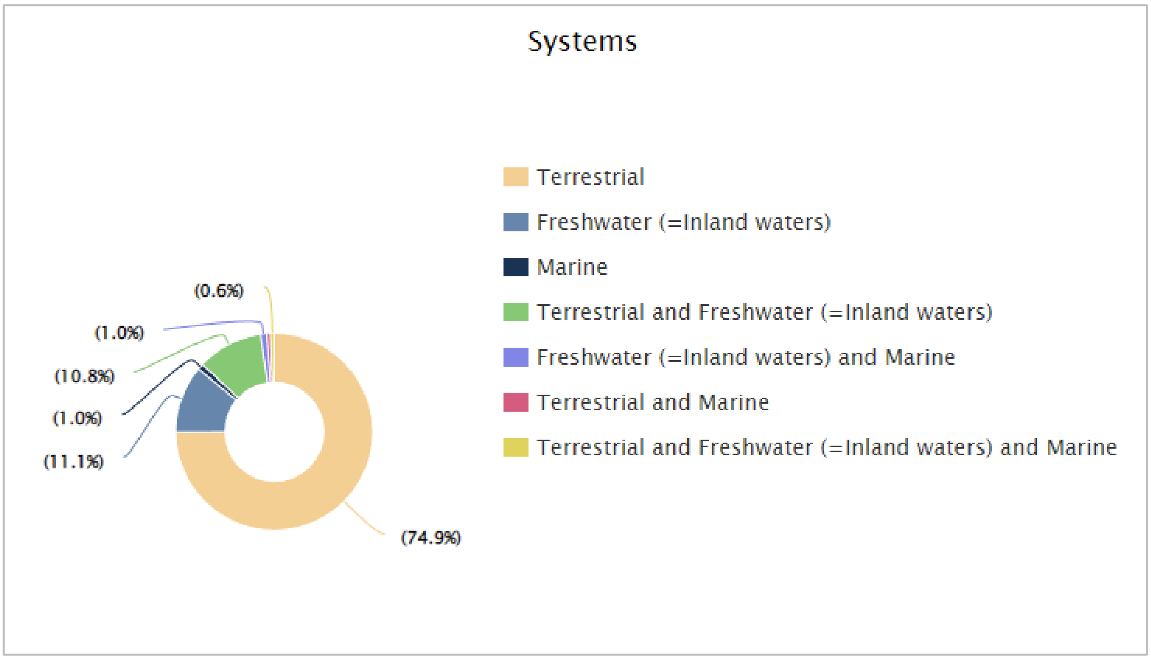

Figure 16: Pie chart showing the faunal diversity within the various ecosystems found within the region (according to the IUCN Red List database).

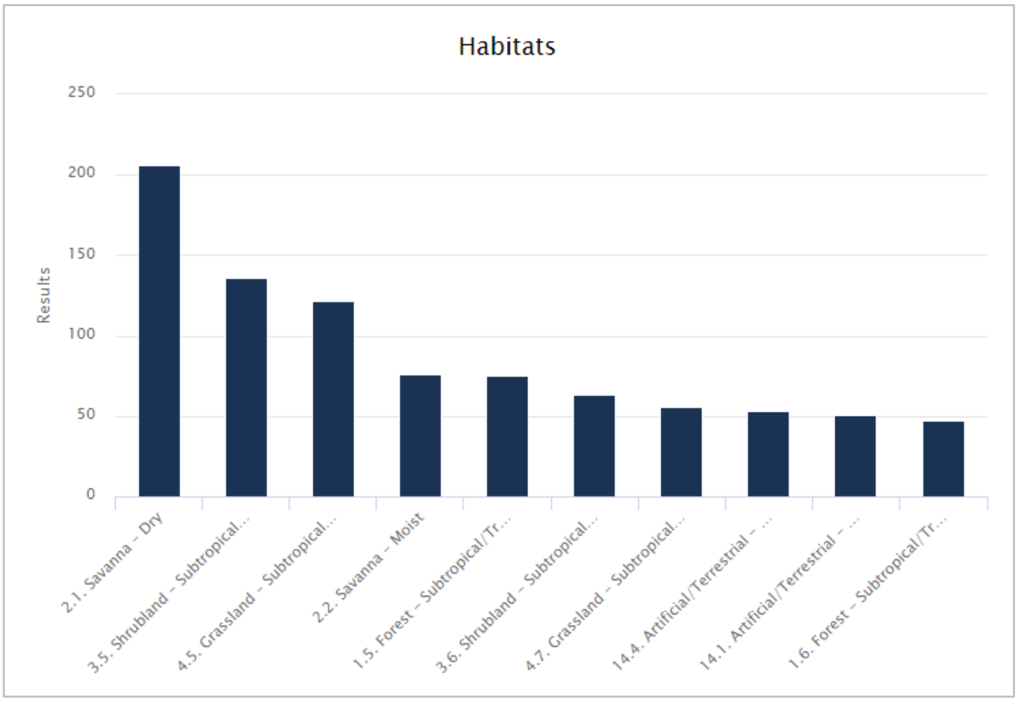

Figure 17: Bar chart showing the faunal diversity within the various habitats found within the region (according to the IUCN Red List database). 2.1 = Savanna (Dry); 3.5 = Shrubland (Subtropical/Tropical Dry); 4.5 = Grassland (Subtropical/Tropical Dry); 2.2 = Savanna (Moist); 1.5 = Forest (Subtropical/Tropical Dry); 3.6 = Shrubland (Subtropical/Tropical Moist); 4.7 = Grassland (Subtropical/Tropical High Altitude); 14.4 = Artificial/Terrestrial (Rural Gardens); 14.1 = Artificial/Terrestrial (Arable Land); and 1.6 = Forest (Subtropical/Tropical Moist Lowland).

According to the IUCN Red List data base (Figure 18) the most significant threats to faunal diversity within the region include:

- Intentional Use (hunting, trapping and persecution) with approximately 80 species threatened through direct/intentional use;
- Residential and commercial development; and
- Livestock farming and ranching (small holder grazing, farming or ranching);
- Agro-industrial farming (annual and perennial non-timber crops); and
- Small-holder farming (annual and perennial non-timber crops)

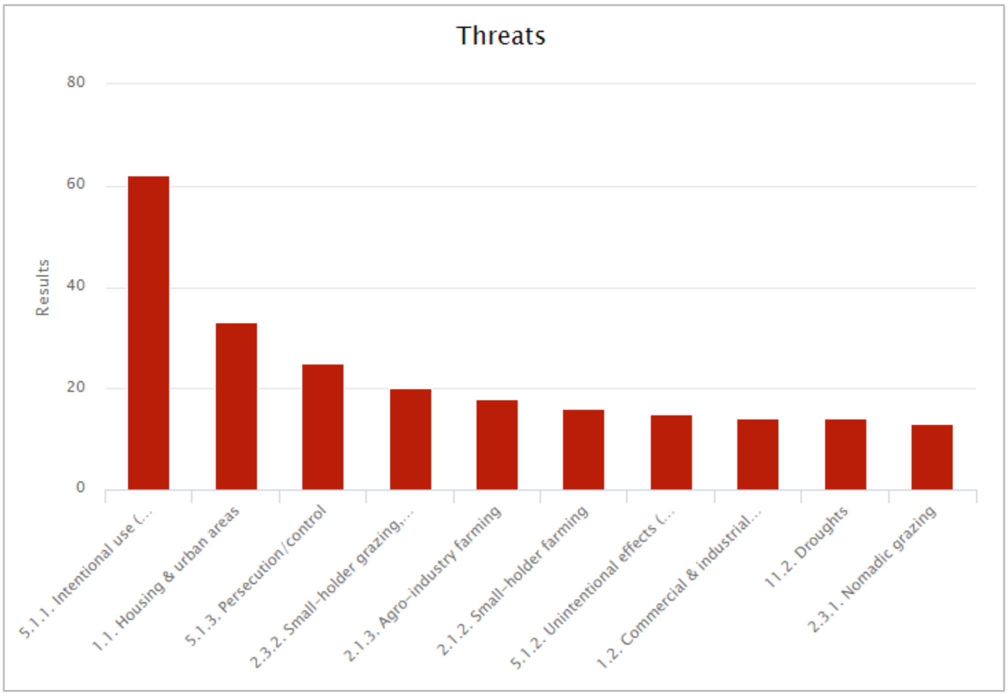

Figure 18: Bar chart showing the various threats to faunal diversity within the region (according to the IUCN Red List database). 5.1.1 = Intentional Use (Hunting and Trapping); 1.1 = Residential and Commercial Development (Housing and Urban areas); 5.1.3 = Persecution/Control; 2.3.2 = Livestock Farming and Ranching (Small-holder grazing/farming/ranching); 2.1.3 = Agro-Industrial Farming (Annual and perennial non-timber crops); 2.1.2 = Small-holder farming (Annual and perennial non-timber crops); 5.1.2 = Unintentional effects (hunting and trapping – species are not the target); 1.2 = Commercial and Industrial Development; 11.2 = Climate Change and Severe Weather (Droughts); and 2.3.1 = Livestock Farming and Ranching (Nomadic grazing).

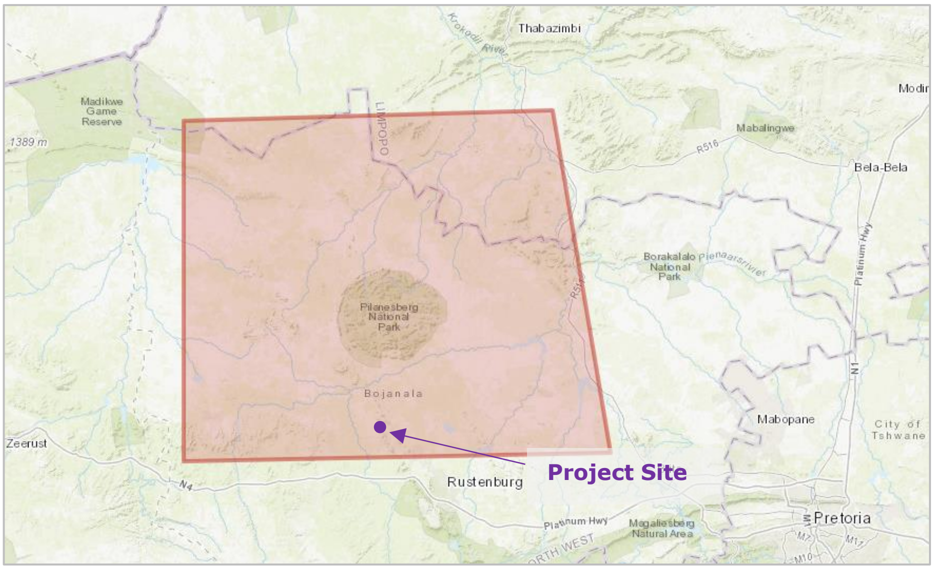

Figure 19: The area used to extract faunal data from the IUCN Red List data base. Extracted data was used to compile a list of faunal species that may potentially occur within the study area, as well as the surrounding area, and provide an indication of potential Species of Conservation Concern that may be found within this area.

5.3.1. Mammal Diversity and Habitats

The IUCN Red List Spatial Data lists 133 mammal species that could be expected to occur within the vicinity of the project site. This is regarded as a moderate mammal species diversity.

Of these species, 22 are medium to large conservation dependant species, or species that had a historical range that included the project area, but with natural populations since becoming locally “extinct” in these areas. These species are now generally restricted to protected areas such as game reserves and protected areas, with most of these species being re-introduced in these areas (e.g. Pilanesberg Nature Reserve). Most of the larger antelope species have been re-introduced within game ranches, especially scarce specimens, and those with exotic variations. These species are extensively bred within small game camps and movement are very strictly controlled, as such these antelope species should rather be seen as part of the agricultural environment rather than natural occurring populations.

Table 15, below provides a list of these species, which can be excluded from the list of natural occurring mammal species/populations, that potentially may inhabit or move naturally across the project site or surrounding areas.

Table 15: List of mammal species that do not occur "naturally" within the area but are rather species that are dependent on human intervention, and the creation of specific conservation/"agricultural" areas within which these mammal species can persist (IUCN, 2017; SANBI, 2016). Abbreviations: NT = Near Threatened; VU = Vulnerable; LC = Least Concern; EN = Endangered; CE = Critically Endangered and DD = Data Deficient.

Species	Common Name	Red Data Categories	
		Regional Red List	IUCN Red List
Damaliscus lunatus lunatus	Tsessebe	VU	LC
Giraffa camelopardalis giraffa	South African Giraffe	LC	VU
Hippopotamus amphibius	Hippopotamus	LC	VU
Hippotragus equinus	Roan Antelope	EN	LC
Hippotragus niger	Sable Antelope	VU	LC
Kobus ellipsiprymnus ellipsiprymnus	Common Waterbuck	LC	LC
Oryx gazella	Gemsbok	LC	LC
Redunca arundinum	Southern Reedbuck	LC	LC
Tragelaphus oryx	Eland	LC	LC
Crocuta crocuta	Spotted Hyaena	LC	LC
Panthera leo	Lion	LC	VU
Aepyceros melampus melampus	Impala	LC	LC
Alcelaphus buselaphus caama	Red Hartebeest	LC	LC
Antidorcas marsupialis	Springbok	LC	LC
Connochaetes taurinus	Blue Wildebeest	LC	LC
Damaliscus pygargus phillipsi	Blesbok	LC	LC
Syncerus caffer	Southern Savannah Buffalo	LC	NT
Tragelaphus sylvaticus	Southern Bushbuck	LC	LC
Ceratotherium simum	Square-lipped Rhinoceros	NT	NT
Diceros bicornis	Black Rhinoceros	CE	CE
Equus quagga	Burchell's Zebra	LC	NT

Following the removal of these mammal species listed in Table 15 above, 111 mammal natural occurring mammal species could be expected to occur within the vicinity of the project site. This is still regarded as a moderate mammal species diversity. These mammal species are grouped within 12 mammal families, with Rodentia (rodents) being the most divers family (29 species), followed by Carnivore (carnivores) with 26 species, Chiroptera (bats) with 22 species and Eulipotyphla (shrews, moles, hedgehogs, sengis and allies) with 11 species.

According to the ADU database 132 mammals have been previously recorded within the larger survey area (Quarter Degree Grids: 2527AC; AA; AB; BA; BC; DA; AD; CB; CA; AC; 2526BD; DB and BB). This includes some of the conservation dependent and/or exotic game species that have been primarily introduced by game farmers. As mentioned above, most of these species are confined by fences and should be considered as part of the farming/agricultural system (game farming, reserves and hunting farms) rather than as wildlife per se. As mentioned, some of these species are indigenous to South African but do not have a natural distribution that include this area. For examples of such introduced or conservation dependant mammal species, refer to Table 15.

Furthermore, according to the Animal Demographic Unit (ADU) database the following indigenous, natural occurring mammal species have been frequently observed within the relevant QDGs:

- Greater Kudu - *Tragelaphus strepsiceros* (No. of Records 294);
- Leopard - *Panthera pardus* (No. of Records 295);
- Scrub Hare - *Lepus saxatilis* (No. of Records 164);
- Steenbok - *Raphicerus campestris* (No. of Records 94);
- Bushbuck - *Tragelaphus scriptus* (No. of Records 82);
- Black-backed Jackal - *Canis mesomelas* (No. of Records 136);
- Slender Mongoose - *Herpestes sanguineus* (No. of Records 103);
- Brown Hyena *Parahyaena brunnea* (No. of Records 147);
- Common Warthog - *Phacochoerus africanus* (No. of Records 75);
- Mountain Reedbuck - *Redunca fulvorufula* (No. of Records 65);
- Bush Duiker - *Sylvicapra grimmia* (No. of Records 58);
- Vervet Monkey - *Chlorocebus pygerythrus* (No. of Records 41);
- Chacma Baboon - *Papio ursinus* (No. of Records 41);
- Cheetah - *Acinonyx jubatus* (No. of Records 52);
- Tete Veld Aethomys - *Aethomys ineptus* (No. of Records 57);
- Namaqua Rock Mouse - *Aethomys namaquensis* (No. of Records 48); and
- Natal Mastomys - *Mastomys natalensis* (No. of Records 41)

5.3.2. Mammal Species of Conservation Concern (SCC)

SCCs include those species listed within the Regional (2016) and Global (2015) Red Data Lists, and indicate severe recent population declines, as well as those species, or populations of species, that are highly range restricted.

The initial screening report revealed that three mammal SCC have a distribution range that include the project site and may potentially inhabit the project site namely; Sensitive Species 5 (for their protection, the identities of these species will not made public); *Crocidura maquassiensis* (Makwassie musk shrew), and *Lycaon pictus* (African wild dog). Subsequently, the project site has been classified as Medium Sensitive within the screening tool.

During the site survey it was determined that there is a very low likelihood of occurrence (LoOC) for all three mammal species to occur within the project site. Due to livestock and intensive game breeding activities within the area, *Lycaon pictus* (African wild dog) and Species 5 these species will likely also not be tolerated within the area, there movement within the area would also be highly restricted due to numerous impenetrable, and frequently electrified game fences. Furthermore, *Crocidura maquassiensis* (Maquassie Musk Shrew) prefers densely vegetated, moist grassland/wetland habitats, and no such habitats are present within the project site.

During the site surveys, no species of conservation concern (SoCC) was observed. Due to a general low habitat and structural complexity, as well as the fact that more than 40% of the project site have been significantly degraded and transformed, the site is likely to have a low faunal diversity, including other potential SoCC. Other SoCC which have a distribution that include the development site and are likely (high likelihood) to occur within the development site due to favourable habitat, include:

» South African Hedgehog – *Atelerix frontalis* (Near Threatened)

In terms of the generated IUCN Red List Spatial Data lists, of the remaining 111 small- to medium sized mammal species, that have a natural distribution range that include the project site and have a likelihood of occurring within the project site, 23 are listed as being of conservation concern on a regional or global basis (Table 16).

The list of potential species includes:

- At a global scale (IUCN Red List):
    - Two (2) species listed as Endangered;
    - Six (6) species listed as Near Threatened;
    - Six (6) species listed as Vulnerable;
    - Five (5) that are listed as Vulnerable (VU) on a regional basis; and
- At a regional scale:
    - SANBI 2016:
        - Four (4) species listed as Endangered;
        - Seven (7) species as Near Threatened;
        - Eight (8) species as Vulnerable;
    - TOPS
        - Four (4) species as Near Threatened;
        - Four (4) species as Vulnerable;
        - One (1) species as Endangered.

Table 16: List of mammal species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016; TOPS)

Species	Common Name	Conservation Status			Likelihood of Occarance (LoOC)
		Red Data	IUCN	TOPS	
Lycaon pictus	African Wild Dog	EN	EN	EN	Very Low
Redunca fulvorufula fulvorufula	Mountain Reedbuck	EN	EN		Very Low
Aonyx capensis	Cape Clawless Otter	NT	NT	NT	Low
Parahyaena brunnea	Brown Hyaena	NT	NT	NT	Very Low
Pelea capreolus	Grey Rhebok	NT	NT		Very Low
Hydrictis maculicollis	Spotted-necked Otter	NT	VU	VU	Very Low
Eidolon helvum	African Straw-coloured Fruit Bat	NT	LC		Moderate
Rhinolophus smithersi	Smithers's Horseshoe Bat	NT	LC		Low
Panthera pardus	Leopard	VU	VU	VU	Low
Acinonyx jubatus	Cheetah	VU	VU	VU	Very Low

Species	Common Name	Conservation Status			Likelihood of Occarance (LoOC)
		Red Data	IUCN	TOPS	
Felis nigripes	Back-footed Cat	VU	VU	VU	Moderate
Smutsia temminckii	Temminck's Ground Pangolin	VU	VU		Low
Chrysospalax villosus	Rough-haired Golden Mole	VU	VU		Low
Mystromys albicaudatus	White-tailed Mouse	VU	VU		Moderate
Ourebia ourebi	Oribi	LC	EN		Very Low
Cloeotis percivali	Short-eared Trident Bat	LC	EN		Moderate
Atelerix frontalis	South African Hedgehog	LC	NT		High
Rhinolophus blasii	Peak-saddle Horseshoe Bat	LC	NT		Low
Crocidura mariquensis	Swamp Musk Shrew	LC	NT		Very Low
Dasymys incomtus	African Marsh Rat	LC	NT		Very Low
Crocidura maquassiensis	Makwassie Musk Shrew	LC	VU		Very Low

Atelerix frontalis (South African Hedgehog) has a tolerance of a degree of habitat modification and occurs in a wide variety of semi-arid and sub-temperate habitats (IUCN, 2017). Based on the Red List of Mammals of South Africa, Lesotho and Swaziland (2016), *A. frontalis* populations are decreasing due to the threats of electrocution, veld fires, road collisions, predation from domestic pets and illegal harvesting. Very limited and fractured suitable habitat exists within the project site as well as the region, however the larger extent of natural to moderately modified habitat within the project site may provide suitable habitat for this species and as such the likelihood of occurrence in the natural grassland areas are rated as **High**.

5.3.3. Protected Mammal Species

Protected mammal species are either protected nationally within TOPS (Threatened and Protected Species Issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004) or provincially within Schedule 2, 2A and 4 of the Transvaal Nature Conservation Ordinance Act No 12 of 1983 (TNCO).

TOPS Regulations:

- The Threatened or Protected Species (TOPS) regulations, 2007, provide a national approach to the sustainable use of species threatened with extinction, or in need of national protection, while ensuring the survival of the species in the wild, thus ensuring the conservation of the species.
- The TOPS regulations address multiple issues including: unethical hunting practices such as hunting in confined spaces, or hunting of tranquilised animals or by means of bait; activities related to the management of damage-causing animals; hybridisation and spreading diseases as a result of translocation; activities threatening cycad populations; and registration of captive breeding and keeping facilities.

- NEMBA enables the Minister to prohibit activities that may impact on the survival of species in the wild, and to regulate activities to ensure the sustainable use of indigenous biological resources.
- According to the definitions provided within the TOPS regulations (Section 56 (1)):
  - a Protected Species (56(1)(d)) is any indigenous species which is of high conservation value or national importance, or requires regulation in order to ensure that the species is managed in an ecologically sustainable manner. Furthermore, all indigenous species listed within CITES (Conservation on International Trade in Endangered Species of Wild Fauna and Flora) are also automatically listed as Protected Species within TOPS.

Schedule 2, and 2A and 4 of the Transvaal Nature Conservation Ordinance Act No 12 of 1983 (MPNCA):

- The aim/purpose of the Act is to provide for;
  - the sustainable utilisation of wild animals, aquatic biota, and plants;
  - to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora;
  - to provide for offences and penalties for contravention of the Act;
  - to provide for the appointment of nature conservators to implement the provisions of the Act;
  - to provide for the issuing of permits and other authorisations; and
  - to provide for matters connected therewith.

In terms of the generated IUCN Red List Spatial Data lists, of the remaining 111 small- to medium sized mammal species, that have a natural distribution range that include the project site and have a likelihood of occurring within the project site, 14 are regarded as provincially protected species (Schedule 2 and 4 of the TNCO), whilst no TOPS protected species have been listed within the IUCN species list (Table 17).

The list of species includes:

- Twelve (12) species protected within Schedule 2 (Protected Game – Section 15(1)(a) of the TNCO)); and
- Two (2) species protected within Schedule 4 (Protected Wild Animals – Section 15(1)(c) of the TNCO))

Table 17: List of Protected mammal species (according to national provincial regulations) that have a distribution that include the study area.

Species	Common Name	CITES	TNCO Schedule 2	TNCO Schedule 4	Likelihood of Occurrence (LoOC)
Panthera pardus	Leopard	I		Protected	Low
Acinonyx jubatus	Cheetah	I		Protected	Very Low

Species	Common Name	CITES	TNCO Schedule 2	TNCO Schedule 4	Likelihood of Occurrence (LoOC)
Felis nigripes	Back-footed Cat	I			Moderate
Galago moholi	Southern Lesser Galago	II	Protected		Moderate
Otolemur crassicaudatus	Thick-tailed Bushbaby	II	Protected		Low
Aonyx capensis	Cape Clawless Otter	II			Very Low
Hydrictis maculicollis	Spotted-necked Otter	II			Very Low
Leptailurus serval	Serval	II			High
Caracal caracal	Caracal	II			Low
Felis silvestris	African Wildcat	II			High
Mellivora capensis	Honey Badger	II			Low
Chlorocebus pygerythrus	Vervet Monkey	II			High
Papio ursinus	Chacma Baboon	II			Moderate
Proteles cristata	Aardwolf	III	Protected		Moderate
Civettictis civetta	African Civet	III			Low
Redunca fulvorufula fulvorufula	Mountain Reedbuck		Protected		Very Low
Parahyaena brunnea	Brown Hyaena		Protected		Very Low
Pelea capreolus	Grey Rhebok		Protected		Very Low
Smutsia temminckii	Temminck's Ground Pangolin		Protected		Low
Ourebia ourebi	Oribi		Protected		Very Low
Atelerix frontalis	South African Hedgehog		Protected		High
Oreotragus oreotragus	Klipspringer		Protected		Very Low
Raphicerus campestris	Steenbok		Protected		Confirmed
Orycteropus afer	Aardvark		Protected		High
Lycaon pictus	African Wild Dog			Protected	Very Low

5.3.4. Reptile and Amphibian Diversity

Based on the IUCN Red List Spatial Data (IUCN, 2017), 99 reptilian species can be expected to occur within the vicinity of the project site, whist according to the distribution maps of Bates et al. (2014) a total of 102 terrestrial reptilian species may be found within the region. Due to the fairly moderate spatial heterogeneity (especially in terms of geomorphology) of the study area, it is expected that the diversity within the study area itself will be low-moderate.

These reptile species are grouped within 24 reptile families, with Gekkonidae (geckos) and Scincidae (skinks) being the most divers families (11 species each), followed by Colubirdae (herald snakes, egg-eaters, green snakes, tiger snakes, twig snakes and boomslang) with nine species and then Elapidae (cobras, mambas and rinkhals) as well as Psammophiidae (house snakes, grass snakes, harlequin snakes, file snakes sand- and grass snakes and allies) with 7 species each.

Of these 102 reptile species, 66 have been previously recorded within the larger survey area (Quarter Degree Grids: 2527AC; AA; AB; BA; BC; DA; AD; CB; CA; AC; 2526BD; DB and BB) according to the Animal Demographic Unit (ADU) database. Species that has been frequently observed within the these QDGs are:

- Speckled Rock Skink - *Trachylepis punctatissima* (No. of Records: 58);
- Common Variable Skink - *Trachylepis varia sensu lato* (No. of Records: 56);
- Southern Rock Agama - *Agama atra* (No. of Records: 54);
- Common Dwarf Gecko - *Lygodactylus capensis* (No. of Records: 44);
- Common Girdled Lizard - *Cordylus vittifer* (No. of Records: 38);
- Transvaal Gecko - *Pachydactylus affinis* (No. of Records: 38);
- Yellow-throated Plated Lizard - *Gerrhosaurus flavigularis* (No. of Records: 30);
- Serrated Hinged Terrapin - *Pelusios sinuatus* (No. of Records: 29);
- Water Monitor - *Varanus niloticus* (No. of Records: 27);
- Southern Tree Agama - *Acanthocercus atricollis* (No. of Records: 26);
- Striped Grass Snake - *Psammophylax tritaeniatus* (No. of Records: 26);
- Leopard Tortoise - Stigmochelys pardalis (No. of Records: 25); and
- Short-snouted Grass Snake - *Psammophis brevirostris* (No. of Records: 24)

Based on the IUCN Red List Spatial Data (IUCN, 2017), 28 amphibian species can be expected to occur within the vicinity of the project site, whist according to the distribution maps of Du Preez & Carruthers (2009) and Minter *et a*l. (2004) a total of 30 amphibian species may be found within the region.

These amphibian species are grouped within 10 amphibia families, with Pyxicephalidae (river frogs, cacos, bullfrogs, stream frogs, sand frogs and allies) being the most divers family (10 species), followed by Bufonidae (toads) with eight species.

Of the 30 amphibian species, 29 have been previously recorded within the larger survey area (Quarter Degree Grids: 2527AC; AA; AB; BA; BC; DA; AD; CB; CA; AC; 2526BD; DB and BB) according to the Animal Demographic Unit (ADU) database. Species that has been frequently observed within the these QDGs are:

- Red Toad - *Schismaderma carens* (No. of Records: 83);
- Bubbling Kassina - *Kassina senegalensis* (No. of Records: 68);
- Common Caco - *Cacosternum boettgeri* (No. of Records: 55);
- Banded Rubber Frog - *Phrynomantis bifasciatus* (No. of Records: 54);
- Plain Grass Frog - *Ptychadena anchietae* (No. of Records: 43);
- Tremelo Sand Frog - *Tomopterna cryptotis* (No. of Records: 37);
- Natal Sand Frog - *Tomopterna natalensis* (No. of Records: 36);
- Olive Toad - *Sclerophrys garmani* (No. of Records: 31);
- Delalande's River Frog - *Amietia delalandii* (No. of Records: 31);
- Guttural Toad - *Sclerophrys gutturalis* (No. of Records: 29);
- Snoring Puddle Frog - *Phrynobatrachus natalensis* (No. of Records: 27);
- Northern Pygmy Toad - *Poyntonophrynus fenoulheti* (No. of Records: 19); and
- Southern Foam Nest Frog - *Chiromantis xerampelina* (No. of Records: 19)

5.3.5. Reptile and Amphibian Species of Conservation Concern (SCC)

SCCs include those species listed within the Regional Red Data List (2017), Global Red Data List (2015), that have experienced severe recent population declines, as well as those species, or populations of species, that are highly range restricted.

In terms of the generated IUCN Red List Spatial Data lists, of the 99 reptile and 28 amphibian species, that have a natural distribution range that include the project site and have a likelihood of occurring within the project site, three (3) reptile species have been listed as being of conservation concern on a regional or global basis (Table 18), whilst no amphibian species have been listed as of conservation concern (least concern).

The list of potential species includes:

- At a global scale (IUCN Red List):
  - One (1) reptile species listed as Vulnerable (VU);
- At a regional scale:
  - SANBI 2016:
    - Two (2) reptile species listed as Vulnerable (VU).

Table 18: List of reptile species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016; TOPS)

Species	Common Name	Conservation Status			Likelihood of Occurance (LoOC)
		Red Data	IUCN	TOPS	
Kinixys lobatsiana	Lobatse Hinge-back Tortoise	VU	VU		Low
Crocodylus niloticus	Nile Crocodile	LC	VU		Very Low

5.3.6. Protected Reptile and Amphibian Species

These are species that are either protected nationally within TOPS (Threatened and Protected Species Issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004) or provincially within Schedule 2 and 4 of the Transvaal Nature Conservation Ordinance (No 12 of 1983).

According to the Transvaal Nature Conservation Ordinance all species of reptiles excluding Water Monitor (*Varanus niloticus*), Rock Monitor (*Varanus albigularis*), and all species of snakes (Sub-Order Serpentes) are protected within Schedule 2 (thus a total of 46 reptile species are protected according to Schedule 2). Furthermore, in terms of Amphibians, only the Giant Bullfrog (Pyxicephalus adspersus) is protected within Schedule 2.

In terms of TOPS, only one reptile species that has a distribution range that include the project site, is protected namely, the Southern African Python (*Python natalensis).* In terms of amphibian species, the Giant Bullfrog (*Pyxicephalus adspersus*) and African

Bullfrog (*Pyxicephalus edulis*) have a distribution range that include the project site and are protected according to the TOPS Regulations.

Table 19: List of Protected reptile and amphibian species (according to national provincial regulations) that have a distribution that include the study area.

Species	Common Name	CITES	TOPS	TNCO Schedule 2	TNCO Schedule 4	Likelihood of Occurance (LoOC)
Class: Reptilia						
All reptile species apart excluding Water Monitor (*Varanus niloticus*), Rock Monitor (*Varanus albigularis*), and all species of snakes (Sub-Order Serpentes)				Protected		High
Python natalensis	Southern African Rock Python	II	Protected			Low
Crocodylus niloticus	Nile Crocodile	II		Protected		Very Low
Kinixys lobatsiana	Lobatse Hinge-back Tortoise	II		Protected		Low
Cordylus jonesii	Jones' Girdled Lizard	II		Protected		Very Low
Cordylus vittifer	Common Girdled Lizard	II		Protected		Very Low
Stigmochelys pardalis	Bergskilpad	II		Protected		High
Chamaeleo dilepis	Flap-necked Chameleon	II				High
Varanus albigularis	Rock Monitor	II				High
Varanus niloticus	Nile Monitor	II				Very Low
Class: Amphibia						
Pyxicephalus adspersus	Giant Bullfrog		Protected	Protected		Very Low
Pyxicephalus edulis	African Bullfrog		Protected			Very Low

6. FINDINGS OF THE BOTANICAL ASSESSMENT

6.1. Site Specific Vegetation Description – Fine Scale Vegetation Patterns

This section describes the different habitats and vegetation patterns observed within the study area. As these are field-based observations taken directly from the study area, they are of greater reliability and pertinence than the coarsely mapped results of the National Vegetation Map, which does not adequately represent such finer details.

According to the National Vegetation Map 2018, the entire study area is mapped as Zeerust Thornveld (SVcb3), with some Gold Reef Mountain Bushveld (SVcb9) occurring nearby (see Figure 13).

Small-scale plant diversity and ecological condition of vegetation varied exceptionally across the development site between natural/near natural and disturbed areas. However, within these areas themselves (within the natural/near natural areas as well as the disturbed areas) small-scale plant diversity and ecological condition of vegetation varied very little. The primary ecological drivers are anthropogenic activities, most notable ploughing and cultivation as well as grazing regimes (within natural/near-natural areas).

A total distance of ± 47.2 km (convex hull = 695.8 ha) was surveyed on foot across the proposed development site and the broader surrounding areas, as well as by vehicle.

The following plant community types were found in the proposed development site and surrounds (see **Error! Reference source not found.** for species totals within each plant community type, and Figure 26 and Figure 27 for representative community photos; also see Figure 29 and Figure 30 for photos of selected plant species):

- *Cenchrus ciliaris Planted Veld*
- *Cymbopogon caesius - Heteropogon contortus*
- *Dichanthium annulatum - Brachiaria brizantha Pasture*
- *Panicum maximum - Urochloa mosambicensis Pasture*
- *Themeda triandra - Ziziphus mucronata*
- *Vachellia tortilis - Heteropogon contortus: A (Eragrostis lehmanniana)*
- *Ziziphus mucronata - Cymbopogon caesius: A (Grewia flava)*
- *Ziziphus mucronata - Cymbopogon caesius: B (Eragrostis lehmanniana)*

The following is brief overall summary: a total of 178 plant species were found within the proposed development site, which consisted of 158 native, 0 SCC, 3 protected, 20 alien, and 7 NEM:BA listed invasive species. Furthermore, a total of 15 species were recorded within the proposed development site that were not recorded within online databases.

Plant species turnover (i.e., the number of species unique to each plant community type) was not exceptionally high for the proposed development site, and the majority of species were shared between plant community types (see "%Unique" in Table 18, as well as Figure 22). Only the Eragrostis chloromelas - Themeda triandra and Eragrostis plana - Kyllinga erecta plant community types had a high number of unique species (41% and 44%, respectively) that were not found in the other types. As such, these are considered the most sensitive of the plant community types occurring in the proposed development site.

The following plant species were found in all the plant community types:

- *Heteropogon contortus*
- *Vachellia tortilis subsp. heteracantha*
- *Ziziphus mucronata subsp. mucronata*

Table 20: Plant species summary statistics for the plant community types of the proposed development site and broader surrounding area. "Unique" species were only observed in the specific plant community type in question, and not in others (note: this does not mean such species cannot or do not occur in other types, but only that they were not specifically observed in the other types during surveying). "Shared" species were shared between two or more types. Note that overall total values might be less than the sum of all the respective values, since species can be shared between plant community types. Also note that these are summary values, and are expanded more in-depth in Figure 23 and Figure 24. SCC = Species of Conservation Concern; THREAT = Threatened species ("CR PE", "CR", "EN", or "VU"); NWE = North West Endemic; NEM:BA = Species listed under NEM:BA Alien and Invasive Species Regulations; N/A = Not Applicable. The row in green indicates the plant community type that had the highest number of plant species, while the row in light-red indicates the plant community type that had the lowest number of plant species; Protected = Provincially protected under Schedule 11 and 12 of the Transvaal Nature Conservation Ordinance (No. 12 of 1983) or a protected tree under Section 12 of the National Forests Act 84 of 1998

	Total	Shared	Unique	%Unique	SCC	THREAT	Protected	NWE	Native	Alien	NEM:BA
Community											
Cenchrus ciliaris Planted Veld	11	11	0	0	0	0	1	0	11	0	0
Cymbopogon caesius - Heteropogon contortus	87	85	2	2	0	0	1	0	77	10	2
Dichanthium annulatum - Brachiaria brizantha Pasture	44	41	3	7	0	0	0	0	37	7	2
Panicum maximum - Urochloa mosambicensis Pasture	20	19	1	5	0	0	0	0	17	3	0
Themeda triandra - Ziziphus mucronata	33	27	6	18	0	0	0	0	28	5	0
Vachellia tortilis - Heteropogon contortus: A (Eragrostis lehmanniana)	77	73	4	5	0	0	1	0	66	11	2
Ziziphus mucronata - Cymbopogon caesius: A (Grewia flava)	126	93	33	26	0	0	2	0	113	13	4
Ziziphus mucronata - Cymbopogon caesius: B (Eragrostis lehmanniana)	101	94	7	7	0	0	1	0	90	11	2
Total											
N/A	178	N/A	N/A	N/A	0	0	3	0	158	20	7

Figure 20: Presence/absence matrix of plant species for each plant community type within the proposed development site and broader surrounds. The presence of a green block indicates the presence of the respective plant species within the respective plant community type. This figure serves as a highly useful reference to visually determine either how many (and which) species occurred in a specific plant community type, or in how many (and which) plant community types a specific species occurred. Note that the plot continues on the next page.

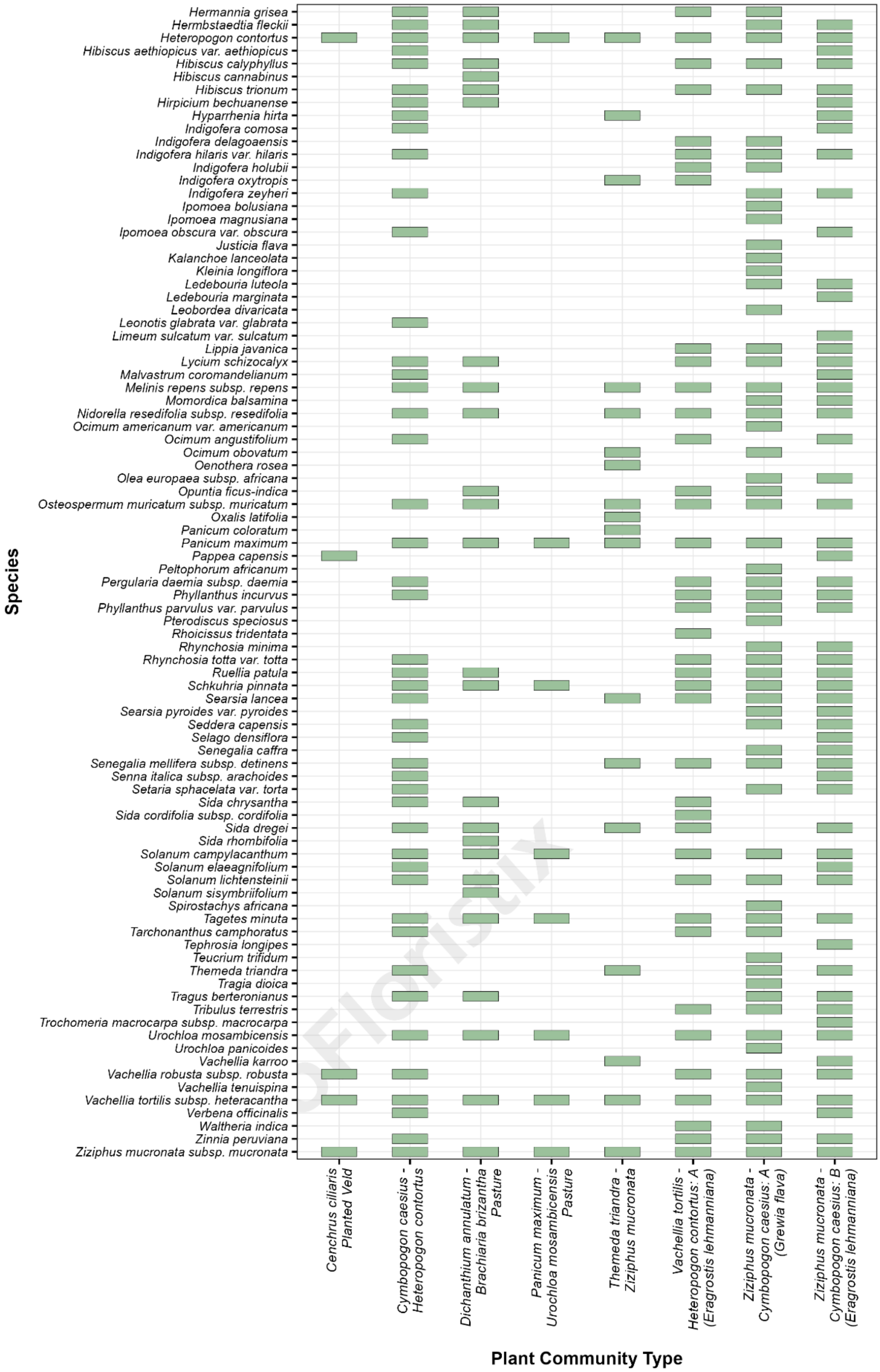

Figure 21: Presence/absence matrix of plant species for each plant community type within the proposed development site and broader surrounds. This is a continuation of Figure 20.

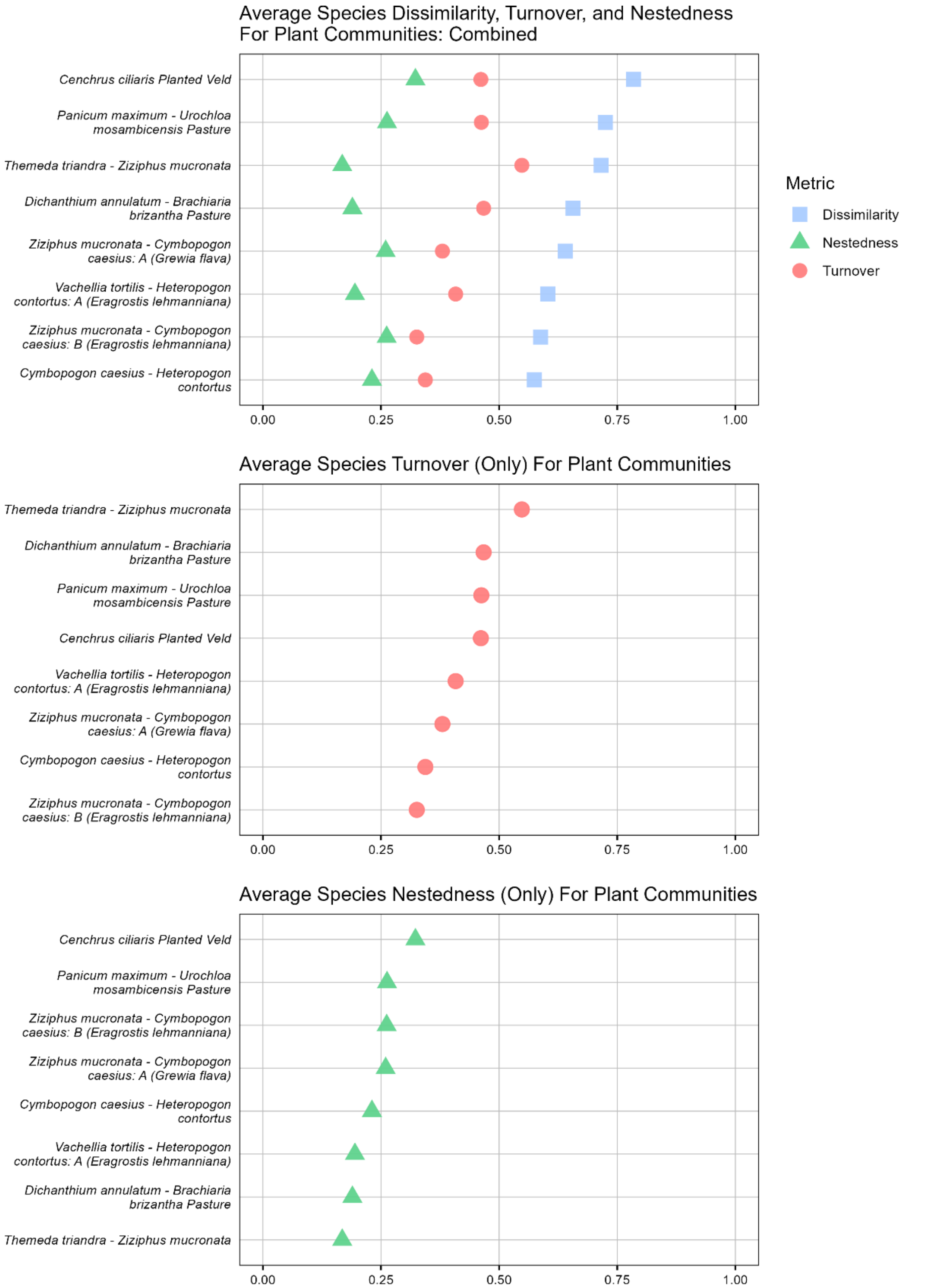

Figure 22: Average dissimilarity, turnover, and nestedness between plant community types found in the proposed development site. The **top panel** is a combined plot and is sorted descending according to full dissimilarity values. The **middle** and **bottom panels** isolate only the components of turnover and nestedness (for enable an easy visual inspection), and each of these panels is also sorted descending according to the respective component. This is a highly useful figure to not only see which communities were the most different (compared to the other communities) overall, but also how they differ. For example, although some communities might yield high dissimilarity values, these can either result due to high levels of turnover (which are more important for conservation) or nestedness (which are less important for conservation, since such communities are mostly subsets of other communities.) Note: these are overall averages; see Figure 23 and Figure 25 for individual values. Values can range from 0 (complete similarity) to 1 (complete dissimilarity).

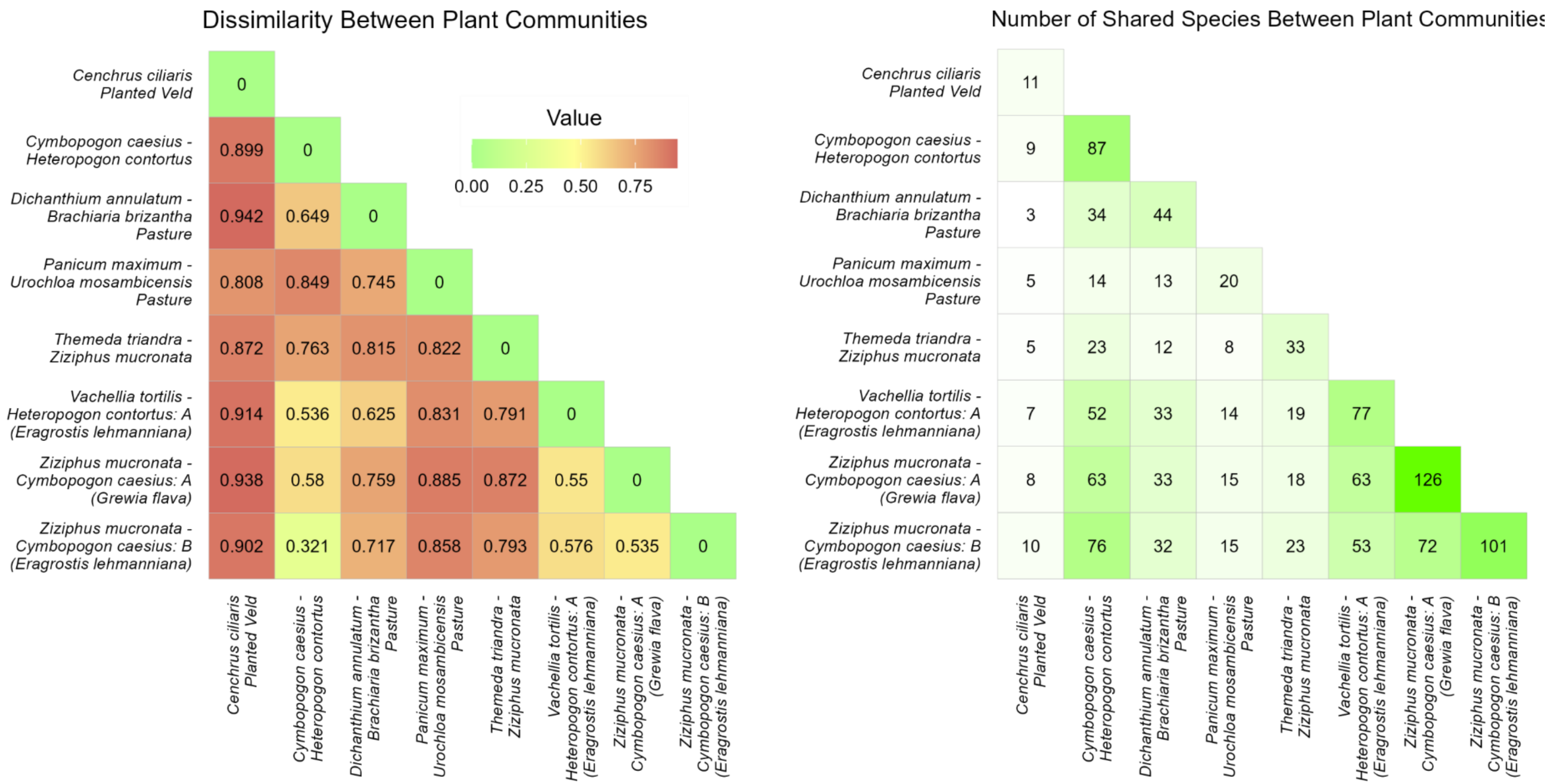

Figure 23: **LEFT PANEL:** Overall similarities between the plant community types found on site. Values can range from 0 to 1. Two plant community types that are very similar have small "dissimilarity" values (0 indicates complete similarity, or zero dissimilarity, and thus the two communities have all species in common); conversely, two plant community types that are not at all similar, but instead very dissimilar, have large "dissimilarity" values (1 indicates zero similarity, or complete dissimilarity, and thus the two communities have no species in common at all). These values are very useful to determine which communities are most similar or dissimilar. However, the notion of similarity does not indicate how the communities differ, since they can differ because they either have many different species (namely, "turnover") or are subsets of one another (namely, "nestedness"). Thus, similarity can be broken down into the two components of turnover and nestedness, which are displayed in Figure 25. The three variables of dissimilarity, turnover, and nestedness have an easy and straightforward relationship, namely: Dissimilarity = Turnover + Nestedness. The level of similarity between two plant community types is determined by the number of species that are shared between them, as well as the number of species that are unique to each (i.e., species that are not shared between the communities); these are given in the left panel, as well as the figures that follow. **RIGHT PANEL:** Number of shared species between plant community types found on site. These values simply indicate the number of species shared between plant community types for each pairwise combination; the top diagonal row of the matrix simply represents the total number of species per plant community type. Note that this is a more in-depth expansion of the totals given in **Error! Reference source not found.**. Compare with Figure 24.

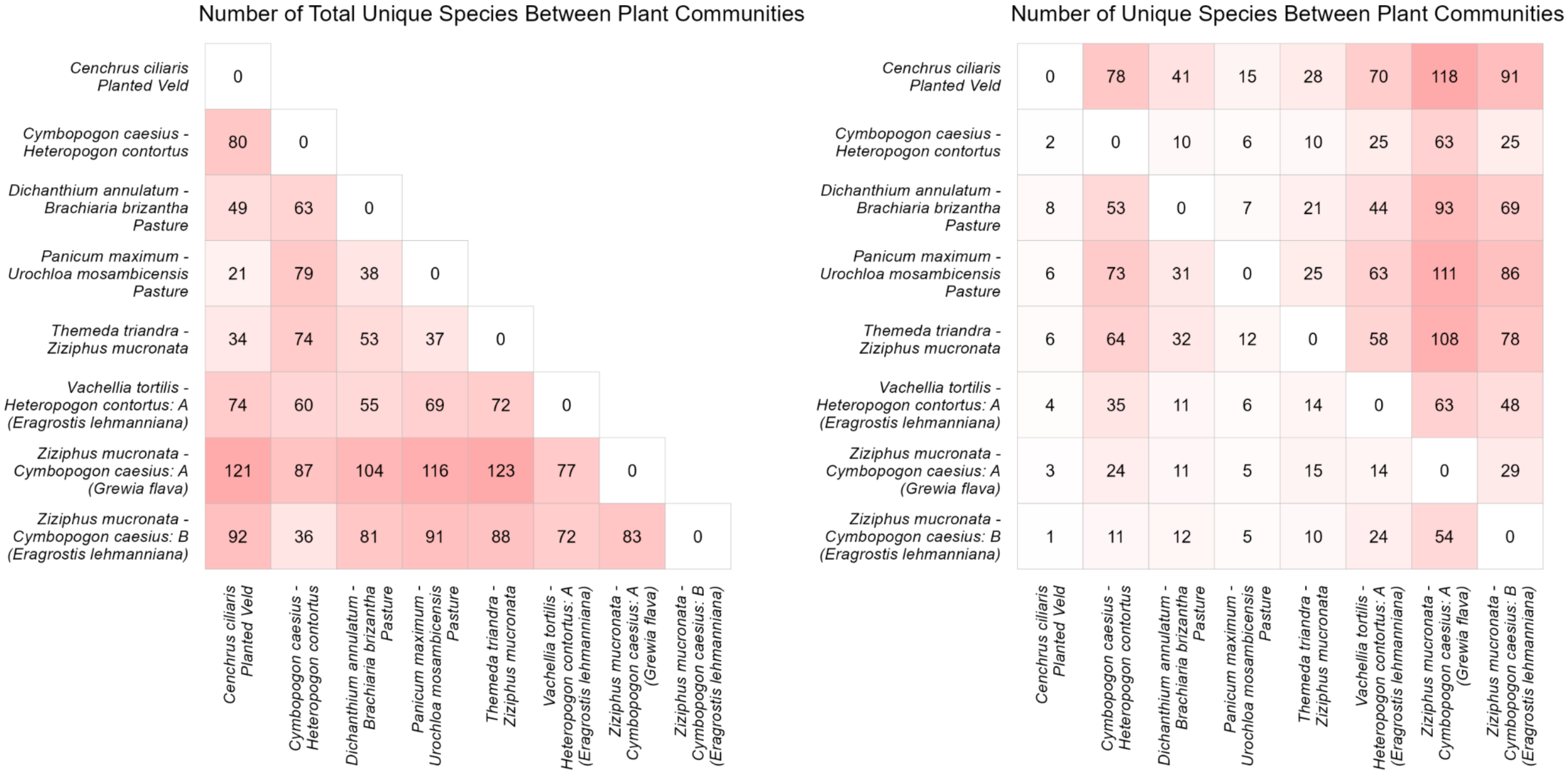

Figure 24: Unique species for the plant community types found on site. **LEFT PANEL:** This represents the total number of unique species (i.e., not shared) for each pairwise comparison between plant community types. **RIGHT PANEL:** Unique species per pairwise comparison of plant community types. Note that this is not the same as the figure in the right panel. The key difference here is that of comparison direction. That is, when a species rich and species poor plant community type is compared, then the former will have more unique species than the latter. As an example of comparing two plant community types with each other, the *Dichanthium annulatum - Verbena officinalis* type has 68 species not found in the *Cymbopogon caesius - Heteropogon contortus* type, while the *Dichanthium annulatum - Verbena officinalis* type has 23 species not found in the *Cymbopogon caesius - Heteropogon contortus* type. Together, these two types have 91 species that are not shared (and 19 species that are shared; see Figure 23).

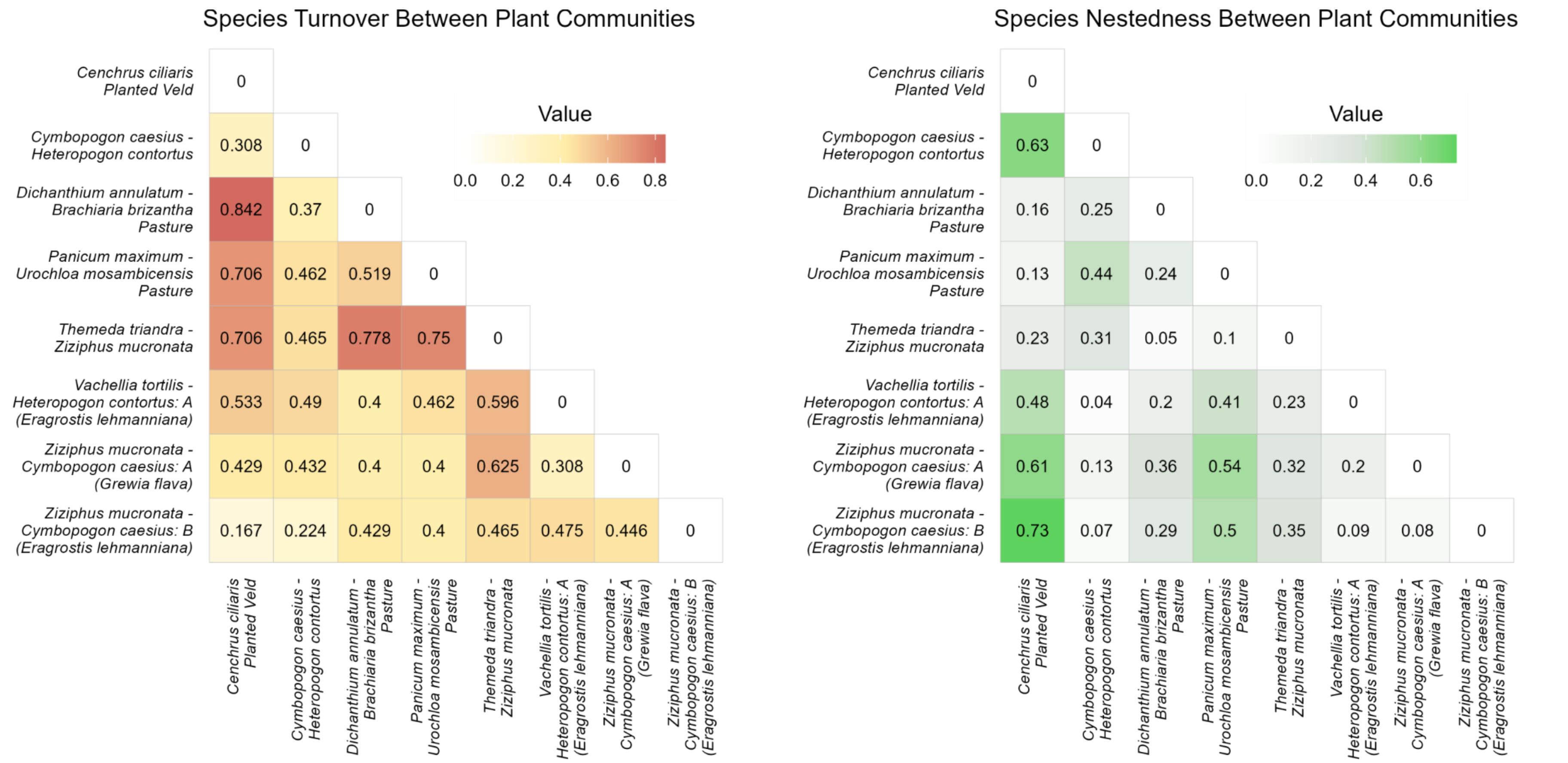

Figure 25: Turnover (left) and nestedness (right) between the plant communities found on site. Values can range from 0 to 1. Large species turnover values indicate that two plant communities do not have many species in common, and species turnover between these communities are therefore high. Conversely, low values are indicative of low levels of turnover between two respective communities. Nestedness (that is, a measure of the number of shared species) between the plant communities found on site. Large nestedness values indicate that two plant communities have many species in common, and these respective communities can therefore be regarded, to some degree, as subsets of one another. Conversely, low values are indicative that the two respective communities do not share many species. Compare with Figure 23.

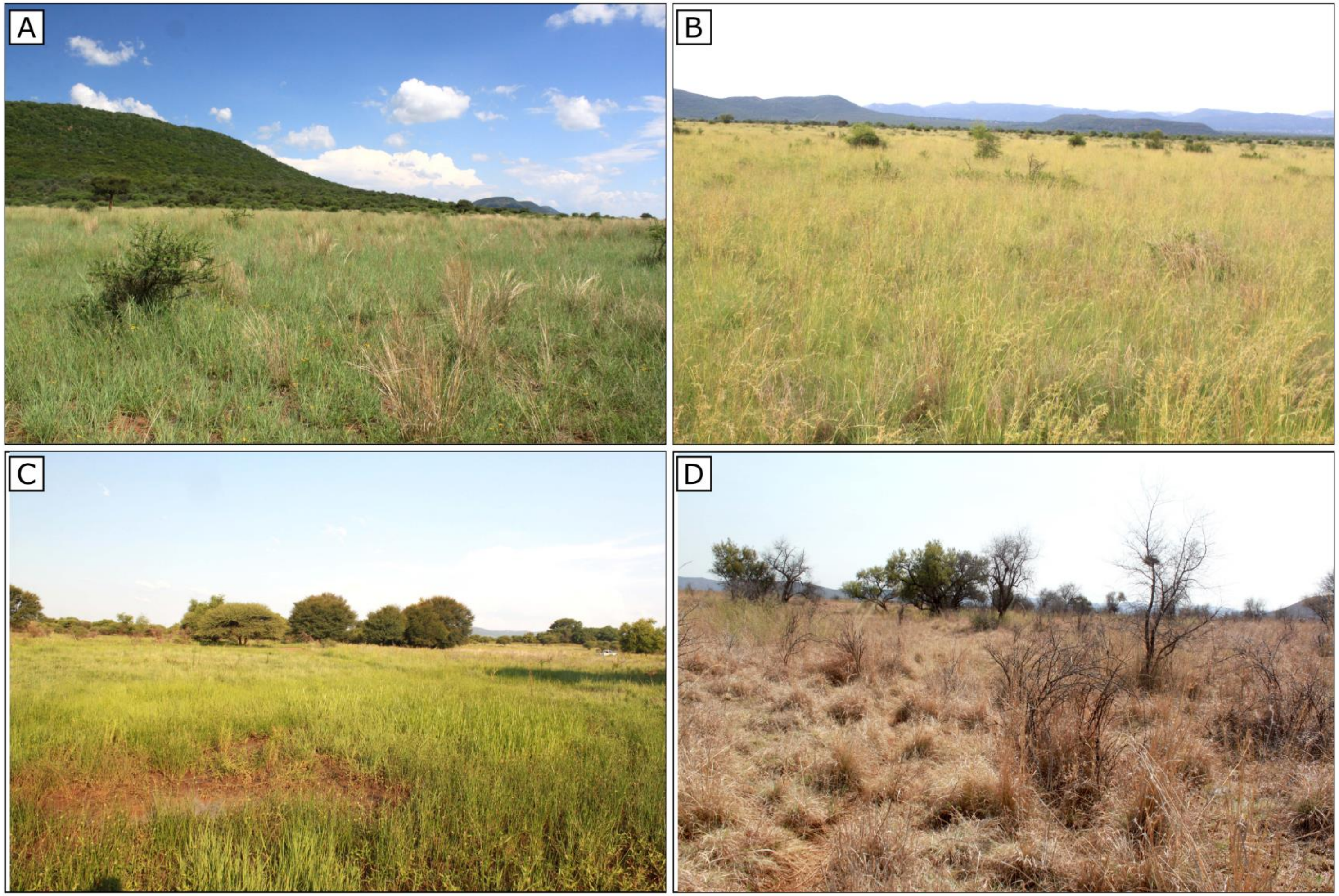

Figure 26: Representative photos of the plant community types encountered within the study area. A) Cenchrus ciliaris Planted Veld, B) C*ymbopogon caesius - Heteropogon contortus*, C) *Dichanthium annulatum - Brachiaria brizantha* Pasture, and D) *Themeda triandra - Ziziphus mucronata*.

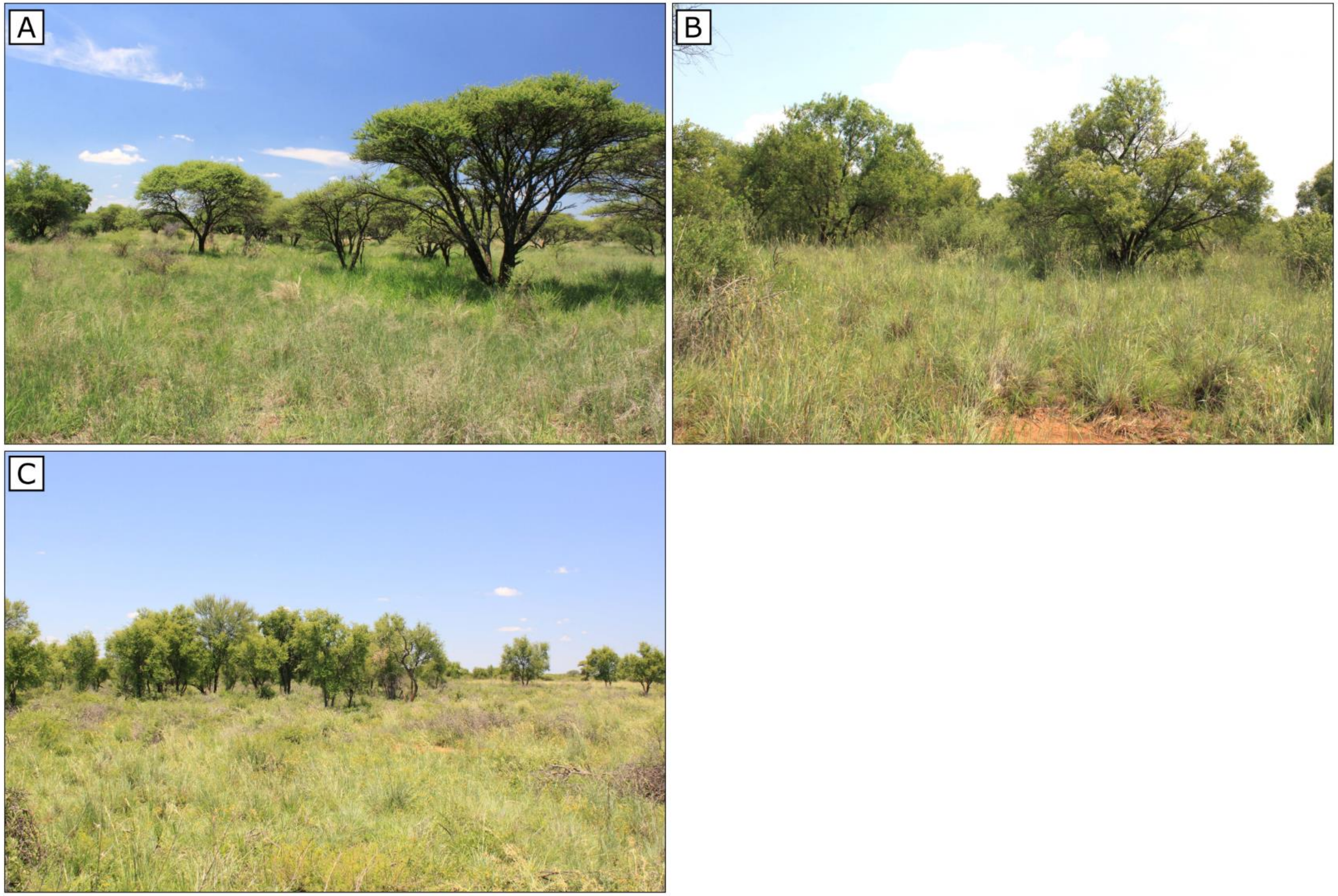

Figure 27: Representative photos of the plant community types encountered within the study area. A) *Vachellia tortilis - Heteropogon contortus*: A *(Eragrostis lehmanniana*), B) *Ziziphus mucronata - Cymbopogon caesius*: A *(Grewia flava*), C) *Ziziphus mucronata - Cymbopogon caesius*: B (*Eragrostis lehmanniana*).

Figure 28: Mapping indicating the different plant community types identified within the project site.

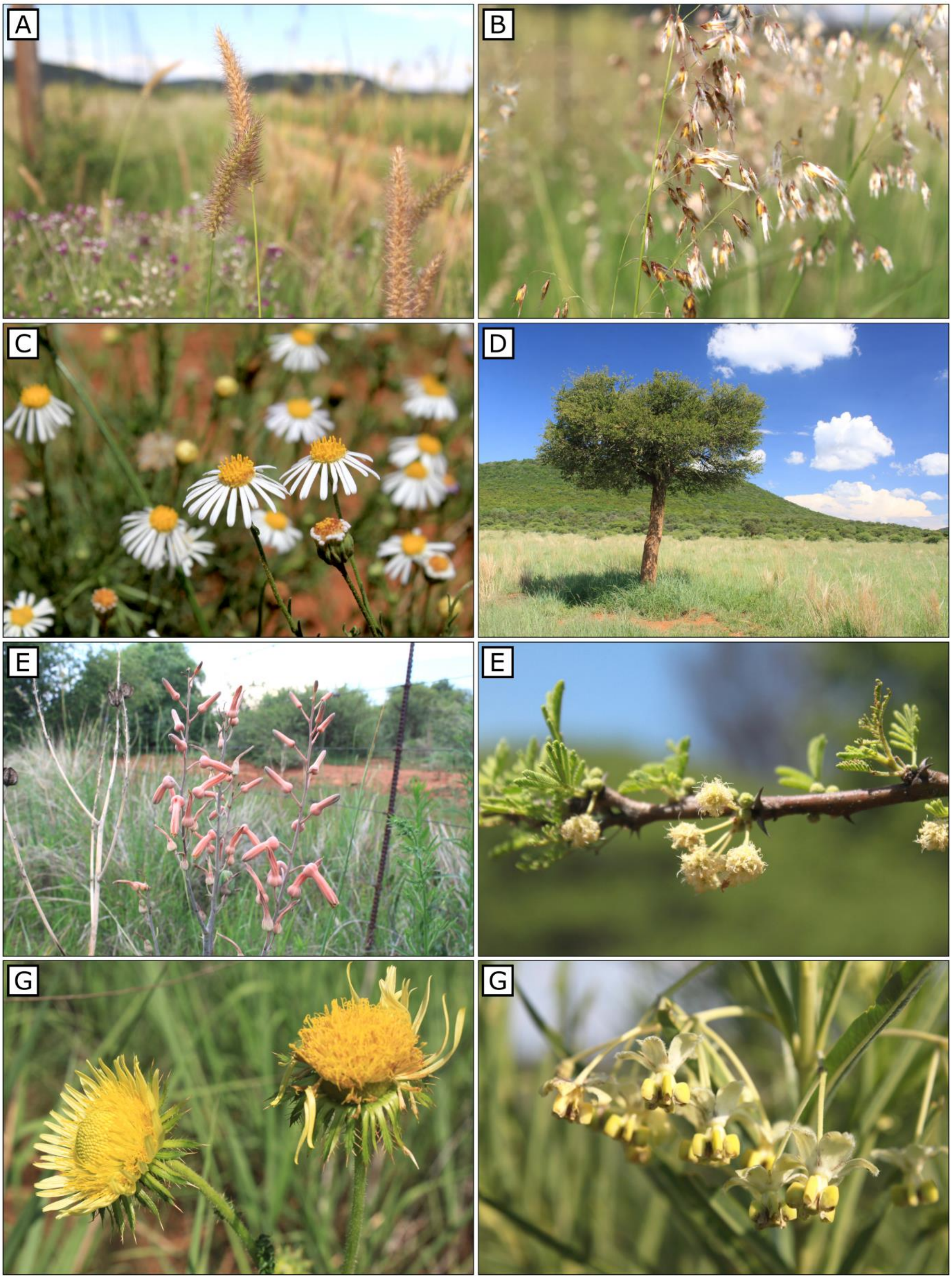

Figure 29: Photos of selected plant species occurring within the various plant community types found within the study area. A) *Cenchrus ciliaris*, B) *Melinis repens* subsp. *repens*, C) *Felicia muricata* subsp. *muricata*, D) *Boscia albitrunca*, E) *Aloe greatheadii*, F) *Senegalia mellifera* subsp. *detinens*, G) *Berkheya radula*, and H) *Gomphocarpus fruticosus* subsp. *fruticosus*.

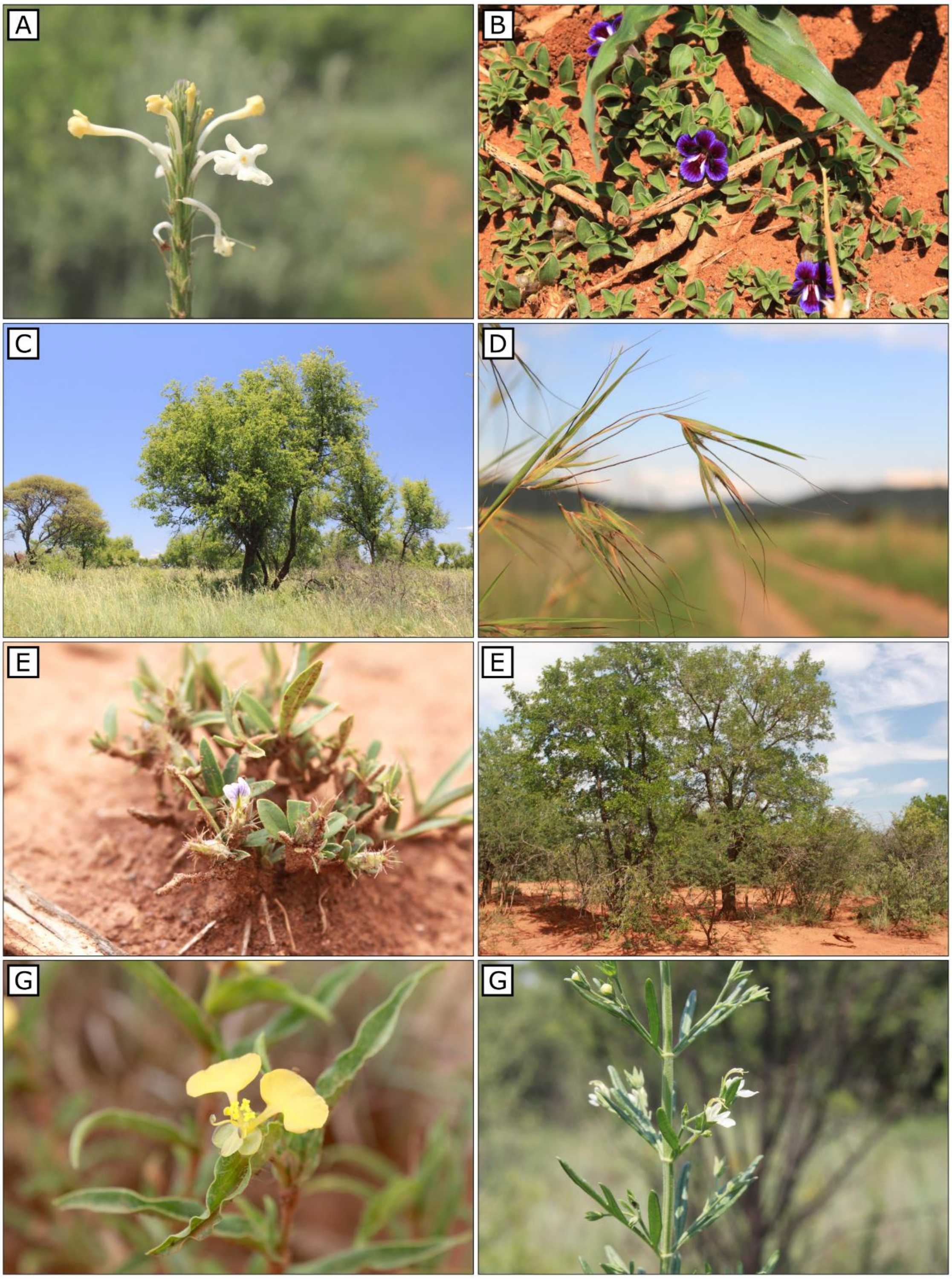

Figure 30: Photos of selected plant species occurring within the various plant community types found within the study area. A) *Chascanum hederaceum* var. *hederaceum*, B) *Aptosimum elongatum*, C) *Ziziphus mucronata* subsp. *mucronata*, D) *Themeda triandra*, E) *Blepharis maderaspatensis*, F) *Spirostachys africana*, G) *Commelina africana* var. *krebsiana*, and H) *Teucrium trifidum*.

6.1.1. *Cenchrus ciliaris* planted veld

This community comprised a total area size of about 2.6 ha (2.7% of the total mapped area) and did not conform to any of the VegMap vegetation types, although it should technically be a part of the Gold Reef Mountain Bushveld (SVcb 9) vegetation type. This is due to it having been transformed to a grassland (specifically planted pasture grasses), and is therefore also regarded as a disturbed/modified plant community type.

It is characterized by a moderate (50 – 75%) to high (>75%) density of vegetation cover, with little variation in topography. This type is mostly dominated by *Vachellia tortilis* subsp. *heteracantha* (LC) and *Ziziphus mucronata* subsp. *mucronata* (LC).

No SoCC, alien, or NEM:BA A&IS Regulations listed species were observed in this plant community type. However, the protected plant species *Boscia albitrunca* (LC; Nationally Protected Tree) was observed, with two specimens occurring within the substation area. Any damage to these specimens must be avoided, and a permit, from the relevant local authority, is required to destroy or remove them.

The following is a list of all species that were observed in this plant community type:

- *Aristida congesta subsp. congesta* (LC)
- *Boscia albitrunca* (LC; Nationally Protected Tree)
- *Cenchrus ciliaris* (LC)
- *Eragrostis rigidior* (LC)
- *Eragrostis superba* (LC)
- *Gomphocarpus tomentosus subsp. tomentosus* (LC)
- *Heteropogon contortus* (LC)
- *Pappea capensis* (LC)
- *Searsia lancea* (LC)
- *Vachellia robusta subsp. robusta* (LC)
- *Vachellia tortilis subsp. heteracantha* (LC)
- *Ziziphus mucronata subsp. mucronata* (LC)

6.1.2. Cenchrus ciliaris Planted Veld

This plant community type is located at the extreme northeastern boundary of the proposed development site and is one of the smallest plant community types, in terms of area of occupancy, that occurs within the proposed development site and surrounds.

The plant community type is dominated by *Cenchrus ciliaris* (LC). It has the lowest number of species of all plant community types in the proposed development site, and also has no unique species since all of its species are shared with other plant community types (see

"%Unique" in **Error! Reference source not found.** and compare with the other plant community types found in the proposed development site).

No SCC were observed. However, one protected plant species was observed, namely *Boscia albitrunca* (LC; Nationally Protected Tree). No alien or NEM:BA A&IS Regulations listed species were observed.

This plant community type has been degraded by past disturbances, notably overgrazing, as well as ploughing for pastures and resultant removal of trees and other woody shrubs. Its functional capacity within the landscape and broader ecosystem has been somewhat comprised, and some rehabilitation will have to be implemented to restore the majority of its ecosystem functions.

This plant community type is considered as very low in sensitivity since there are no SCC present. Moreover, even though protected plant species are present, they occur in very low densities across the proposed development site and can therefore easily be avoided by the proposed activities. The limited extent of these species do not pose a significant limitation for the development. Also, the low number of unique species contributes this communities' very low sensitivity rating, since the majority of these species occur in other plant community types, and will thus not be impacted to a large degree.

Finally, the following is a summary list of all species that were observed in this plant community type:

- *Aristida congesta subsp. congesta (LC)*
- *Boscia albitrunca (LC; Nationally Protected Tree)*
- *Cenchrus ciliaris (LC)*
- *Eragrostis rigidior (LC)*
- *Eragrostis superba (LC)*
- *Gomphocarpus fruticosus subsp. fruticosus (LC)*
- *Heteropogon contortus (LC)*
- *Pappea capensis (LC)*
- *Vachellia robusta subsp. robusta (LC)*
- *Vachellia tortilis subsp. heteracantha (LC)*
- *Ziziphus mucronata subsp. mucronata (LC)*

6.1.3. Cymbopogon caesius - Heteropogon contortus

This plant community type is located near the extreme northeastern boundary of the proposed development site. It is one of the smallest plant community types, in terms of area of occupancy, that occurs within the proposed development site and surrounds.

The plant community type is dominated by *Cymbopogon caesius* (LC), *Heteropogon contortus* (LC), *Aristida congesta subsp. congesta* (LC), *Cenchrus ciliaris* (LC), *Eragrostis lehmanniana var. lehmanniana* (LC), *Themeda triandra* (LC), *Aristida canescens subsp. canescens* (LC), and *Digitaria eriantha* (LC).

This plant community type did not have a very high number of unique species, and the majority of species were shared with other plant community types (see "%Unique" in **Error! Reference source not found.** and compare with the other plant community types found in the proposed development site).

No SCC were observed. However, one protected plant species was observed, namely *Euphorbia inaequilatera* (LC; Protected [Provincial Schedule 2]). Furthermore, 10 alien species were also observed, including 2 NEM:BA A&IS Regulations listed species, namely *Malvastrum coromandelianum* (Prickly malvastrum; Category 1b) and *Solanum elaeagnifolium* (Silver-leaf bitter apple; Category 1b).

The low number of unique species contributes this communities' low sensitivity rating, since the majority of these species occur in other plant community types, and will thus not be impacted to a large degree.

Finally, the following is a summary list of all species that were observed in this plant community type:

- *Aptosimum elongatum (LC)*
- *Aristida adscensionis (LC)*
- *Aristida canescens subsp. canescens (LC)*
- *Aristida congesta subsp. barbicollis (LC)*
- *Aristida congesta subsp. congesta (LC)*
- *Asparagus laricinus (LC)*
- *Barleria macrostegia (LC)*
- *Bidens pilosa (Not Evaluated)*
- *Blepharis maderaspatensis (LC)*
- *Cenchrus ciliaris (LC)*
- *Chaetacanthus costatus (LC)*
- *Chamaecrista comosa var. comosa (LC)*
- *Chascanum hederaceum var. hederaceum (LC)*
- *Chloris virgata (LC)*
- *Clematis brachiata (LC)*
- *Commelina africana var. krebsiana (LC)*
- *Corbichonia decumbens (LC)*
- *Corchorus asplenifolius (LC)*
- *Crotalaria lotoides (LC)*
- *Cymbopogon caesius (LC)*
- *Cynodon dactylon (LC)*
- *Digitaria eriantha (LC)*

- *Diospyros lycioides subsp. lycioides (LC)*
- *Eragrostis curvula (LC)*
- *Eragrostis lehmanniana var. lehmanniana (LC)*
- *Eragrostis patentipilosa (LC)*
- *Eragrostis rigidior (LC)*
- *Eragrostis superba (LC)*
- *Eragrostis trichophora (LC)*
- *Erigeron bonariensis (Not Evaluated)*
- *Euphorbia inaequilatera (LC; Protected [Provincial Schedule 2])*
- *Evolvulus alsinoides (LC)*
- *Felicia muricata subsp. muricata (LC)*
- *Geigeria burkei subsp. burkei var. burkei (Not Evaluated)*
- *Gomphocarpus fruticosus subsp. fruticosus (LC)*
- *Gomphrena celosioides (Not Evaluated)*
- *Grewia flava (LC)*
- *Helichrysum argyrosphaerum (LC)*
- *Heliotropium nelsonii (LC)*
- *Heliotropium ovalifolium (LC)*
- *Hermannia boraginiflora (LC)*
- *Hermannia grisea (LC)*
- *Hermbstaedtia fleckii (LC)*
- *Heteropogon contortus (LC)*
- *Hibiscus aethiopicus var. aethiopicus (LC)*
- *Hibiscus calyphyllus (LC)*
- *Hibiscus trionum (Not Evaluated)*
- *Hirpicium bechuanense (LC)*
- *Hyparrhenia hirta (LC)*
- *Indigofera comosa (LC)*
- *Indigofera hilaris var. hilaris (LC)*
- *Indigofera zeyheri (LC)*
- *Ipomoea obscura var. obscura (LC)*
- *Leonotis glabrata var. glabrata (LC)*
- *Lycium schizocalyx (LC)*
- *Malvastrum coromandelianum (Not Evaluated)*
- *Melinis repens subsp. repens (LC)*
- *Nidorella resedifolia subsp. resedifolia (LC)*
- *Ocimum angustifolium (LC)*
- *Osteospermum muricatum subsp. muricatum (LC)*
- *Panicum maximum (LC)*
- *Pergularia daemia subsp. daemia (LC)*
- *Phyllanthus incurvus (LC)*
- *Rhynchosia totta var. totta (LC)*
- *Ruellia patula (LC)*
- *Schkuhria pinnata (Not Evaluated)*
- *Searsia lancea (LC)*
- *Seddera capensis (LC)*
- *Selago densiflora (LC)*
- *Senegalia mellifera subsp. detinens (LC)*
- *Senna italica subsp. arachoides (LC)*
- *Setaria sphacelata var. torta (LC)*
- *Sida chrysantha (LC)*
- *Sida dregei (LC)*
- *Solanum campylacanthum (LC)*
- *Solanum elaeagnifolium (Not Evaluated)*
- *Solanum lichtensteinii (LC)*
- *Tagetes minuta (Not Evaluated)*
- *Tarchonanthus camphoratus (LC)*
- *Themeda triandra (LC)*
- *Tragus berteronianus (LC)*
- *Urochloa mosambicensis (LC)*
- *Vachellia robusta subsp. robusta (LC)*
- *Vachellia tortilis subsp. heteracantha (LC)*
- *Verbena officinalis (Not Evaluated)*
- *Zinnia peruviana (Not Evaluated)*
- *Ziziphus mucronata subsp. mucronata (LC)*

6.1.4. Dichanthium annulatum - Brachiaria brizantha Pasture

This plant community type is located in the western section of the proposed development site. It is one of the largest plant community types, in terms of area of occupancy, that occurs within the proposed development site and surrounds.

The plant community type is dominated by *Dichanthium annulatum var. papillosum* (LC), *Brachiaria brizantha* (LC), *Urochloa mosambicensis* (LC), *Ziziphus mucronata subsp. mucronata* (LC), *Aristida canescens subsp. canescens* (LC), *Asparagus cooperi* (LC), and *Eragrostis lehmanniana var. lehmanniana* (LC).

This plant community type did not have a very high number of unique species, and the majority of species were shared with other plant community types (see "%Unique" in **Error! Reference source not found.** and compare with the other plant community types found in the proposed development site).

No SCC or protected plant species were observed. However, 7 alien species was / were also observed, including 2 NEM:BA A&IS Regulations listed species, namely *Opuntia ficus-indica* (Mission prickly pear, Sweet prickly pear; Category Multi) and *Solanum sisymbriifolium* (Wild tomato, Dense- thorned bitter apple; Category 1b).

This plant community type is considered as very low in sensitivity since there are no SCC or protected plant species present. The low number of unique species also contributes to this sensitivity rating, since the majority of these species occur in other plant community types, and will thus not be impacted to a large degree.

Finally, the following is a summary list of all species that were observed in this plant community type:

- *Alternanthera pungens (Not Evaluated)*
- *Aristida canescens subsp. canescens (LC)*
- *Aristida stipitata subsp. stipitata (LC)*
- *Asparagus cooperi (LC)*
- *Brachiaria brizantha (LC)*
- *Chloris virgata (LC)*
- *Clematis brachiata (LC)*
- *Corchorus asplenifolius (LC)*
- *Crotalaria lotoides (LC)*
- *Cymbopogon caesius (LC)*
- *Dichanthium annulatum var. papillosum (LC)*
- *Eragrostis curvula (LC)*
- *Eragrostis lehmanniana var. lehmanniana (LC)*
- *Erigeron bonariensis (Not Evaluated)*
- *Grewia flava (LC)*
- *Heliotropium nelsonii (LC)*
- *Hermannia boraginiflora (LC)*
- *Hermannia depressa (LC)*
- *Hermannia grisea (LC)*
- *Hermbstaedtia fleckii (LC)*
- *Heteropogon contortus (LC)*
- *Hibiscus calyphyllus (LC)*
- *Hibiscus cannabinus (LC)*
- *Hibiscus trionum (Not Evaluated)*

- *Hirpicium bechuanense (LC)*
- *Lycium schizocalyx (LC)*
- *Melinis repens subsp. repens (LC)*
- *Nidorella resedifolia subsp. resedifolia (LC)*
- *Opuntia ficus-indica (Not Evaluated)*
- *Osteospermum muricatum subsp. muricatum (LC)*
- *Panicum maximum (LC)*
- *Ruellia patula (LC)*
- *Schkuhria pinnata (Not Evaluated)*
- *Sida chrysantha (LC)*
- *Sida dregei (LC)*
- *Sida rhombifolia ()*
- *Solanum campylacanthum (LC)*
- *Solanum lichtensteinii (LC)*
- *Solanum sisymbriifolium (Not Evaluated)*
- *Tagetes minuta (Not Evaluated)*
- *Tragus berteronianus (LC)*
- *Urochloa mosambicensis (LC)*
- *Vachellia tortilis subsp. heteracantha (LC)*
- *Ziziphus mucronata subsp. mucronata (LC)*

6.1.5. Panicum maximum - Urochloa mosambicensis Pasture

This plant community type is located near the northwestern boundary of the proposed development site and is a relatively small plant community type, in terms of area of occupancy, that occurs within the proposed development site and surrounds.

The plant community type is dominated by *Panicum maximum* (LC), *Urochloa mosambicensis* (LC), *Digitaria eriantha* (LC), *Brachiaria brizantha* (LC), *Dichanthium annulatum var. papillosum* (LC), *Enneapogon cenchroides* (LC), and *Eragrostis curvula* (LC).

This plant community type had only one unique species (see "%Unique" in **Error! Reference source not found.** and compare with the other plant community types found in the proposed development site). It also had the second lowest number of species of all plant community types on site.

No SCC, protected plant species, NEM:BA A&IS Regulations listed species were observed in this plant community type. Only 3 alien species were observed.

This plant community type is considered as very low in sensitivity since there are no SCC or protected plant species present. The low number of unique species, as well as overall low richness, also contributes to this communities' very low sensitivity rating.

Finally, the following is a summary list of all species that were observed in this plant community type:

- *Alternanthera pungens (Not Evaluated)*
- *Aristida congesta subsp. congesta (LC)*

- *Brachiaria brizantha (LC)*
- *Cenchrus ciliaris (LC)*
- *Crotalaria sphaerocarpa subsp. sphaerocarpa (LC)*
- *Cynodon dactylon (LC)*
- *Dactyloctenium giganteum (LC)*
- *Dichanthium annulatum var. papillosum (LC)*
- *Digitaria eriantha (LC)*
- *Enneapogon cenchroides (LC)*
- *Eragrostis curvula (LC)*
- *Eragrostis lehmanniana var. lehmanniana (LC)*
- *Heteropogon contortus (LC)*
- *Panicum maximum (LC)*
- *Schkuhria pinnata (Not Evaluated)*
- *Solanum campylacanthum (LC)*
- *Tagetes minuta (Not Evaluated)*
- *Urochloa mosambicensis (LC)*
- *Vachellia tortilis subsp. heteracantha (LC)*
- *Ziziphus mucronata subsp. mucronata (LC)*

6.1.6. Themeda triandra - Ziziphus mucronata

This plant community type is located near the north-central boundary of the proposed development site. It is dominated by *Themeda triandra* (LC), *Ziziphus mucronata subsp. mucronata* (LC), *Cymbopogon caesius* (LC), *Vachellia karroo* (LC), *Asparagus laricinus* (LC), *Cenchrus ciliaris* (LC), *Cynodon dactylon* (LC), and *Nidorella resedifolia subsp. resedifolia* (LC). This plant community type had moderate number of unique species (see "%Unique" in **Error! Reference source not found.** and compare with the other plant community types found in the proposed development site).

No SCC, protected plant species, or NEM:BA A&IS Regulations listed species were observed in this plant community type. However, 5 alien species were found.

This plant community type is considered as low in sensitivity since there are no SCC or protected plant species present. The moderate number of unique species prevents if from being "very low" in sensitivity rating, since these do not occur in other plant community types.

Finally, the following is a summary list of all species that were observed in this plant community type:

- *Aristida adscensionis (LC)*
- *Aristida transvaalensis (LC)*
- *Asparagus laricinus (LC)*
- *Berkheya radula (LC)*
- *Bidens pilosa (Not Evaluated)*
- *Cenchrus ciliaris (LC)*
- *Chenopodium album (Not Evaluated)*
- *Chloris virgata (LC)*
- *Cymbopogon caesius (LC)*
- *Cynodon dactylon (LC)*
- *Digitaria eriantha (LC)*
- *Eragrostis lehmanniana var. lehmanniana (LC)*
- *Gomphocarpus fruticosus subsp. fruticosus (LC)*
- *Gomphrena celosioides (Not Evaluated)*
- *Hermannia depressa (LC)*

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- *Heteropogon contortus (LC)*
- *Hyparrhenia hirta (LC)*
- *Indigofera oxytropis (LC)*
- *Melinis repens subsp. repens (LC)*
- *Nidorella resedifolia subsp. resedifolia (LC)*
- *Ocimum obovatum (LC)*
- *Oenothera rosea (Not Evaluated)*
- *Osteospermum muricatum subsp. muricatum (LC)*
- *Oxalis latifolia (Not Evaluated)*
- *Panicum coloratum ()*
- *Panicum maximum (LC)*
- *Searsia lancea (LC)*
- *Senegalia mellifera subsp. detinens (LC)*
- *Sida dregei (LC)*
- *Themeda triandra (LC)*
- *Vachellia karroo (LC)*
- *Vachellia tortilis subsp. heteracantha (LC)*
- *Ziziphus mucronata subsp. mucronata (LC)*

6.1.7. Vachellia tortilis - Heteropogon contortus: A (Eragrostis lehmanniana)

This plant community type is located near the extreme northeastern boundary of the proposed development site. It is one of the smallest plant community types, in terms of area of occupancy, that occurs within the proposed development site and surrounds.

The plant community type is dominated by *Eragrostis lehmanniana var. lehmanniana* (LC), *Vachellia tortilis subsp. heteracantha* (LC), *Heteropogon contortus* (LC), *Panicum maximum* (LC), *Ziziphus mucronata subsp. mucronata* (LC), *Aristida congesta subsp. congesta* (LC), *Cenchrus ciliaris* (LC), and *Cymbopogon caesius* (LC), and had a very low number of unique species (see "%Unique" in **Error! Reference source not found.** and compare with the other plant community types found in the proposed development site).

No SCC, or NEM:BA A&IS Regulations listed species were observed in this plant community type. However, one protected plant species was found, namely *Boscia albitrunca* (LC; Nationally Protected Tree), as well as 5 alien species were found. It must be noted that a permit must be obtained from relevant local competent authorities to damage, destroy, or relocate any SCC or protected plant species; any such actions are considered illegal without a permit, in which case such species must be avoided completely. This plant community type is considered as having a medium in sensitivity rating.

Finally, the following is a summary list of all species that were observed in this plant community type:

- *Achyranthes aspera var. aspera (Not Evaluated)*
- *Acrotome inflata (LC)*
- *Albuca glauca (LC)*
- *Aloe greatheadii (LC)*
- *Alternanthera pungens (Not Evaluated)*
- *Aptosimum elongatum (LC)*
- *Aristida canescens subsp. canescens (LC)*
- *Aristida congesta subsp. barbicollis (LC)*
- *Aristida congesta subsp. congesta (LC)*

- *Aristida stipitata subsp. stipitata (LC)*
- *Barleria macrostegia (LC)*
- *Bidens pilosa (Not Evaluated)*
- *Boscia albitrunca (LC; Nationally Protected Tree)*
- *Cenchrus ciliaris (LC)*
- *Cereus jamacaru (Not Evaluated)*
- *Chamaecrista comosa var. comosa (LC)*
- *Chloris virgata (LC)*
- *Clematis brachiata (LC)*
- *Combretum hereroense subsp. hereroense (LC)*
- *Commelina africana var. krebsiana (LC)*
- *Commelina benghalensis (LC)*
- *Corbichonia decumbens (LC)*
- *Corchorus asplenifolius (LC)*
- *Corchorus kirkii (LC)*
- *Crabbea angustifolia (LC)*
- *Cymbopogon caesius (LC)*
- *Dichrostachys cinerea subsp. africana (LC)*
- *Digitaria eriantha (LC)*
- *Enneapogon cenchroides (LC)*
- *Eragrostis lehmanniana var. lehmanniana (LC)*
- *Eragrostis trichophora (LC)*
- *Erigeron bonariensis (Not Evaluated)*
- *Geigeria burkei subsp. burkei var. burkei (Not Evaluated)*
- *Gomphrena celosioides (Not Evaluated)*
- *Grewia flava (LC)*
- *Heliotropium nelsonii (LC)*
- *Hermannia boraginiflora (LC)*
- *Hermannia depressa (LC)*
- *Hermannia grisea (LC)*
- *Heteropogon contortus (LC)*
- *Hibiscus calyphyllus (LC)*
- *Hibiscus trionum (Not Evaluated)*
- *Indigofera delagoaensis (LC)*
- *Indigofera hilaris var. hilaris (LC)*
- *Indigofera holubii (LC)*
- *Indigofera oxytropis (LC)*
- *Lippia javanica (LC)*
- *Lycium schizocalyx (LC)*
- *Melinis repens subsp. repens (LC)*
- *Nidorella resedifolia subsp. resedifolia (LC)*
- *Ocimum angustifolium (LC)*
- *Opuntia ficus-indica (Not Evaluated)*
- *Osteospermum muricatum subsp. muricatum (LC)*
- *Panicum maximum (LC)*
- *Pergularia daemia subsp. daemia (LC)*
- *Phyllanthus incurvus (LC)*
- *Phyllanthus parvulus var. parvulus (LC)*
- *Rhoicissus tridentata (LC)*
- *Rhynchosia totta var. totta (LC)*
- *Ruellia patula (LC)*
- *Schkuhria pinnata (Not Evaluated)*
- *Searsia lancea (LC)*
- *Senegalia mellifera subsp. detinens (LC)*
- *Sida chrysantha (LC)*
- *Sida cordifolia subsp. cordifolia (LC)*
- *Sida dregei (LC)*
- *Solanum campylacanthum (LC)*
- *Solanum lichtensteinii (LC)*
- *Tagetes minuta (Not Evaluated)*
- *Tarchonanthus camphoratus (LC)*
- *Tribulus terrestris (LC)*
- *Urochloa mosambicensis (LC)*
- *Vachellia robusta subsp. robusta (LC)*
- *Vachellia tortilis subsp. heteracantha (LC)*
- *Waltheria indica (LC)*
- *Zinnia peruviana (Not Evaluated)*
- *Ziziphus mucronata subsp. mucronata (LC)*

6.1.8. Ziziphus mucronata - Cymbopogon caesius: A (Grewia flava)

This plant community type covers the lower half of the proposed development site. It is the largest plant community type, in terms of area of occupancy, that occurs within the proposed development site and surrounds.

The plant community type is dominated by *Cymbopogon caesius* (LC), *Grewia flava* (LC), *Ziziphus mucronata subsp. mucronata* (LC), *Aristida canescens subsp. canescens* (LC), *Aristida congesta subsp. congesta* (LC), *Searsia lancea* (LC), and *Vachellia robusta subsp. robusta* (LC).

This plant community type had a moderate number of unique species, which were not shared with other plant community types (see “%Unique” in **Error! Reference source not found.** and compare with the other plant community types found in the proposed development site). Also, it had the highest number of species (126) of all the plant community types in the proposed development site.

No SCC were observed. However, 2 protected plant species were observed, namely *Boscia albitrunca* (LC; Nationally Protected Tree) and *Spirostachys africana* (LC; Protected [Provincial Schedule 2]). Furthermore, 13 alien species was / were also observed, including 4 NEM:BA A&IS Regulations listed species, namely *Cereus jamacaru* (Queen of the night; Category 1b), *Datura ferox* (Large thorn apple; Category 1b), *Flaveria bidentis* (Smelter’s-bush; Category 1b), and *Opuntia ficus-indica* (Mission prickly pear, Sweet prickly pear; Category Multi).

Finally, the following is a summary list of all species that were observed in this plant community type:

- *Achyranthes aspera var. aspera (Not Evaluated)*
- *Achyropsis leptostachya (LC)*
- *Acrotome inflata (LC)*
- *Albuca glauca (LC)*
- *Aloe greatheadii (LC)*
- *Alternanthera pungens (Not Evaluated)*
- *Ammocharis coranica (LC)*
- *Aptosimum elongatum (LC)*
- *Aristida bipartita (LC)*
- *Aristida canescens subsp. canescens (LC)*
- *Aristida congesta subsp. barbicollis (LC)*
- *Aristida congesta subsp. congesta (LC)*
- *Asparagus cooperi (LC)*
- *Asparagus suaveolens (LC)*
- *Barleria macrostegia (LC)*
- *Bidens pilosa (Not Evaluated)*
- *Blepharis maderaspatensis (LC)*
- *Boscia albitrunca (LC; Nationally Protected Tree)*
- *Cadaba termitaria (LC)*
- *Carissa bispinosa (LC)*
- *Celtis africana (LC)*

- *Cereus jamacaru (Not Evaluated)*
- *Chaetacanthus costatus (LC)*
- *Chamaecrista comosa var. comosa (LC)*
- *Chascanum hederaceum var. hederaceum (LC)*
- *Chloris virgata (LC)*
- *Chlorophytum cooperi (LC)*
- *Chlorophytum galpinii var. galpinii (LC)*
- *Clematis brachiata (LC)*
- *Commelina africana var. krebsiana (LC)*
- *Commelina benghalensis (LC)*
- *Corbichonia decumbens (LC)*
- *Corchorus asplenifolius (LC)*
- *Corchorus kirkii (LC)*
- *Cordylostigma longifolium (LC)*
- *Crabbea angustifolia (LC)*
- *Crabbea hirsuta (LC)*
- *Crotalaria lotoides (LC)*
- *Cymbopogon caesius (LC)*
- *Cynodon dactylon (LC)*
- *Cyphocarpa angustifolia ()*
- *Cyphostemma lanigerum (LC)*
- *Dactyloctenium giganteum (LC)*
- *Datura ferox (Not Evaluated)*
- *Dichanthium annulatum var. papillosum (LC)*
- *Dicliptera minor subsp. minor (LC)*
- *Digitaria eriantha (LC)*
- *Diospyros lycioides subsp. lycioides (LC)*
- *Dipcadi gracillimum (LC)*
- *Dyschoriste setigera (LC)*
- *Eragrostis curvula (LC)*
- *Eragrostis rigidior (LC)*
- *Eragrostis trichophora (LC)*
- *Erigeron bonariensis (Not Evaluated)*
- *Euclea crispa subsp. crispa (LC)*
- *Felicia muricata subsp. muricata (LC)*
- *Flaveria bidentis (Not Evaluated)*
- *Geigeria burkei subsp. burkei var. burkei (Not Evaluated)*
- *Gladiolus permeabilis subsp. edulis (LC)*
- *Gomphocarpus fruticosus subsp. fruticosus (LC)*
- *Gomphrena celosioides (Not Evaluated)*
- *Grewia flava (LC)*
- *Grewia retinervis (LC)*
- *Gymnosporia buxifolia (LC)*
- *Helichrysum argyrosphaerum (LC)*
- *Heliotropium nelsonii (LC)*
- *Hermannia grisea (LC)*
- *Hermbstaedtia fleckii (LC)*
- *Heteropogon contortus (LC)*
- *Hibiscus calyphyllus (LC)*
- *Hibiscus trionum (Not Evaluated)*
- *Indigofera delagoaensis (LC)*
- *Indigofera hilaris var. hilaris (LC)*
- *Indigofera holubii (LC)*
- *Indigofera zeyheri (LC)*
- *Ipomoea bolusiana (LC)*
- *Ipomoea magnusiana (LC)*
- *Justicia flava (LC)*
- *Kalanchoe lanceolata (LC)*
- *Kleinia longiflora (LC)*
- *Ledebouria luteola (LC)*
- *Leobordea divaricata (LC)*
- *Lippia javanica (LC)*
- *Lycium schizocalyx (LC)*
- *Melinis repens subsp. repens (LC)*
- *Momordica balsamina (LC)*
- *Nidorella resedifolia subsp. resedifolia (LC)*
- *Ocimum americanum var. americanum (LC)*
- *Ocimum obovatum (LC)*
- *Olea europaea subsp. africana (LC)*
- *Opuntia ficus-indica (Not Evaluated)*
- *Osteospermum muricatum subsp. muricatum (LC)*
- *Panicum maximum (LC)*
- *Peltophorum africanum (LC)*

- *Pergularia daemia subsp. daemia (LC)*
- *Phyllanthus incurvus (LC)*
- *Phyllanthus parvulus var. parvulus (LC)*
- *Pterodiscus speciosus (LC)*
- *Rhynchosia minima (LC)*
- *Rhynchosia totta var. totta (LC)*
- *Ruellia patula (LC)*
- *Schkuhria pinnata (Not Evaluated)*
- *Searsia lancea (LC)*
- *Searsia pyroides var. pyroides (LC)*
- *Seddera capensis (LC)*
- *Senegalia caffra (LC)*
- *Senegalia mellifera subsp. detinens (LC)*
- *Setaria sphacelata var. torta (LC)*
- *Solanum campylacanthum (LC)*
- *Solanum lichtensteinii (LC)*
- *Spirostachys africana (LC; Protected [Provincial Schedule 2])*
- *Tagetes minuta (Not Evaluated)*
- *Tarchonanthus camphoratus (LC)*
- *Teucrium trifidum (LC)*
- *Themeda triandra (LC)*
- *Tragia dioica (LC)*
- *Tragus berteronianus (LC)*
- *Tribulus terrestris (LC)*
- *Urochloa mosambicensis (LC)*
- *Urochloa panicoides (LC)*
- *Vachellia robusta subsp. robusta (LC)*
- *Vachellia tenuispina (LC)*
- *Vachellia tortilis subsp. heteracantha (LC)*
- *Waltheria indica (LC)*
- *Zinnia peruviana (Not Evaluated)*
- *Ziziphus mucronata subsp. mucronata (LC)*

6.1.9. Ziziphus mucronata - Cymbopogon caesius: B (Eragrostis lehmanniana)

This plant community type is located mostly near the north-central boundary section of the proposed development site, but also occurs as scattered patches throughout the site.

The plant community type is dominated by *Cymbopogon caesius* (LC), *Cenchrus ciliaris* (LC), *Eragrostis lehmanniana var. lehmanniana* (LC), *Grewia flava* (LC), *Heteropogon contortus* (LC), *Panicum maximum* (LC), *Themeda triandra* (LC), *Ziziphus mucronata subsp. mucronata* (LC), *Aristida congesta subsp. congesta* (LC), and *Digitaria eriantha* (LC).

Despite having the second highest number of species, this community did not have a very high number of unique species, and the majority of species were shared with other plant community types (see "%Unique" in **Error! Reference source not found.** and compare with the other plant community types found in the proposed development site).

No SCC were observed. However, 1 protected plant species was observed, namely *Euphorbia inaequilatera* (LC; Protected [Provincial Schedule 2]). Furthermore, 11 alien species was / were also observed, including 2 NEM:BA A&IS Regulations listed species, namely *Malvastrum coromandelianum* (Prickly malvastrum; Category 1b) *Solanum elaeagnifolium* (Silver-leaf bitter apple; Category 1b).

The low number of unique species contributes to this communities' low sensitivity rating, since the majority of these species occur in other plant community types, and will thus not be impacted to a large degree.

Finally, the following is a summary list of all species that were observed in this plant community type:

- *Acrotome hispida (LC)*
- *Acrotome inflata (LC)*
- *Albuca glauca (LC)*
- *Aloe greatheadii (LC)*
- *Alternanthera pungens (Not Evaluated)*
- *Ammocharis coranica (LC)*
- *Aptosimum elongatum (LC)*
- *Aristida congesta subsp. congesta (LC)*
- *Asparagus laricinus (LC)*
- *Barleria macrostegia (LC)*
- *Bidens pilosa (Not Evaluated)*
- *Blepharis maderaspatensis (LC)*
- *Cenchrus ciliaris (LC)*
- *Ceratotheca triloba (LC)*
- *Chamaecrista comosa var. comosa (LC)*
- *Chloris virgata (LC)*
- *Clematis brachiata (LC)*
- *Commelina africana var. krebsiana (LC)*
- *Convolvulus sagittatus (LC)*
- *Corchorus asplenifolius (LC)*
- *Cordylostigma longifolium (LC)*
- *Crotalaria lotoides (LC)*
- *Cymbopogon caesius (LC)*
- *Cynodon dactylon (LC)*
- *Digitaria eriantha (LC)*
- *Diospyros lycioides subsp. lycioides (LC)*
- *Eragrostis curvula (LC)*
- *Eragrostis lehmanniana var. lehmanniana (LC)*
- *Eragrostis rigidior (LC)*
- *Eragrostis superba (LC)*
- *Eragrostis trichophora (LC)*
- *Erigeron bonariensis (Not Evaluated)*
- *Euphorbia inaequilatera (LC; Protected [Provincial Schedule 2])*
- *Evolvulus alsinoides (LC)*
- *Felicia muricata subsp. muricata (LC)*
- *Geigeria burkei subsp. burkei var. burkei (Not Evaluated)*
- *Gladiolus permeabilis subsp. edulis (LC)*
- *Gomphocarpus fruticosus subsp. fruticosus (LC)*
- *Gomphrena celosioides (Not Evaluated)*
- *Grewia flava (LC)*
- *Helichrysum argyrosphaerum (LC)*
- *Heliotropium nelsonii (LC)*
- *Heliotropium ovalifolium (LC)*
- *Hermannia boraginiflora (LC)*
- *Hermbstaedtia fleckii (LC)*
- *Heteropogon contortus (LC)*
- *Hibiscus aethiopicus var. aethiopicus (LC)*
- *Hibiscus calyphyllus (LC)*
- *Hibiscus trionum (Not Evaluated)*
- *Hirpicium bechuanense (LC)*
- *Hyparrhenia hirta (LC)*
- *Indigofera comosa (LC)*
- *Indigofera hilaris var. hilaris (LC)*
- *Indigofera zeyheri (LC)*
- *Ipomoea obscura var. obscura (LC)*
- *Ledebouria luteola (LC)*
- *Ledebouria marginata (LC)*
- *Limeum sulcatum var. sulcatum (LC)*
- *Lippia javanica (LC)*
- *Lycium schizocalyx (LC)*
- *Malvastrum coromandelianum (Not Evaluated)*

- *Melinis repens subsp. repens (LC)*
- *Momordica balsamina (LC)*
- *Nidorella resedifolia subsp. resedifolia (LC)*
- *Ocimum angustifolium (LC)*
- *Olea europaea subsp. africana (LC)*
- *Osteospermum muricatum subsp. muricatum (LC)*
- *Panicum maximum (LC)*
- *Pappea capensis (LC)*
- *Pergularia daemia subsp. daemia (LC)*
- *Phyllanthus incurvus (LC)*
- *Phyllanthus parvulus var. parvulus (LC)*
- *Rhynchosia minima (LC)*
- *Rhynchosia totta var. totta (LC)*
- *Ruellia patula (LC)*
- *Schkuhria pinnata (Not Evaluated)*
- *Searsia lancea (LC)*
- *Searsia pyroides var. pyroides (LC)*
- *Seddera capensis (LC)*
- *Selago densiflora (LC)*

- *Senegalia caffra* (LC)
- *Senegalia mellifera subsp. detinens* (LC)
- *Senna italica subsp. arachoides* (LC)
- *Setaria sphacelata var. torta* (LC)
- *Sida dregei* (LC)
- *Solanum campylacanthum (LC)*
- *Solanum elaeagnifolium* (Not Evaluated)
- *Solanum lichtensteinii* (LC)
- *Tagetes minuta* (Not Evaluated)
- *Tephrosia longipes* ()
- *Themeda triandra* (LC)
- *Tragus berteronianus* (LC)
- *Tribulus terrestris* (LC)
- *Trochomeria macrocarpa subsp. macrocarpa* (LC)
- *Urochloa mosambicensis* (LC)
- *Vachellia karroo* (LC)
- *Vachellia robusta subsp. robusta* (LC)
- *Vachellia tortilis subsp. heteracantha* (LC)
- *Verbena officinalis* (Not Evaluated)
- *Zinnia peruviana* (Not Evaluated)
- *Ziziphus mucronata subsp. mucronata* (LC)

6.2. Plant Species of Conservation Concern

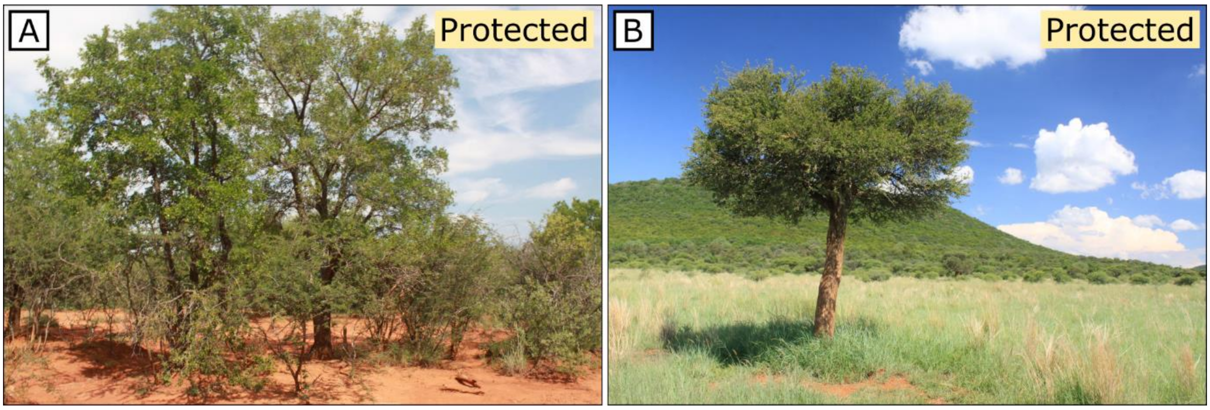

Figure 31: Selected examples of protected plant species found in the plant community types. A) *Spirostachys africana* and B) *Boscia albitrunca*. No plant SoCC were found in the proposed development site.

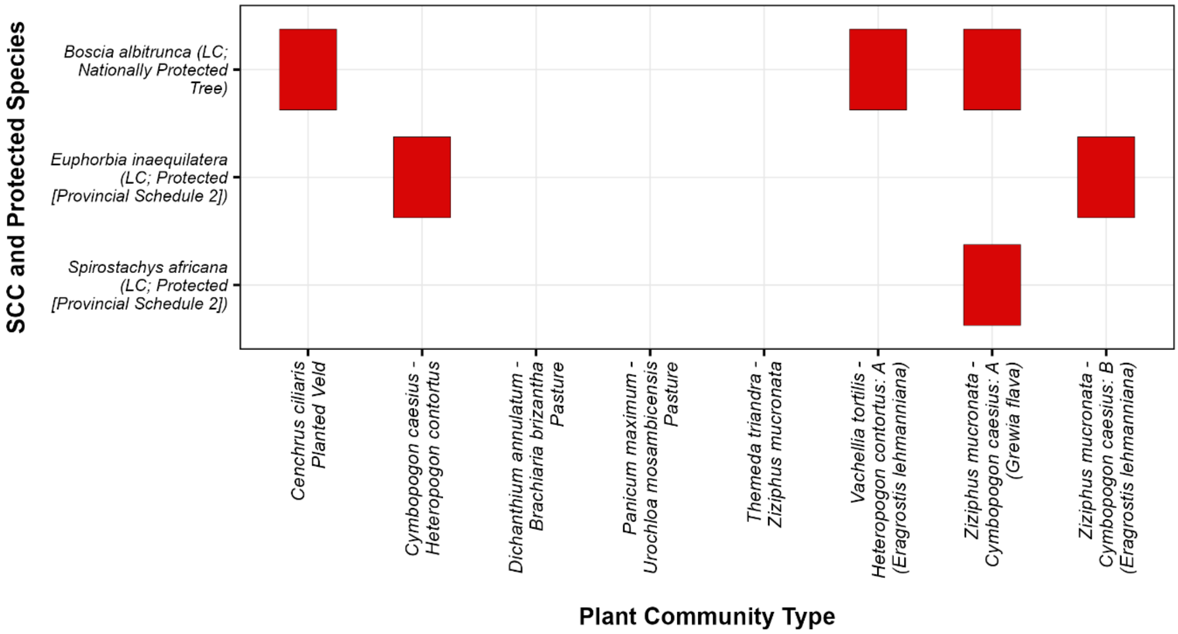

Figure 32: Presence/absence matrix of plant SCC for each plant community type within the proposed development site and broader surrounds. The presence of a red block indicates the presence of the respective plant SCC within the respective plant community type. This figure serves as a highly useful reference to visually determine either how many (and which) species occurred in a specific plant community type, or in how many (and which) plant community types a specific species occurred.

Ground truthing confirmed that no SCC occur within the proposed development site and surrounds. However, this does not mean that no SoCC can occur within the proposed development site and surrounds, and thus care must still be taken to keep an eye out for any such SoCC.

Furthermore, a total of 3 protected plant species were observed, namely:

- *Boscia albitrunca (Nationally Protected Tree)*
- *Euphorbia inaequilatera (Provincial Schedule 2)*
- *Spirostachys africana (Provincial Schedule 2)*

Care must be taken to avoid any of these species, should they be found. It is recommended that a pre-construction walkthrough be undertaken by a qualified botanist prior to commencement of construction. It must be noted that a permit must be obtained from relevant local competent authorities to damage, destroy, or relocate any SCC or protected plant species; any such actions are considered illegal without a permit, in which case such species must be avoided completely.

6.3. Alien Plant Species

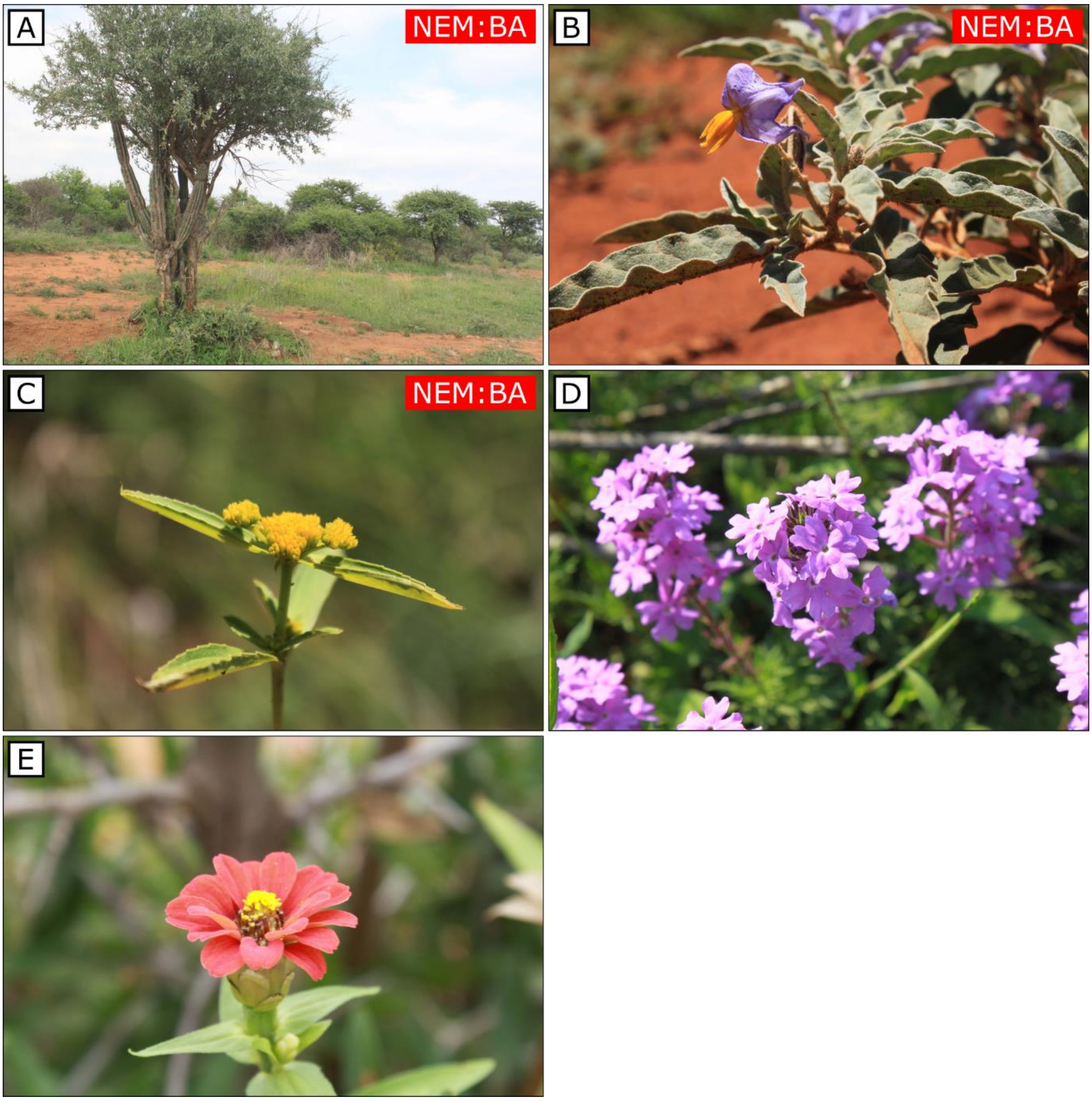

Figure 33: Selected weed and alien plant species that were observed in proposed development site. A) *Cereus jamacaru* (Queen of the night; Category 1b), B) *Solanum elaeagnifolium* (Silver-leaf bitter apple; Category 1b), C) *Flaveria bidentis* (Smelter's-bush; Category 1b), D) *Verbena aristigera*, and E) *Zinnia peruviana*.

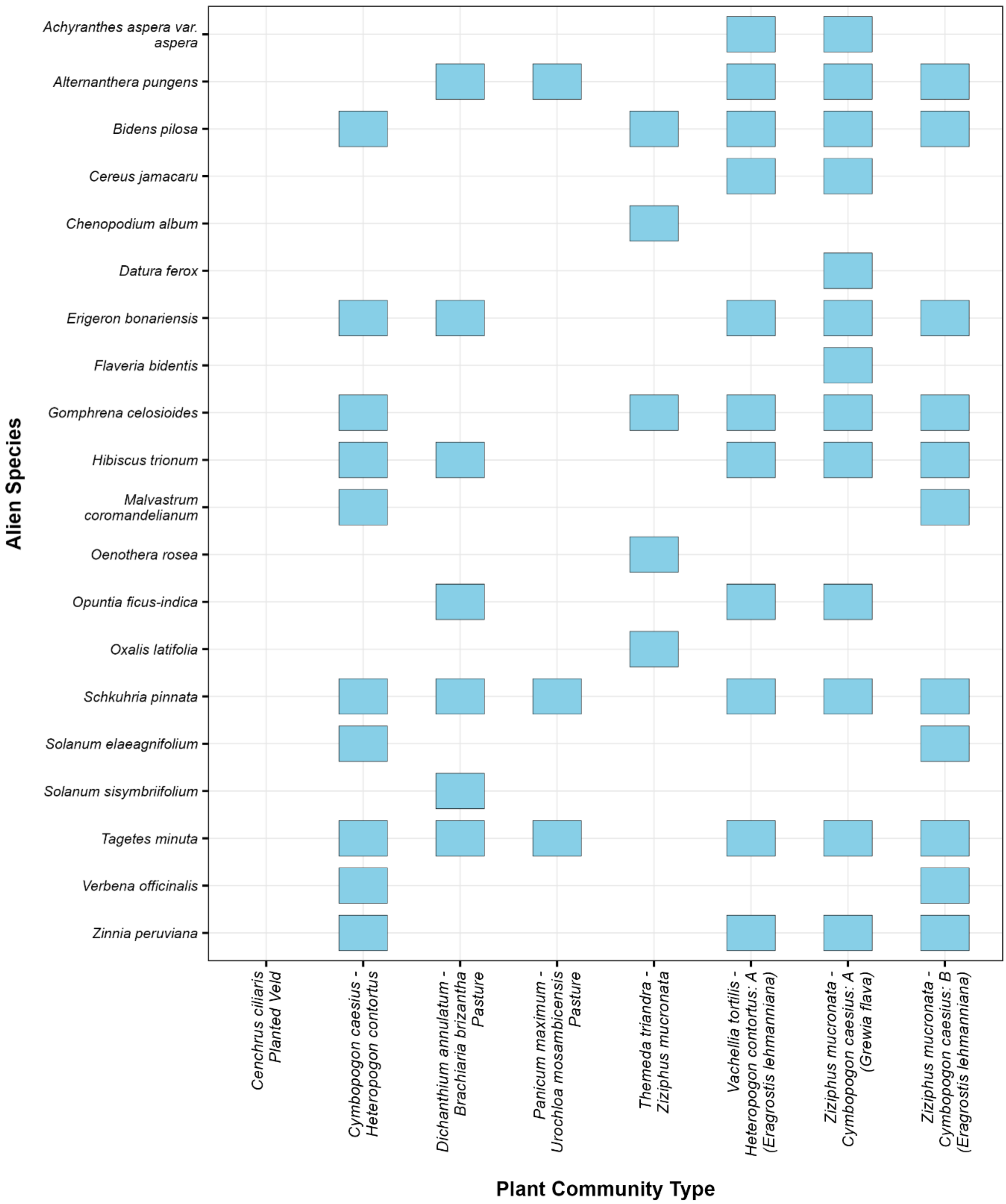

Figure 34: Presence/absence matrix of alien plant species for each plant community type within the proposed development site and broader surrounds. The presence of a blue block indicates the presence of the respective alien plant species within the respective plant community type. This figure serves as a highly useful reference to visually determine either how many (and which) species occurred in a specific plant community type, or in how many (and which) plant community types a specific species occurred.

A total of 20 alien plant species were found within the proposed development site, of which 7 are NEM:BA A&IS Regulations listed invasive species, namely:

- *Cereus jamacaru (Queen of the night; Category 1b)*
- *Datura ferox (Large thorn apple; Category 1b)*
- *Flaveria bidentis (Smelter's-bush; Category 1b)*
- *Malvastrum coromandelianum (Prickly malvastrum; Category 1b)*
- *Opuntia ficus-indica (Mission prickly pear, Sweet prickly pear; Category Multi)*
- *Solanum elaeagnifolium (Silver-leaf bitter apple; Category 1b)*
- *Solanum sisymbriifolium (Wild tomato, Dense- thorned bitter apple; Category 1b)*

Cereus jamacaru: A serious invader in many parts of South Africa, especially in the savanna biome, but it also invades grasslands, karoo, and rocky ridges. It can be difficult to distinguish from other cacti in the *Cereus hexagonus* complex; for example, it is possible that some specimens might be *C. hildmannianus* subsp. *uruguayanus* and that it might even be interbreeding with *C. jamacaru*. This species has large, attractive white flowers that open at night during springtime, and its seeds are spread by birds and monkeys that consume the fruit. Subsequently, excreted seeds fall and germinate under trees where the monkeys and birds sit. It mainly invades open veld where it grows under and among trees. It can replace indigenous vegetation and also prevents animals from accessing food and shade. Branches that are removed possess the capacity to root and form new plants. Any fragments of this species should therefore be burned, and not translocated to be discarded elsewhere, since these fragments will inevitably form new plants and might potentially form new invasive populations. Small pants can be sprayed with appropriate weed killers, while larger plants can be injected with MSMA. Plants can be chopped down, but as mentioned all fragments must be thoroughly destroyed, and stem bases must be dug out and also appropriately destroyed. The biocontrol stem borer *Alcidion cereicola* has proved to be somewhat successful. Nevertheless, every effort must be made to eradicate this species wherever it is found.

Datura ferox: A serious annual weed of many crops in South Africa, as well as an invader of wastelands and disturbed areas, roadsides, and riverbanks. Seeds and seedlings are poisonous to humans, with deaths having been recorded as resulting from deliberate or accidental ingestions (from there the colloquial name "malpitte", translated directly as "crazy seeds" or "crazy kernels", and alluding to the hallucinogenic effects that manifest after ingestion). These highly poisonous seeds can have a major negative impact on agricultural produce. A single seed per 10 kg of maize is enough to cause a grain buyer to reject a crop. This is roughly equivalent to one plant per hectare, which serves to demonstrate the impact that this noxious weed can have. Furthermore, the leaves, flowers, and fruits can cause skin irritations. The plants very aggressive growers and can quickly outgrow and outcompete other plants. They are very difficult to manage in maize fields, especially when using pre-emergence herbicides, since the plants are deep germinators, thus allowing them to elude the effects of the herbicides.

Flaveria bidentis: A native of tropical America, it is a semi-herbaceous annual up to 1 m high with sparsely hairy, yellowish, or orange stems, and bluish green, opposite, stalkless to shortly stalked leaves with finely toothed margins and that are prominently

3-veined from the base. Flowerheads are dark yellow, and dense, and are axillary or terminal, stalkless or stalked. It flowers mostly in summer, but also all year round. The species was probably introduced in imported fodder during the Anglo-Boer War. It has spread rapidly in South Africa and is most common in northern and eastern Mpumalanga, the Northern Cape, and Namibia, but is found throughout the country with the exception of the southern and Eastern Cape. It invades roadsides, rail sides, cultivated lands, waste ground, overgrazed land, riverbanks, floodplains, and wetlands, and is widespread in South Africa. It is a common annual weed of crops, gardens, and waste places, occasionally becoming dense and competitive. This species is fortunately very easy to control with shallow cultivation and conventional herbicides.

Malvastrum coromandelianum: This is a variable perennial or annual weed, native to North America. It is an erect herb up to 1 m high with tough stems that are often purplish and with long, silvery, appressed hairs. It has green, ovate to lanceolate leaves with venation conspicuously sunken on the upper surface, and with a coarsely toothed margin. Flowers are yellow and solitary or a few clustered in leaf axils. It does not have any thorns or prickles but is rather tough and leathery. It should not be confused with *Sida cordifolia*, which it resembles strongly. *Malvastrum coromandelianum* is a common and sometimes serious weed of roadsides, orchards, waste places, disturbed sites, cultivated lands, savanna, wetlands, riverbanks, and perennial crops in the summer-rainfall region, with the exception of the Free State. It is very drought resistant, and can be found growing on dry road shoulders where other weeds may perish. Very few herbicides are registered for its control, although it is probably susceptible to conventional herbicides, but only if sprayed when young. Seedlings can be removed by shallow cultivation, but mature plants are very difficult to pull up.

Opuntia ficus-indica: One of several species introduced from Central America. It is mainly used for hedging and its fruit. The species propagates easily from leaf pads (technically called "cladodes") and fragments; even small pieces can take root. The species can become an aggressive invader, and land that is heavily infested can be rendered virtually useless. Although some cultivars and varieties are supposedly non-invasive, certain spineless cultivars can potentially revert back to spiny forms and become invasive. The small spines on the fruit of these plants are highly irritating. Stock and game readily browse the leaf pads. This species can be controlled with herbicides such as MSMA and glyphosate. Biological control with cactoblastis and cochineal has been highly successful, and dense infestations have fortunately become very rare and sporadic. Nevertheless, every effort should be made to remove and eradicate this species wherever it occurs naturally.

Solanum elaeagnifolium: A herbaceous shrublet, from North, Central, and South America, 30 – 60 cm high with annual stems and perennial, deep, spreading roots. It has characteristic reddish prickles on the stems and undersides of leaves, but these can be absent. Leaves are greyish green above, often wavy, and folded upwards along the margins to expose silvery or whitish undersurfaces. Flowers are mauve, blue, or white, and eventually yield small yellow berries. It was recorded in South Africa in 1952, although some authorities believe it was identified at Wolmaransstad as early as 1919. It was probably introduced from the Americas with hay and has now spread to large parts of the Free State, Mpumalanga, and the Eastern and southwestern Cape. This species is an important perennial weed and invasive species that occurs mainly on disturbed and ploughed soil, neglected lands, in grazing camps, along roads, and in water furrows. Firebreaks that have been ploughed or disked along fence lines provide an ideal environment for the seeds dropped by birds perching on fences. In cultivated land it can completely swamp the crop. Young fruits and leaves are poisonous and has been suspected as being a source of potato viruses. In recent years the government has spent large sums of money on the control of *S. elaeagnifolium* but without much success. Its very extensive root system, which penetrates to depths of up to 3 m or more, and its ability to propagate from its roots, make this an extremely difficult weed to control. Fluroxypyr is registered as a foliar application. Biological control is showing promise and several defoliating beetles are being studied by the Department of Agriculture. The plants, with as much of the root as possible, should be removed before seeds are formed. Continuous removal will debilitate the plant and prevent the roots from forming shoots.

Solanum sisymbriifolium: A much-branched, very spiny, low shrub 0.5 – 1.5 m high, with an extensive root system; all parts are covered with sticky, glandular hair and bright orange-red to brown-yellow spines up to 2 cm long. Leaves are dull green, spiny, glandular-hairy, deeply pinnately lobed and toothed, and up to 20 cm long, with spines mainly on midrib and veins. Flowers are white, cream, or bluish; the species flowers all year. Fruits are shiny berries, green turning bright red and about 1.5 cm across. This species was introduced from South America during the Anglo-Boer War. It is a spiny, woody shrub, with a very extensive root system that is highly resistant to nematodes. As such, it is used as a trap crop for potato cyst nematode in the United Kingdom. If often grows along fences in open veld, as this is where birds that have eaten the fruit will sit and deposit the seeds. Many other species of *Solanum* are often referred to as "bitter apple" or "wild tomato". Many of them have thorns on the stems and the leaves. Some of them are toxic, with unripe fruit being more toxic than ripe fruit. The ripe fruit does not fall off easily and often remains on the plant in winter when they are then spread around in hay or by birds and other animals that consume them. This species occurs in roadsides, orchards, and tramped-out veld, and also invades wastelands, disturbed grassland, agricultural lands, and forestry plantations. It is a very resilient and aggressive invader. Once established, it is very difficult to remove and can replace large areas of indigenous vegetation. *Solanum sisymbriifolium* can be controlled with a foliar application of triclopyr. Unfortunately, this is an expensive operation. Biocontrol investigations are under way, but so far with minimal success.

6.4. Terrestrial Site Ecological Importance

Refer to Section **Error! Reference source not found.** for a description of the Relative Plant Species Theme Sensitivity and Relative Biodiversity Theme Sensitivity as described and classified within the DFFE Environmental Screening Tool as well as Section 40 for remarks based on on-site findings (verification/disproving) regarding the components and features underlying the various Environmental Planning Frameworks that underpin the findings and mapping of the Relative Biodiversity Theme Sensitivity within the screening tool.

Field observations, together with the SEI assessment presented here, indicated that the bulk of the PAOI is regarded as of "Low" sensitivity (64%) (Figure 35 and Table 21). The bulk of the "Low" sensitive area have been moderately to largely modified through anthropogenic intervention in the form of brush/tree management/control (thinning out) in order to improve the grazing potential of these rangelands. Severe historical livestock overgrazing has resulted in some small patches becoming bare/devoid of vegetation, exposing these areas to soil capping/compaction. Fairly recent underutilization of these areas has resulted in *Cymbopogon caesius* becoming the dominant species. No plant Species of Conservation Concern (SCC) or highly range restricted species/populations that are dependent on these habitats for survival, have been recorded within these areas and due to limited habitat suitability, there are some potential habitat for plant SCC.

Natural to near-natural savannas have also been classified as "Low" sensitive. These areas contain vegetation consistent with the Zeerust Thornveld. Livestock (cattle) grazing is the most significant impact within these areas, with these areas being subjected to livestock grazing for a very long period. These habitats have been subjected to fairly frequent periods of overgrazing and have resulted in some transformation of the vegetation composition, including the encroachment of woody shrubs and trees. Land use practices within the area (intensive game breeding and cultivation) as well as road infrastructure, have resulted in natural areas being highly fragmented. Only a small area of natural/near-natural habitat (< 11.6 ha) will be impacted by the proposed grid infrastructure. No plant Species of Conservation Concern (SCC) or highly range restricted species/populations that are dependent on these habitats for survival, have been recorded within these natural/near-natural areas. These areas do however provide potential habitat for plant SCC.

More than 36% of the project site have been significantly impacted through agricultural activities, with these areas being ploughed and cultivated with pasture grasses (cattle grazing). These areas contain very little natural vegetation and furthermore no plant Species of Conservation Concern (SCC) or highly range restricted species/populations that are dependent on these habitats for survival. These pastures also contribute to the highly fragmented nature of the area, significantly impacting habitat connectivity. Due to the highly degraded nature of the area, including the removal of natural, indigenous vegetation, significant disturbance of topsoil including tilling and ploughing, the loss of the indigenous seedbank, habitat recovery will be limited and very slow, requiring intensive human intervention.

The proposed grid corridor will cross a small/narrow drainage line which is regarded as "medium" sensitive. This drainage line has been significantly modified in terms of hydrology, geomorphology and vegetation coverage. The bulk of this drainage line is located within pasture paddocks and are subjected to significant grazing pressure (small paddocks used for intensive game breeding, mainly grazers). Furthermore, this drainage line has been dammed upstream (small gravel dams) and such dams have a profound impact on the hydrology of such smaller systems. No plant Species of Conservation Concern (SCC) or highly range restricted species/populations, that are dependent on such habitats for survival, have been recorded within the drainage line that crosses the grid corridor. This drainage line is however regarded as "Medium" sensitive as this drainage line feeds into a short intermittent watercourse, which is a minor tributary of the Elands River. Impacts on this drainage line can be successfully avoided through the implementation of buffer areas (appropriate buffer size will be provided within the Aquatic Biodiversity Report) and the mere spanning of the drainage line and the use of existing farm roads for access.

The SEI score interpretations according to the *Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa* (South African National Biodiversity Institute, 2020) are as follows:

- "High": requires avoidance mitigation wherever possible, or minimization mitigation, and subsequent changes to limit the amount of habitat impacted.
- "Low": minimization and restoration mitigation.
- "Very Low": minimization mitigation.

Table 21: Evaluation of Site Ecological Importance (SEI) for the plant community type(s) (Plant Species and Terrestrial Biodiversity Theme combined) within the proposed development site and surrounds. BI = Biodiversity Importance.

Plant Community Type / Habitat	Conservation Importance (CI)	Functional Integrity (FI)	Receptor Resilience (RR)	SEI
Ziziphus mucronata - Cymbopogon caesius (Variation B)	Medium: • More than 50% of receptor contains natural habitat with potential to support SCC.	Medium: • Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential. • Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches.	High: • Habitat that can recover relatively quickly (5–10 years) to restore > 75% of the original species composition and receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.	**Low (BI: Medium)**
Ziziphus mucronata - Cymbopogon caesius (Variation A)	Medium: • More than 50% of receptor contains natural habitat with potential to support SCC.	High: • Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g., ploughing) and good rehabilitation potential. • Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches.	High: • Habitat that can recover relatively quickly (5–10 years) to restore > 75% of the original species composition and receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.	**Low (BI: Medium)**
Vachellia tortilis - Heteropogon contortis (Variation C)	Low: • No confirmed or highly likely populations of SCC. • No confirmed and highly unlikely populations of range-restricted species.	Very Low: • Several major current negative ecological impacts.	Low: • Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.	**Very Low (BI: Very Low)**

Themeda triandra - Ziziphus mucronata	Medium: • More than 50% of receptor contains natural habitat with potential to support SCC.	Medium: • (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type.	Medium: • Will recover slowly (more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.	**Medium (BI: Medium)**
Cymbopogon caesius - Heteropogon contortus	Low: • Less than 50% of receptor contains natural habitat with limited potential to support SCC.	Medium: • Mostly minor current negative ecological impacts with some major impacts (e.g., established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential. • Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches.	Medium: • Will recover slowly (more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.	**Low (BI: Low)**
Panicum maximum - Urochloa mosambicensis planted veld	Very Low: • No natural habitat remaining.	Very Low: • Several major current negative ecological impacts. • Very limited habitat connectivity except for with wind-dispersed seeds.	Medium: • Will recover slowly (more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.	**Very Low (BI: Very Low)**
Dichanthium annulatum - Brachiaria brizantha planted veld	Very Low: • No natural habitat remaining.	Very Low: • Several major current negative ecological impacts. • Very limited habitat connectivity except for with wind-dispersed seeds.	Medium: • Will recover slowly (more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.	**Very Low (BI: Very Low)**

Cenchrus ciliaris planted veld	Very Low: • No confirmed and highly unlikely populations of SCC. • No confirmed and highly unlikely populations of range-restricted species.	Low: • Very limited habitat connectivity except for with wind-dispersed seeds. • Several minor and major current negative ecological impacts.	Medium: • Will recover slowly (more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.	**Very Low** **(BI = Very Low)**

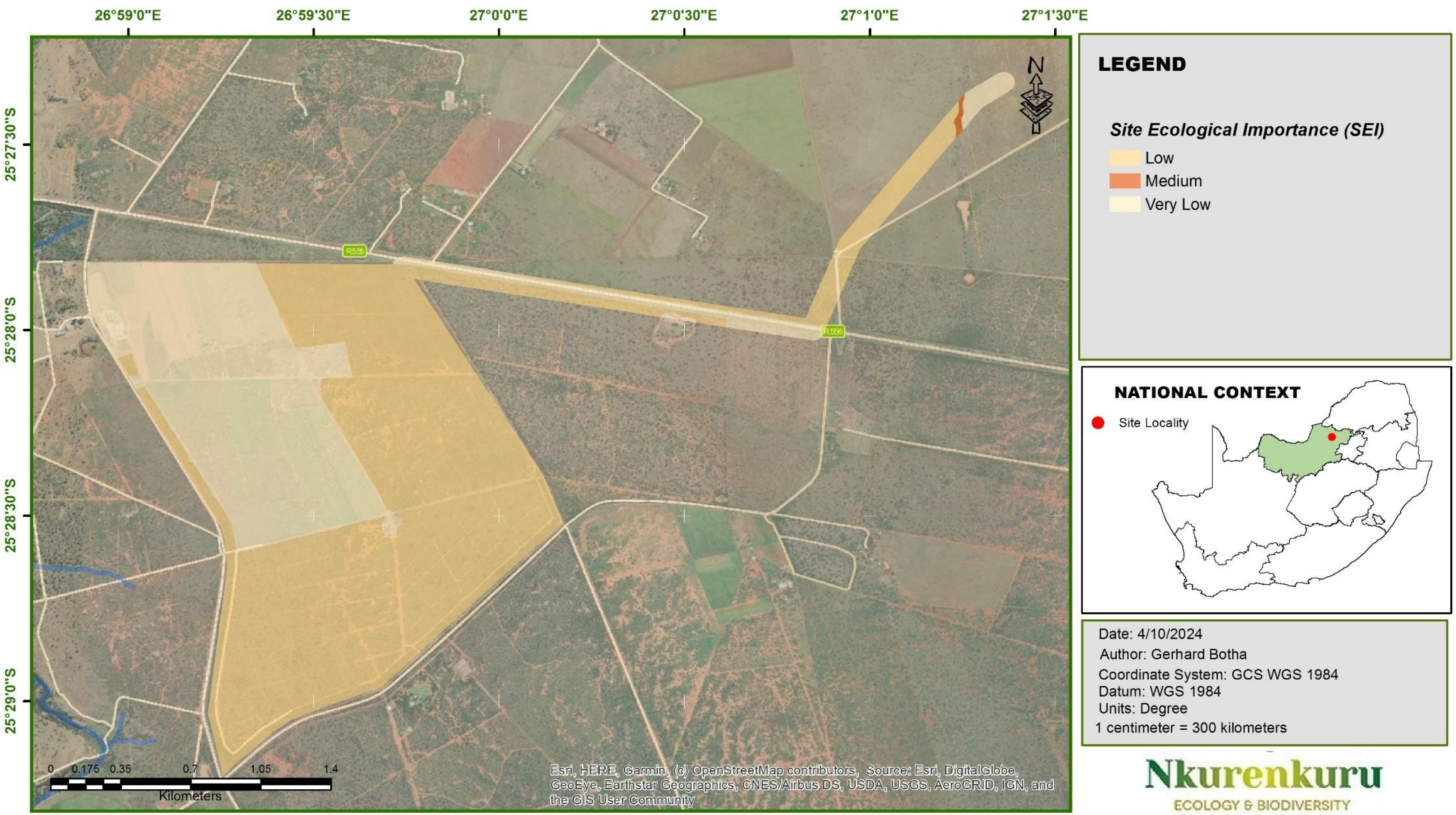

Figure 35: Site Ecological Importance (SEI) for the proposed development site and surrounds (see Table 21 for more details).

7. FINDINGS OF THE FAUNAL ASSESSMENT

This section describes the faunal ecology of the PAOI and the immediate surrounding areas as well as mapping and defining areas of increased Sensitivity and Ecological Importance (SEI). Furthermore, as mentioned the purpose of this study/report was furthermore, to:

- Define the Faunal Present Ecological State (PES) of the PAOI
- To provide inventories of faunal species as encountered within the PAOI
- To determine and describe major faunal habitat types,
- To determine and describe the faunal communities associated with the habitat types;
- To identify and consider all sensitive systems/habitats and landscape units, including outcrops, hills, rocky ridges, riparian habitats, watercourses, wetlands and/ or any other special features;
- To conduct a Species of Conservation Concern (SoCC) assessment, and the overall potential for such species to occur within the PAOI.

A total distance of ± 47.2 km (convex hull = 695.8 ha) was surveyed on foot across the proposed development site, as well as by vehicle (Figure 5). As mentioned, the timing of the survey can be regarded as acceptable as the timing of the survey aligns well with the natural behaviours and activities of the majority of the faunal species. Recent climatic events and seasonal conditions were also acceptable. Subsequently, vegetation coverage and natural fodder was fairly readily available, and was still in a fairly decent condition. Furthermore, time spend on site, can be regarded as minimal, but still acceptable in order to obtain enough relevant data.

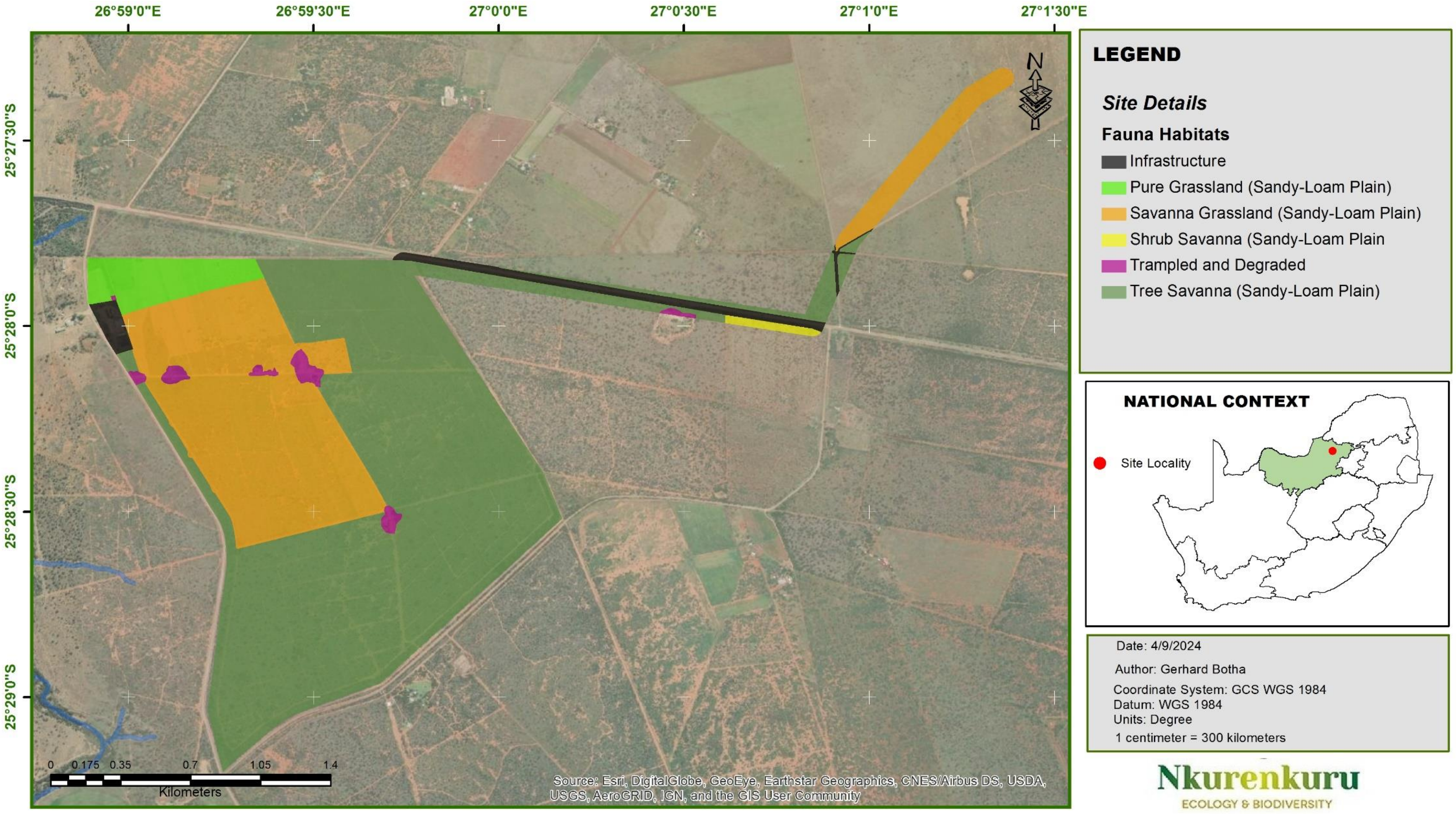

Figure 36: Mapping indicating the major faunal habitat types identified within the project site.

7.1. Faunal Habitat

Faunal species are adapted to a particular niche which often comprises a unique set of environmental conditions creating optimal habitat. The reliance of fauna on species-specific plant resources indicates the interconnected nature between faunal and floristically diversity. These "micro-habitats" do not always correspond strictly to vegetation associations, but rather to a combination of vegetation structure and species composition, topography, land use, available food source and other factors. Landscape composed of spatially heterogeneous abiotic conditions create a greater diversity of potential niches for fauna species, providing both diverse forage as well as refuge areas. Habitat availability is often used to determine databases due to the often cryptic, nocturnal and highly mobile nature displayed by many fauna species.

In the rich tapestry of South Africa's savannas, the interactions between the landscape and its inhabitants, particularly browsers and grazers, are pivotal in shaping the ecosystem's structure and biodiversity. Grazers, such as zebras, wildebeests, and various antelope species, wield a transformative influence on the savanna's form. These grazers' appetite for grasses maintains the landscape's openness, preventing the encroachment of shrubs and trees that could otherwise dominate. This control over vegetation encourages the continuous growth of grasses, ensuring a diverse mosaic of habitats within the savanna. Meanwhile, browsers like njalas, kudus, and giraffe have a profound impact on the vegetation structure by selectively consuming leaves and branches from trees and shrubs. This pruning behaviour not only affects plant growth but also fosters a complex array of plant species adapted to such grazing pressures. Consequently, the coexistence and interaction between browsers, grazers, and the vegetation create a dynamic balance that fosters biodiversity within the savanna. Fauna diversity, especially in terms of ungulates and mega herbivores in general, are extremely high and the potential of these savannas to sustain such diversity is astonishing, from the iconic African elephant to the smallest insects and birds. Each species plays a unique role in the intricate web of interactions, contributing to the resilience and richness of the savanna biome. These animals act as ecosystem engineers, influencing soil fertility, nutrient cycling, and even water retention, further emphasizing their fundamental role in maintaining the vitality and diversity of South Africa's savannas. The disturbance and/or removal of these interactions, along with the avoidance of frequent fires, have resulted in large scale bush encroachment across all types of South African savannas, a reduction in grass cover and in turn has led to a general decline in plant and animal diversity within these modified habitats.

In terms of habitat diversity/heterogeneity, the PAOI can be regarded as low and largely homogenous. Within the PAOI, four (4) major faunal habitats have been identified (Figure 36). Furthermore, no aquatic faunal habitats are present within the PAOI or within proximity to the PAOI.

Terrestrial Habitats:

- Tree Savanna Plains occupying deep to moderately deep sandy-loam soils (near natural to moderately modified);

- Shrub Savanna Plains occupying deep sandy-loam soils (seriously modified).
- Savanna Grassland Plains occupying deep sandy-loam soils (critically to seriously modified)
- Pasture or Pure Grassland Plains occupying deep sandy-loam soils (completely modified)

As stated during the description of the various vegetation types (Section 6.1), small-scale plant diversity and ecological condition of vegetation varied across the development site and was primarily driven by anthropogenic activities. Edaphic factors (soil texture and soil depth played a minor role.

Vegetation community/type diversity has a significant impact on faunal diversity in ecosystems. The variety of plant species within a community provides different niches and resources for various animal species. Herbivores, for instance, rely on specific plant species for food. The relationship between grass, tree and shrub coverage for example will determine the relationship and diversity of browsers and grazers within an area, whilst the hight of the shrubs/trees as well as grass species may influence the type of grazers and browsers that will occupy the area. Additionally, the structural complexity of diverse vegetation communities offers shelter and breeding sites for animals. Furthermore, flowering plants in diverse communities attract a variety of pollinators, contributing to the diversity of insect and bird species. As such, rich and varied vegetation communities can support a wide array of animal species, creating a web of interdependence that underscores the significance of preserving plant diversity for the conservation of animal biodiversity.

As mentioned, the various vegetation types/units/communities found within the project site have been listed and described within Section 6.1 of this report. To aligning this section (faunal habitats) with the vegetation types/communities we have indicated in Table 22 below, were the faunal habitat units, as identified in this section, overlap the vegetation types/units as mentioned in Section 6.1. It should be noted that the faunal habitats are more broad units as much of the vegetation types share similar structure and some ecological drivers, but may slightly vary in diagnostic and dominant species. Subsequently some of these “fairly” similar vegetation types will be very similar in terms of faunal assemblages, interactions, faunal functions and services as well as faunal importance and sensitivity, and subsequently have been delineated as such to allow for practical implementation of fauna and flora management practices.

Table 22: Table illustrating the overlap between the faunal habitat units and the vegetation communities/units/types as identified and described within this report.

Faunal Habitats	Size of Faunal Habitat (Ha)	Vegetation Communities	Size of Vegetation Community (Ha)	% Coverage of Vegetation Community within Faunal Habitat
Tree Savanna Plains (Sandy-Loam Soils)	210.5	*Ziziphus mucronata - Cymbopogon caesius (*Variation A*)*	173.4	82.4 %
		*Ziziphus mucronata - Cymbopogon caesius (*Variation B*)*	37.4	18.2 %

Savanna Grassland Plains (Sandy-Loam Soils)	99.8	*Cenchrus ciliaris* planted veld	2.8	2.8 %
		Cymbopogon caesius - Heteropogon contortus	7.9	7.9 %
		Dichanthium annulatum - Brachiaria brizantha planted veld	88.7	88.9 %
		Themeda triandra - Ziziphus mucronata	0.4	0.4 %
Savanna Shrubland Plain (Sandy-Loam Soils)	1.5	*Vachellia tortilis - Heteropogon contortus (*Variation C*)*	1.5	100 %
Pastures or Pure Grassland Plains (Sandy-Loam Soils)	15	*Panicum maximum – Urochloa mosambicensis* Planted Veld	15	100 %
Infrastructure	12.1	Agricultural Infrastructure	2.8	23.1 %
		Gravel Road	0.7	5.8 %
		Tar Road (R556)	8.5	70.2 %
Trampled and Degraded	4.23	Trampled and Degraded	4.23	100 %

7.1.1. Tree Savanna occupying Sandy-Loam Plains

The bulk of the project site comprises this faunal habitat (210.5 ha). The bulk of the area is utilized as small breeding camps for scares and exotic game species, whilst only a small portion is utilized for livestock farming (cattle). Approximately 173.4 ha (82.4 %) of this faunal habitat has been moderately to largely modified through the artificial (mechanically) and strategically removal of certain woody species (trees and shrubs), Signs of severe historical overgrazing is also present in the form of small patches of bare soil exposed to soil capping. The remaining 18.2 % (37.4 ha) is regarded as near natural vegetation utilized for cattle farming, and is currently also being intensively overgrazed.

Furthermore, this habitat is associated with reddish, sandy loam soils (mostly deep) with no to very little surface gravel/stones. However, sallow soils with surface stones and rocks are present in one fairly small location.

Floral, alpha diversity within this habitat type was low-moderate. Typically, this habitat can be characterised as a fairly open savanna with a moderately to well-developed grass layer and medium sized trees. The grass layer is highly variable within this habitat and may cover up to 80% in areas where a dense grass layer has been encouraged through brush management. Overgrazed areas may cover a grass layer of less than 55%, and as mentioned small exposed soil patches are present, and are remnants of severe historical overgrazing. The tree layer throughout this habitat occur at a density of between 20 and 35%, with an average height of between 4 and 5 m. The shrub layer, as in the case of the grass layer, is highly variable (vary in coverage from 10 % to 55%) and are also closely tied to land management practices (especially brush management and grazing regimes.

Key plant species found within this habitat type include: *Cymbopogon caesius, Aristida congesta var. congesta, Heteropogon contortus, Eragrostis rigidior, E. lehmanniana Themeda triandra, Urochloa mosambicensis, Grewia flava, Peltophorum africanum, Vachellia robusta, Vachellia tortilis Ziziphus mucronata, Searsia lancea, Panicum maximum, Lycium schizocalyx, Blepharis maderaspatensis, Nidorella resedifolia, Osteospermum muricatum, Seddera capensis, and Solanum campylacanthum*. The integrity and functions of this habitat type are overall regarded as moderately modified.

This low to low-moderately structurally variable habitat generally provides moderate refugia and forage. This habitat is also regarded as low-moderately important breeding site, especially for mammal species. However, natural movement patterns of "natural" occurring mammals, especially medium to larger sized mammals have been significantly impacted by tall game fences surrounding numerous small breeding camps within the project site, as well as within the larger surroundings. This, along with a fairly busy road network within the area have significantly fractured the landscape.

The highly fractured nature of the area, the low-moderate structural complexity (habitat and niche diversity) and moderate foraging potential allows for a low natural faunal diversity, with a noteworthy absence of carnivore species, apart from smaller, more adaptable carnivores such as mongooses.

Most of the species recorded within this habitat type can be regarded as habitat generalists. The most frequently observed mammals include; Common Duiker (*Sylvicapra grimmia)*, Steenbok (*Raphicerus campestris*), African Savanna Hare (*Lepus victoriae*), Slender Mongoose (*Herpestes sanguineus*).

In terms of herpetofauna diversity within this habitat, due to a low habitat and niche diversity and structural complexity, reptilian diversity is expected to be low. Only three reptile species recorded, namely: Savanna Lizard (*Meroles squamulosus*), Spotted Grass Snake (*Psammophylax rhombeatus rhombeatus*) and Mozambique Spitting Cobra *(Naja mossambica*).

No amphibian species have been recorded within this habitat, with very limited suitable habitat available for amphibian species.

In terms of faunal SoCC, no species were observed within this faunal habitat.

In terms of provincially protected mammals, the following protected mammals were recorded within this faunal habitat:

- Steenbok - *Raphicerus campestris*

Figure 37: Representative photos of the shrubland savanna occupying heavy clay soils. This habitat is found within the north-eastern portion of the projects site. A & C) This habitat has been significantly impacted through anthropogenic activities, including the removal of larger woody plants for firewood and frequent burning. B & D) This habitat type is now dominated by tall shrubs and small multi-stemmed tree species.

7.1.2. Savanna Grassland and Pure Grassland occupying Sandy-Loam Plains (Pastures)

This faunal habitat represents seriously to critically modified form of the tree savanna (on sandy-loam plains), where significant bush (trees and shrubs) clearance has occurred, along with irregular ripping and ploughing and re-seeding of the areas with more palatable gras species (pastures). These activities have occurred over, at least, the last 30 to 50 years, with the aim of improving the grazing potential of these areas, in the past for intensive cattle farming, but for the last 10 to 15 years, for intensive game breeding. This has led to significant changes in the vegetation cover and structure with this habitat now being regarded as an open grassland savanna, with the tree and shrub cover being reduced by at least 70 to 80%, however the percentage of trees and shrubs do differ between the various pastures.

This habitat is located on weak red to reddish yellow, sandy-loam soils of varying depth (mostly moderately deep). Furthermore, this habitat is characterized by flat plains (slope>1%). Currently, these areas are all utilized for intensive game breeding (scarce and exotic game) and comprise of small game camps cordoned off by tall, mostly impenetrable game fences, which has had a significant impact on the natural movement patterns of larger, "natural" wildlife, especially carnivores.

These pastures are characterised by mostly dense, medium grassland, with grasses and forbs covering between 65 – 85% of this habitat. However, localised overgrazing has resulted in a few, mostly small patches, of sparser areas (soil capping and compaction are frequent observed within these overgrazed patches). Key or dominant grass and forb species observed within these patches include; *Cenchrus ciliaris, Brachiaria deflexa, Dichanthium annulatum, Cymbopogon caesius, Aristida congesta, Eragrostis rigidior, Aristida adscensionis, Heteropogon contortus, Nidorella resedifolia, Panicum maximum Solanum campylacanthum, Eragrostis lehmanniana, Urochloa mosambicensis, Vachellia tortilis, Ziziphus mucronata* and *Tagetes minuta*. As mentioned, the tree and shrub layer have been significantly reduced and comprise of shrub/small tree layer (*Vachellia tortilis, and Ziziphus mucronata)* with a density varying between 10% and 30%, and a medium sized tree layer covering a combined area of between 4% and 7% (most areas<5%).

Floral diversity within this habitat type was low, and as mentioned the integrity and functionality of this habitat type have been significantly modified, however this habitat is still capable of providing some functions and services, albeit in a modified manner.

Structurally, this habitat is the most homogenous, of the faunal habitats. The most significant function of this habitat is the provision of fairly good grazing, however, as mentioned the mostly impenetrable game fences have prevented the use of these pastures for medium sized "natural" occurring mammals. Furthermore, due to low structural complexity, and frequent past disturbances, "natural" faunal diversity within this habitat is low. The softer substrate is, however, more optimal for smaller fossorial or burrowing species such as mole rats, mongooses, and porcupines and subsequently, these smaller mammals are the most frequently observed species within the area. Warthog, frequently dig underneath the fences providing occasional passage to and from this habitat for smaller antelopes such as steenbok and common duiker as well as smaller carnivores such as black-baked jackal. However, these fences are frequently patrolled, and any holes/passages are promptly closed up. Meso and small carnivores such as black-baked jackal and caracal are religiously persecuted within these areas, in order to protect the breeding herds of scarce and exotic game.

No Herpetofaunal species have been recorded within this area. Subsequently, the overall faunal diversity and habitat connectivity, of this habitat can be regarded as low.

No animal SoCC were recorded within the PAOI. However, there is a moderate Likelihood of Occurrence (LoO) for some animal SoCC to occur within this habitat.

In terms of provincially protected mammals, only one mammal species has been recorded namely:

- Steenbok - *Raphicerus campestris*

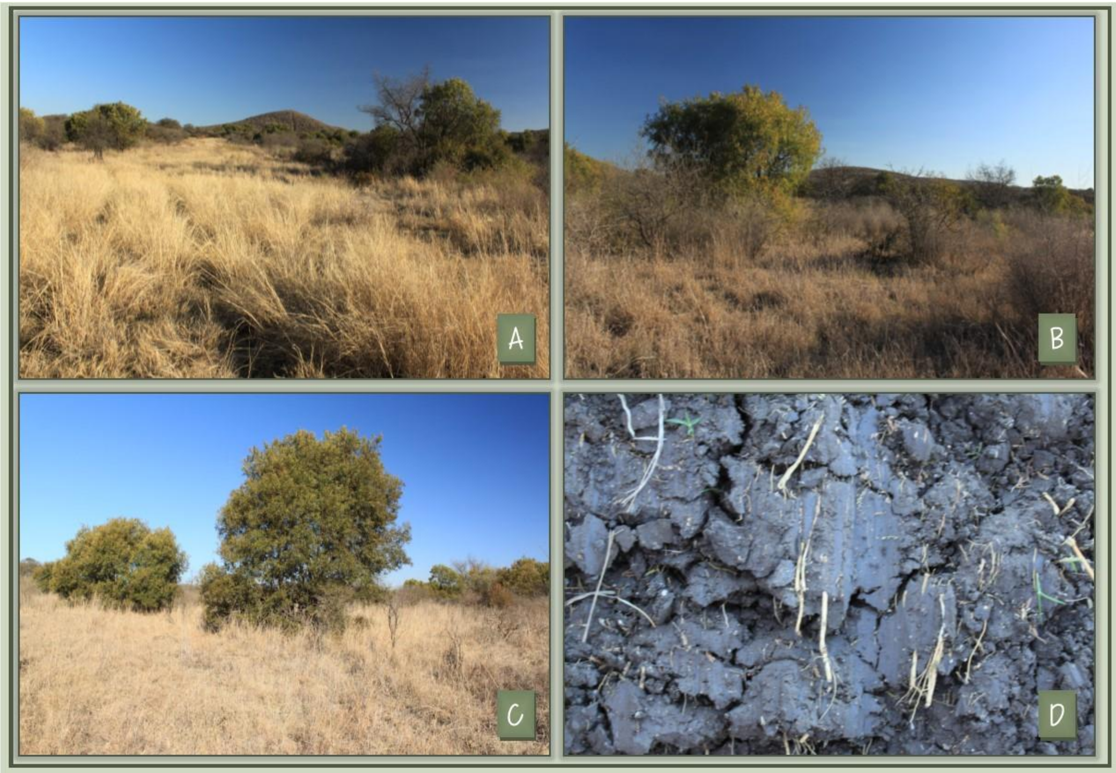

Figure 38: Representative study area photos of the tree savanna occupying heavy clay soils A - C) natural open tree savanna comprising a dense, well developed grass layer and medium sized trees, *especially Searsia lancea* and *Senegalia mellifera*. D) Dark, swelling (wet) and cracking (dry) vertic soils with slickenside (Rensburg form).

7.1.3. Savanna Shrubland occupying Sandy-Loam Plains

This faunal habitat represents seriously to critically modified form of the tree savanna (on sandy-loam plains), where historic cultivation activities have been abandoned and the area being allowed to re-establish a more natural vegetation cover. These activities have occurred over, at least, the last 30 to 50 years. Following the re-establishment of a vegetation cover, the area has been utilized as grazing (cattle). This area experience high to severe grazing pressure and has resulted in the encroachment of small thorny trees and shrubs.

This habitat type is a transitional area between the typical sandy-loam areas that characterize the majority of the region and areas with a slightly higher clay content. The clay content is still quite low within this habitat, but enough to have an influence on the species composition and structure, most notable within the tree and shrub layer (especially in terms of species composition and height).

This area is also located within a flat plain (slope<1%) with very little geomorphological variations. Floral, alpha diversity within this habitat type was very low. Typically, this habitat was characterised by a moderately sparse ground cover, with numerous bare patches, exposing the soils to soil capping, sheet erosion and trampling. The grass cover is fairly sparse and is characterized by short to moderate-tall grass species (coverage:

40%), dominated by *Cynodon dactylon, Aristida canescens, Aristida adscensionis, Aristida congesta var. congesta, Melenis repens*, and Eragrostis *rigidior.* The shrub (1.6 m) and small tree (2.5 m to 3 m) layer covered collectively between 75 % and 80 % of this habitat, with Vachellia tortilis, Senegalia mellifera and *Grewia flava* being the diagnostic species within this layer. Trees taller than 3m was scarce, throughout this habitat type (predominantly *Vachellia tortilis*).

This habitat unit generally provides poor refugia and forage for faunal species. This habitat is also not regarded as an important breeding and foraging site. The grasses in this habitat are mainly wiry pioneers and sub-climax species of low palatability and forage value. The low structural complexity (habitat and niche diversity) and low foraging potential allows for a low faunal species diversity for this area. Natural movement patterns of larger "natural" occurring mammals, especially carnivores have been impacted by tall game fences within the surroundings, however within the property itself, cattle fences surrounding this grazing camp do not provide much hindrance for small and medium sized mammals. Most of the species recorded within this habitat type can be regarded as habitat generalists. The most frequently observed mammals include; Black-backed Jackal (*Canis mesomelas*), Single-striped Grass Mouse (*Lemniscomys rosalia*) and Slender Mongoose (*Herpestes sanguineus*).

In terms of herpetofaunal diversity, this habitat type was found to be low in diversity with no reptile or amphibian species recorded within this habitat very limited, suitable habitat being available for amphibian species.

No animal SoCC were recorded within this habitat and there is a low Likelihood of Occurrence (LoO) for animal SoCC to inhabit or utilize this habitat for forage.

Figure 39: Representative study area photos of the tree savanna occupying heavy clay soils A - C) natural open tree savanna comprising a dense, well developed grass layer and medium sized trees, *especially Searsia lancea* and *Senegalia mellifera*. D) Dark, swelling (wet) and cracking (dry) vertic soils with slickenside (Rensburg form).

Table 23: Summary of the results of the faunal habitat sensitivity assessment. Abbreviations: SoCC = Species of Conservation Concern; LoOC = Likelihood of Occurance.

Sensitivity Summary	FAUNAL HABITATS		
	Tree Savanna (Sandy-Loam Plains)	**Savanna Grassland and Pure Grassland (Sandy-Loam Plains)**	**Savanna Shrubland (Sandy-Loam Plains)**
Observed Species Diversity	3 Reptiles; 6 Mammals 0 Amphibians	0 Reptiles; 6 Mammals 0 Amphibians	0 Reptiles; 3 Mammals 0 Amphibians
Potential Species Diversity	Moderate	Low	Low
Habitat Specialist	Mainly generalists	Mainly generalists	Mainly generalists
Observed Species of Conservation Concern *(excluding species that have been introduced for intensive game breeding)*	0	0	0
Potential SoCC = Medium to High LoOC *(refer to **Error! Reference source not found.**)*	0 Reptiles; 1 Mammals 0 Amphibians	0 Reptiles; 1 Mammals 0 Amphibians	0 Reptiles; 0 Mammals 0 Amphibians
Observed Protected Species *(excluding species that have been introduced for intensive game breeding)*	1 Mammal	0	0
Structural Complexity *(micro-habitat and niche space)*	Low-Moderate	Very Low	Very Low
Habitat Integrity	Moderate	Low	Low
Present Ecological Status	Mainly moderately modified	Serious Modifications	Serious Modifications

Sensitivity Summary	FAUNAL HABITATS		
	Tree Savanna (Sandy-Loam Plains)	Savanna Grassland and Pure Grassland (Sandy-Loam Plains)	Savanna Shrubland (Sandy-Loam Plains)
	A slight to moderate change in ecosystem processes is discernible and a loss of natural habitats and biota have taken place.	The change in ecosystem processes and loss of natural habitat and biota was great during the initial disturbance/ transformation, however some natural habitat features have returned and are now recognizable.	The change in ecosystem processes and loss of natural habitat and biota was great during the initial disturbance/ transformation, however some natural habitat features have returned and are now recognizable.
Food Availability	Moderate	Moderate	Low-
Connectivity	Low	Low	Low-Moderate
Important Structural and Landscape Elements	No important structural and landscape elements observed	No important structural and landscape elements observed	No important structural and landscape elements observed
Climate Resilience	Moderate	Low	Low
RATING	**Medium**	**Very Low**	**Very Low**

Mammals

7.1.4. Overall Diversity

Mammal diversity within the PAOI was considered low. A total of 16 mammal species were observed within the PAOI. However, 6 of these species are larger antelope (Family: Cetartiodactyla) species that has been introduced into the area for "agricultural purposes (intensive game breeding). These species are predominantly larger and scarcer antelope species as well as exotic variation of these antelope species. Furthermore, these species are kept in fairly small grazing camps which is surrounded by tall, impenetrable game fences, restricting any natural movement in and out of these areas (larger mammals). These larger more scarce and exotic antelope species that were observed within the PAOI include:

- *Syncerus caffer* – African Buffalo
- *Hippotragus niger* - Sable Antelope
- *Aepyceros melampus melampus* - Impala
- *Connochaetes taurinus* - Blue Wildebeest
- *Damaliscus pygargus phillipsii* - Blesbok
- *Tragelaphus angasii* - Nyala

Subsequently, a total of 10 "natural" occurring mammals were recorded namely:

- Family: Carnivora

  - *Canis mesomelas* - Black-backed Jackal (LC)
  - *Herpestes sanguineus* - Slender Mongoose (LC)
- Family: Cetartiodactyla
  - *Phacochoerus africanus* - Common Warthog (LC)
  - *Raphicerus campestris* – Steenbok (LC)
  - *Sylvicapra grimmia* - Common Duiker (LC)
- Family: Lagomorpha
  - *Lepus victoriae* - African Savanna Hare (LC)
- Family: Rodentia
  - *Aethomys ineptus* - Tete Veld Rat (LC)
  - *Lemniscomys rosalia* - Single-striped Grass Mouse (LC)
  - *Hystrix africaeaustralis* - Cape Porcupine (LC)
  - *Rhabdomys dilectus* - Mesic Four-striped Grass Rat (LC)

Based on the various sampling techniques, the following mammals were the most frequently observed within the project site:

- Steenbok (*Raphicerus campestris*): Physical observations and numerous dry pellet heaps.
- Slender Mongoose (*Herpestes sanguineus*): Physical observations.
- Duiker (*Sylvicapra grimmia*): Caught on camera traps

Natural movement patterns of "natural" occurring mammals, especially medium to larger sized mammals have been significantly impacted by tall game fences surrounding numerous small breeding camps within the project site, as well as within the larger surroundings. This, along with a fairly busy road network within the area have significantly fractured the landscape.

The highly fractured nature of the area, the low-moderate structural complexity (habitat and niche diversity) and moderate foraging potential allows for a low natural faunal diversity.

The condition of the mammals observed looked good, indicating that sufficient forage is available for mammals occupying the focus area. Forage availability for primary consumers is considered intermediate to high. Forage for small carnivorous mammals like mongooses and shrews etc. is anticipated to be intermediate. Mesopredators will occur occasionally occur within the area but large predators were completely absent from the PAOI.

7.1.5. Protected Mammal Species

Apart from the introduced mammals that are protected within the relevant Provincial Conservation Act (South African Giraffe and Sable Antelope), one (1) "natural" occurring mammal have been observed, which is protected within the relevant legislation namely:

- Steenbok (*Raphicerus campestris*);

This species is fairly common within the region and have a fairly wide range within South Africa.

It is highly unlikely that the proposed development will have a significant impact on these species and its population within the area as this species is also well represented outside of the development footprint.

7.1.6. Mammal Species of Conservation Concern (SCC)

During the site visit no mammal SoCC were recorded within the PAOI.

The initial screening report revealed that three mammal SCC have a distribution range that include the project site and may potentially inhabit the project site namely; Sensitive Species 5 (for their protection, the identities of these species will not made public); *Crocidura maquassiensis* (Makwassie musk shrew), and *Lycaon pictus* (African wild dog). Subsequently, the project site has been classified as Medium Sensitive within the screening tool.

During the site survey it was determined that there is a very low likelihood of occurrence (LoOC) for all three mammal species to occur within the project site. Due to livestock and intensive game breeding activities within the area, *Lycaon pictus* (African wild dog) and Species 5 these species will likely also not be tolerated within the area, there movement within the area would also be highly restricted due to numerous impenetrable, and frequently electrified game fences. Furthermore, *Crocidura maquassiensis* (Maquassie Musk Shrew) prefers densely vegetated, moist grassland/wetland habitats, and no such habitats are present within the project site.

It is highly unlikely that the proposed development will have a significant impact on potential SoCC species and their regional populations, as large tracts of natural habitat will still persist outside of the development site.

7.2. Reptile and Amphibian

7.2.1. Overall Diversity

A very low reptile diversity was observed during the field assessment, with only five (3) reptile species observed within PAOI namely:

The following reptiles were observed within the project site:

- *Meroles squamulosus* - Savanna Lizard (LC)
- *Psammophylax rhombeatus rhombeatus* - Spotted Grass Snake (LC)
- *Naja mossambica* - Mozambique Spitting Cobra (LC)

Diversity and abundance are anticipated to fairly low to a low habitat and niche diversity and general structural complexity within the project site. Reptiles are inherently secretive and shy, making their detection and identification in the field challenging (specifically during site visits of a short duration).

No limitations of reptile movement are anticipated within the area and they will readily utilise even transformed areas to move through. The higher density of taller trees and shrubs within the tree savanna habitat provide favourable habitat for more arboreal species. Rodent burrows and those of larger species, which are often utilised by snakes, were observed in low densities, providing fairly limited shelter for burrowing snake species or food resources (rodents). There are likely sufficient levels of food resources for predatory snakes preying on small mammals, as well as for herbivorous and insectivorous reptile species.

No amphibian species have been recorded within the project area. The fairly arid nature of the locality and the absence of freshwater resources, reduces the suitability of the site for amphibians. Artificially impoundments and watering points (for game and livestock) may be suitable habitat but only to amphibians able to withstand poor water quality. Subsequently, the general arid landscape does not lend itself to habitation by amphibians as a result of the fairly arid nature of the landscape. Some species can be anticipated but will occur at low densities. The diversity anticipated within the focus area is very low (based on the habitat suitability). Forage is not anticipated to be a limiting factor for amphibians. Impacts on amphibians will be low given the absence of suitable habitat within the project site.

7.2.2. Reptile and Amphibian Species of Conservation Concern (SCC)

During the site visit no Reptile or Amphibian SoCC were recorded through active searching (diurnal and nocturnal surveys), and through random observations.

It is highly unlikely that the proposed development will have a significant impact on potential SoCC species and their regional populations.

Figure 40: Photos of some of the faunal species that were recorded within the PAOI. Species names: A) South African Giraffe (*Giraffa camelopardalis giraffa*), B) *Aepyceros melampus melampus* (Impala); C & D) *Damaliscus pygargus phillipsii (*Blesbok); E) *Tragelaphus angasii* (Nyala); F) *Tragelaphus oryx* (Eland); G) Spoor of *Canis mesomelas* (Black-backed Jackal); H) Spoor of *Tragelaphus strepsiceros* (Greater Kudu); I) Dung of *Hystrix africaeaustralis* (Cape Porcupine), J) Dry dung pellets of *Raphicerus campestris* (Steenbok); K) Rodent burrow; L) Dry dung pellets of *Lepus victoriae* (African Savanna Hare); M) *Procavia capensis* (Rock Dassie) latrine; N) Spoor of *Parahyaena brunnea* (Brown Hyaena); O) Shell of *Kinixys lobatsiana* (Lobatse Hinge-back Tortoise).

7.3. Faunal Habitat Sensitivity

Faunal species are adapted to a particular niche which often comprises a unique set of environmental conditions creating optimal habitat. The reliance of fauna on species-specific plant resources indicates the interconnected nature between faunal and floristically diversity. These "micro-habitats" do not always correspond strictly to vegetation associations, but rather to a combination of vegetation structure and species composition, topography, land use, available food source and other factors. Landscape composed of spatially heterogeneous abiotic conditions create a greater diversity of potential niches for fauna species, providing both diverse forage as well as refuge areas. Habitat availability is often used to determine databases due to the often cryptic, nocturnal and highly mobile nature displayed by many fauna species.

Field observations, together with the SEI assessment presented here, indicated that the majority of the site can be regarded as of "Low" sensitivity (210.5 ha or 61% of project site) whist the remaining 39% (132.6 ha) are regarded as "Very Low" sensitive (Table 24). None of the areas were scored as "High" or "Very High".

The SEI score interpretations according to the *Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa* (South African National Biodiversity Institute, 2020) are as follows:

- "High": requires avoidance mitigation wherever possible, or minimization mitigation, and subsequent changes to limit the amount of habitat impacted.
- "Medium": minimization and restoration mitigation.
- "Low": minimization and restoration mitigation.
- "Very Low": minimization mitigation.

Table 24: Evaluation of Site Ecological Importance (SEI) for the faunal habitats within the proposed development site and surrounds. BI = Biodiversity Importance.

Faunal Habitat	Conservation Importance (CI)	Functional Integrity (FI)	Receptor Resilience (RR)	SEI
Infrastructure	**Very Low**: • No natural habitat remaining • No confirmed and highly unlikely populations of SCC. • No confirmed and highly unlikely populations of range-restricted species.	**Very Low**: • No habitat connectivity except for flying species. • Several major current negative ecological impacts.	**Low**: • Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.	**Very Low** (BI = Very Low)
Trampled and Degraded	**Very Low:** • No natural habitat remaining • No confirmed and highly unlikely populations of SCC. • No confirmed and highly unlikely populations of range-restricted species.	**Very Low**: • Several major current negative ecological impacts. • Very small (< 1 ha) area.	**Low**: • Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.	**Very Low** (BI = Very Low)
Savanna Grassland and Pure Grassland on sandy-loam plains	**Very Low**: • No confirmed and highly unlikely populations of SCC. • No confirmed and highly unlikely populations of range-restricted species.	**Low**: • Several minor and major current negative ecological impacts. • Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential.	**Medium:** • Will recover slowly (more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.	**Very Low** (BI = Very Low)
Savanna Shrubland on sandy-loam plains	**Very Low**: • No confirmed and highly unlikely populations of SCC. • No confirmed and highly unlikely populations of range-restricted species.	**Low**: • Several minor and major current negative ecological impacts.	**Medium:** • Will recover slowly (more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.	**Very Low** (BI = Very Low)
Tree Savanna on sandy-loam plains	**Medium:**	**Medium:**	**High**:	**Low**

	• More than 50% of receptor contains natural habitat with potential to support SCC.	• Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g., ploughing) and good rehabilitation potential. • Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches.	• Habitat that can recover relatively quickly (5–10 years) to restore > 75% of the original species composition and receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.	(BI = Medium)

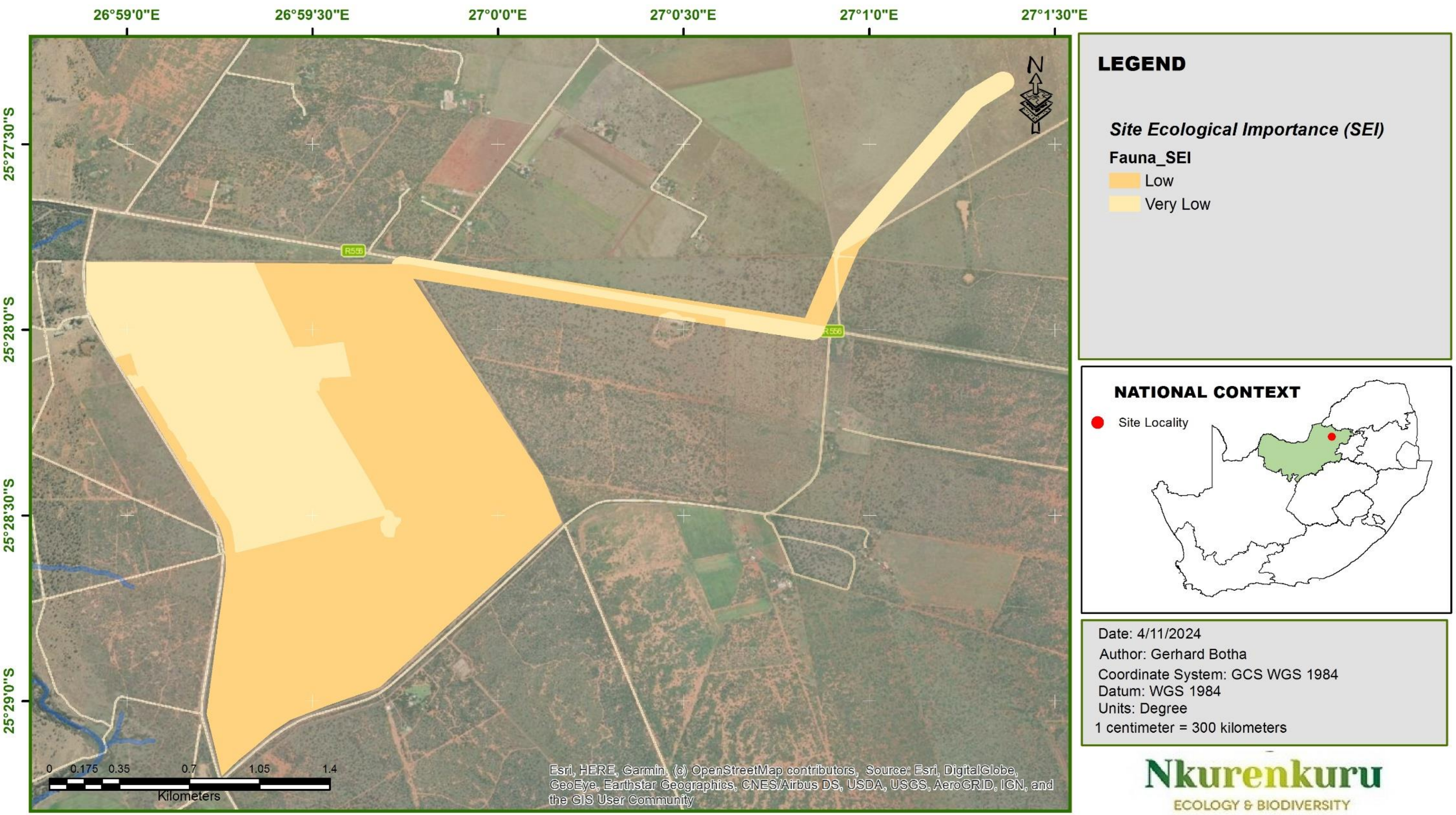

Figure 41: Faunal Site (Habitat) Ecological Importance (SEI) for the proposed development site and surrounds (see Table 24 for more details).

8. COMBINED SITE ECOLOGICAL IMPORTANCE AND SENSITIVITY (FLORA, FAUNA AND TERRESTRIAL BIODIVERSITY THEMES)

The map below (Figure 42) illustrate the sensitivities identified within the faunal, floral, and terrestrial biodiversity assessments.

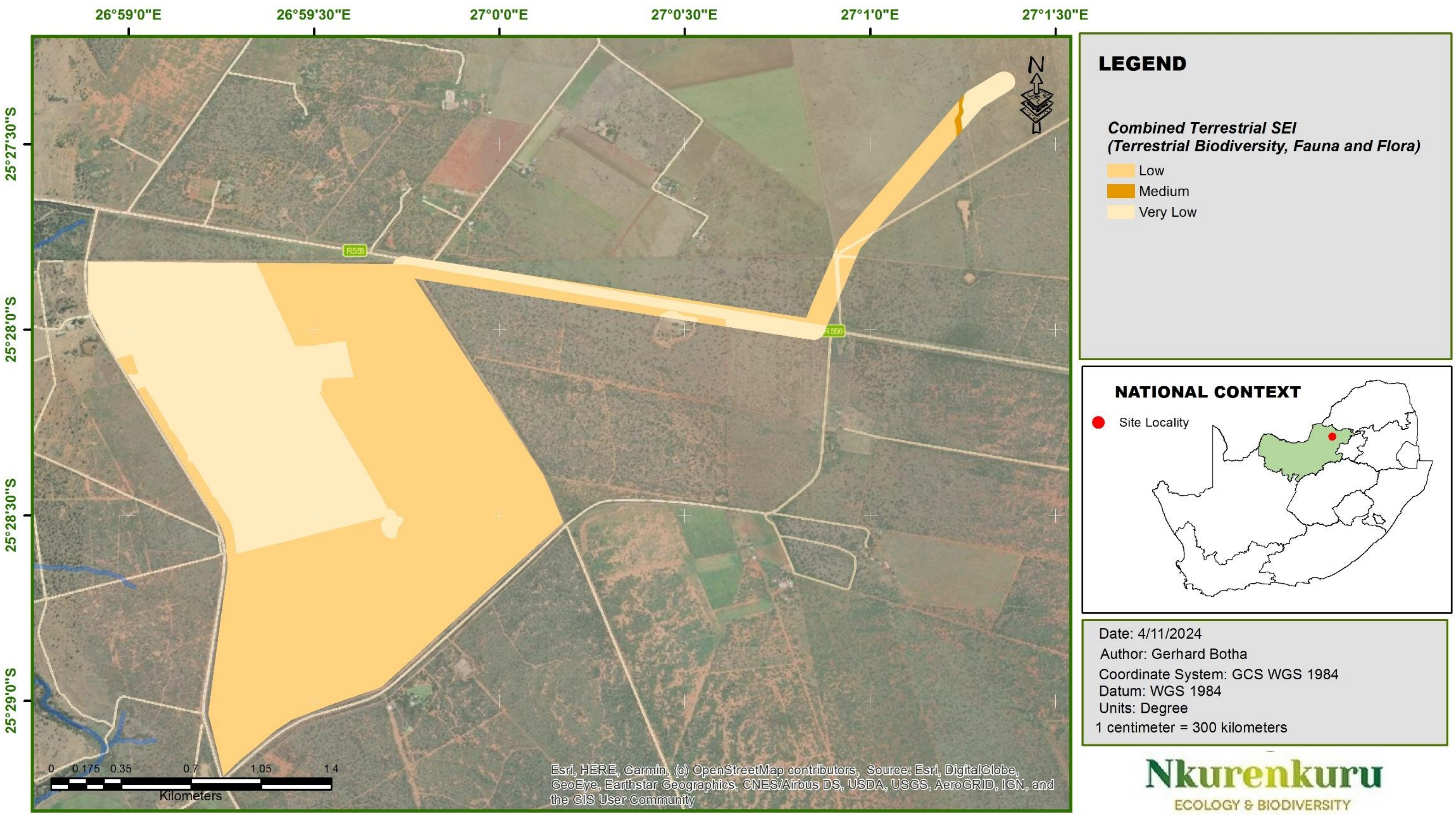

Figure 42: Mapping indicating the combined (Terrestrial Biodiversity, Fauna and Flora) ecological importance and sensitivity for the study area.

9. ASSESSMENT OF PROPOSED IMPACTS

9.1. Assumptions

The following is assumed and/or known:

» A thorough ecological walkthrough of all footprint areas will be conducted to detect and map all protected species. These results should then be used during the permit application process for the removal/relocation, destruction, and disturbance of these protected species.

  - Such an investigation should be carried out by a suitably qualified botanist prior to commencement of construction, and
  - must be carried out at a time when the maximum number of species is actively growing and thus visible (preferably between November and February)

» Prior to development, and after construction, the development footprint will be routinely cleared of all alien invasive plants if detected.

» The construction phase itself will be associated with clearing of vegetation within the development footprint only.

» Where practically possible, the need for grading is expected to be minimal, limited mostly to contour buffer strips and/or small-scale levelling where necessary.

» All removal of vegetation for construction purposes will be done mechanically, without the use of herbicides for indigenous species and in the case of Invasive Alien Species only where deemed absolutely necessary and with the authorisation of the EO.

» A continuous vegetation layer is the most important aspect of ecosystem functionality within and beyond the project site.

  - A weakened or absent vegetation layer not only exposes the soil surface, but also lacks the binding and absorption capacity that creates the buffering functionality of vegetation to prevent or lessen erosion as a result of floods.

» All existing access and service roads will be used as far as possible.

9.2. Fixed and Tracking PV Panels

Impacts on the environment will be influenced by the types of PV panel arrays to be used. The most important differences that are envisaged to influence the impact on the ecological environment (Tsoutsos et al. 2005, Turney and Fthenakis 2011) can be summarised as follows:

Types of PV panel array	Fixed panel	Tracking panel
Size of land needed	smaller	larger
Shading and associated change of vegetation	More continuous and intense shading. Less stable and dense vegetation expected, reduced buffering capacity of extreme weather events by vegetation expected.	More variable and less intense overall shading. More stable and denser vegetation cover expected, smaller reduction of buffering capacity of extreme weather events expected.
Effect on runoff and accelerated erosion	Larger continuous panel area, more concentrated runoff, constant runoff edges potentially create more erosion, especially where vegetation is weakened.	Smaller continuous panel areas, runoff more dissipated, moderate variation of runoff edges that are expected to create less erosion where vegetation is weakened.
Mounting height	PV panels may be as low as 50 cm above ground to allow for higher panels, increasing the limits of permissible vegetation due to maintenance and fire risks.	Expected to be more than 1 m off the ground, increasing the possibility of low vegetation establishment and small fauna movement without compromising safety.

9.3. Localised vs. cumulative impacts: some explanatory notes.

Ecosystems consist of a mosaic of many different patches. The size of natural patches affects the number, type, and abundance of species they contain. At the periphery of patches, influences of neighbouring patches become apparent, known as the 'edge effect'. Patch edges may be subjected to increased levels of heat, dust, desiccation, disturbance, invasion of exotic species, and other factors. Edges seldom contain rare species, habitat specialists, or species that require larger tracts of undisturbed core habitat. Fragmentation due to development reduces core habitat and greatly extends edge habitat, which causes a shift in the species composition, which in turn puts great pressure on the dynamics and functionality of ecosystems (Perlman & Milder, 2005).

Cumulative impacts of developments on population viability of species can be reduced significantly if new developments are kept as close as possible to existing developed and/or transformed areas or, where such is not possible, different sections of a development be kept as close together as possible. Thus, new power lines should follow routes of existing servitudes if such exist. Renewable energy facilities should be constructed as close as possible to existing infrastructure or substations, and if several developments are planned within proximity, these developments should be situated as close together as possible, not scattered throughout the landscape.

According to the REEA database (May 2023), only one REF apart from the proposed Boshoek Solar 2 and 3 REFs is located within the 30 km cumulative radius. In terms of a 50 km cumulative radius, three additional REFS, apart from the aforementioned REFS will be considered. Existing renewable energy projects that were considered in terms of their potential cumulative terrestrial ecological impacts, that are in an approximate 50 km radius of the Boshoek Solar 1 Energy Facility, are illustrated below in Figure 43.

Subsequently, as mentioned, apart from the other two Boshoek SEF projects (Boshoek Solar PV 2 and 3), only four other REFs are currently included within the REEA database (May 2023), and which are located within the 50 km radius.

The construction and operation of the Boshoek Solar 1 is expected to have a **limited to very limited contribution** to the cumulative impacts of the area and will **not:**

- compromise the ecological functioning of the larger "natural" environment; and
- disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations.

The combined, cumulative footprint of all renewable energy projects (located within the 50 km radius) is estimated at around 4407.6 ha, covering only 0.5 % of the area within the 50 km radius (Figure 43). Of the 4407.6 ha, Boshoek Solar 1 SEF will contribute approximately 7.8 % (343.1 ha). The contribution of the Boshoek Solar 1 SEF, to the loss of natural/near-natural to moderately modified vegetation within the 50 km radius is even smaller as most of the project site is located within already transformed and degraded areas.

In terms of the cumulative impact on the Zeerust Thornveld Vegetation Type, all three Boshoek PV Facilities as well as three other REFs (according to the REEA database) are located within the Zeerust Thornveld Vegetation Type. For an impact on vegetation types and ecosystems one will have to look beyond the 50 km radius, at all of the REFs located completely or partially within this ecosystem/vegetation type. The combined footprint of all the REFs located within the Zeerust Thornveld Vegetation Type will be approximately 4961.2 ha and will impact only 1.2 % of the total extent of the mentioned vegetation type. The contribution of the Boshoek Solar 1 SEF itself will be very small to insignificant and thus the cumulative impact of the REFs on the affected vegetation type will be insignificant and will not impact or threaten the conservation targets as well as Red List status of this vegetation type.

The cumulative loss and transformation of intact habitats pose a significant threat to the status and ecological functioning of provincially identified Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), thereby affecting the biodiversity conservation targets outlined by the North West Province. Within a 50 km radius, five out of seven Renewable Energy Facilities (REFs) are situated within ESA 1 (natural) and/or ESA 2 (unnatural), which aids crucial corridors and nodes for wildlife movement. Among these REFs, only one (Boshoek PV 2 SEF) is located entirely within a CBA2 Corridor Node, while another is partially situated within such a node.

Regarding ecosystem functions and services, particularly landscape connectivity, the three Boshoek PV SEFs are expected to exert a cumulative impact due to their close proximity to one another and their adjacency to identified corridor nodes and linkages (CBAs). Although Boshoek Solar 1 and 3 are positioned within an ecological support area that connects three Corridor Nodes and a Critical Corridor Linkage, their current contribution to landscape connectivity is minimal. This is primarily due to extensive habitat transformation and degradation on these properties, both of which are extensively used for intensive game breeding activities. These properties are divided into small game breeding camps enclosed by highly secure, electrified game fences, which are rigorously monitored, severely constraining natural movement across the area.

Furthermore, the surrounding areas of these properties are characterised by a prominent trafficked road network, further impeding connectivity within the region.

Table 25: Renewable energy projects listed within the REEA database, and which are within a 50 km radius of Kingston Solar PV Energy Facility.

Project Name	Distance from study area	Proposed generating capacity	DFFE reference	EIA process	Project status
Renewable energy projects listed within the REEA database					
GI Renewable IPP: Matau PV	~ 35 km	150 MW	14/12/16/3/3/1/498	BAR	In Process
50 MW Photovoltaic Solar Farm on Portion 44 Of Farm Kortfontein No.461	~ 38 km	50 MW	2012/09/12	Scoping & EIA	Approved
RUSTMO3 PV plant, North West Province	~ 50 km	5 MW	2012/07/04	BAR	Approved
Rustmo2 PV Plant, North West Province	~ 50 km	10 MW	2012/01/31	BAR	Approved
Renewable energy projects not listed within the REEA database					
Boshoek PV 2 Solar Energy Facility	~ 1 km	150 MW	To be confirmed	Scoping & EIA	In Process
Boshoek PV 3 Solar Energy Facility	~ 0.6 km	150 MW	To be confirmed	Scoping & EIA	In Process

Conclusion on cumulative impacts within the 50 km radius due to this and the surrounding renewable energy developments:

» These renewable energy facilities (REFs) will impact a very small area within the 50 km radius and will subsequently result in minimal transformation of intact habitats. Subsequently, the cumulative threat posed by these developments on the ecological functioning of these habitats are very small to insignificant, and it is unlikely that these REFS will result in significant habitat fragmentation, disruption of landscape connectivity, and impair the ability of these habitat types to respond to environmental fluctuations.
» The proposed REFs will not threaten the conservation status and targets of set out for national or provincially identified conservation features.

Excessive clearing of vegetation can, and will, influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of plains, and this could also have detrimental effects on downslope areas.

- » Rehabilitation and revegetation of all surfaces disturbed or altered during construction is desirable.
- » Runoff from sealed surfaces, or surfaces that need to be kept clear of vegetation to facilitate operation of a development, must be monitored regularly to ensure that erosion control and stormwater management measures are adequate to prevent the degradation of the surrounding environment.

Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent agricultural land and rangelands.

- » A regular monitoring and eradication protocol must be part of all the developments' long-term management plans.

Excessive clearing of vegetation can and will influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of plains and intermittent drainage lines, and this could also have detrimental effects on the lower-lying areas.

- o Rehabilitation and revegetation of all surfaces disturbed or altered during the operational phase are desirable.

Disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent rangelands.

- » A regular monitoring and eradication protocol must be part of all the developments' long-term management plans.

After decommissioning, a continuous vegetation layer will be the most important aspect of ecosystem functionality within and beyond the project site.

- o A weakened or absent vegetation layer not only exposes the soil surface; but, lacks the binding and absorption capacity that creates the buffering functionality of vegetation to prevent or lessen erosion as a result of floods.

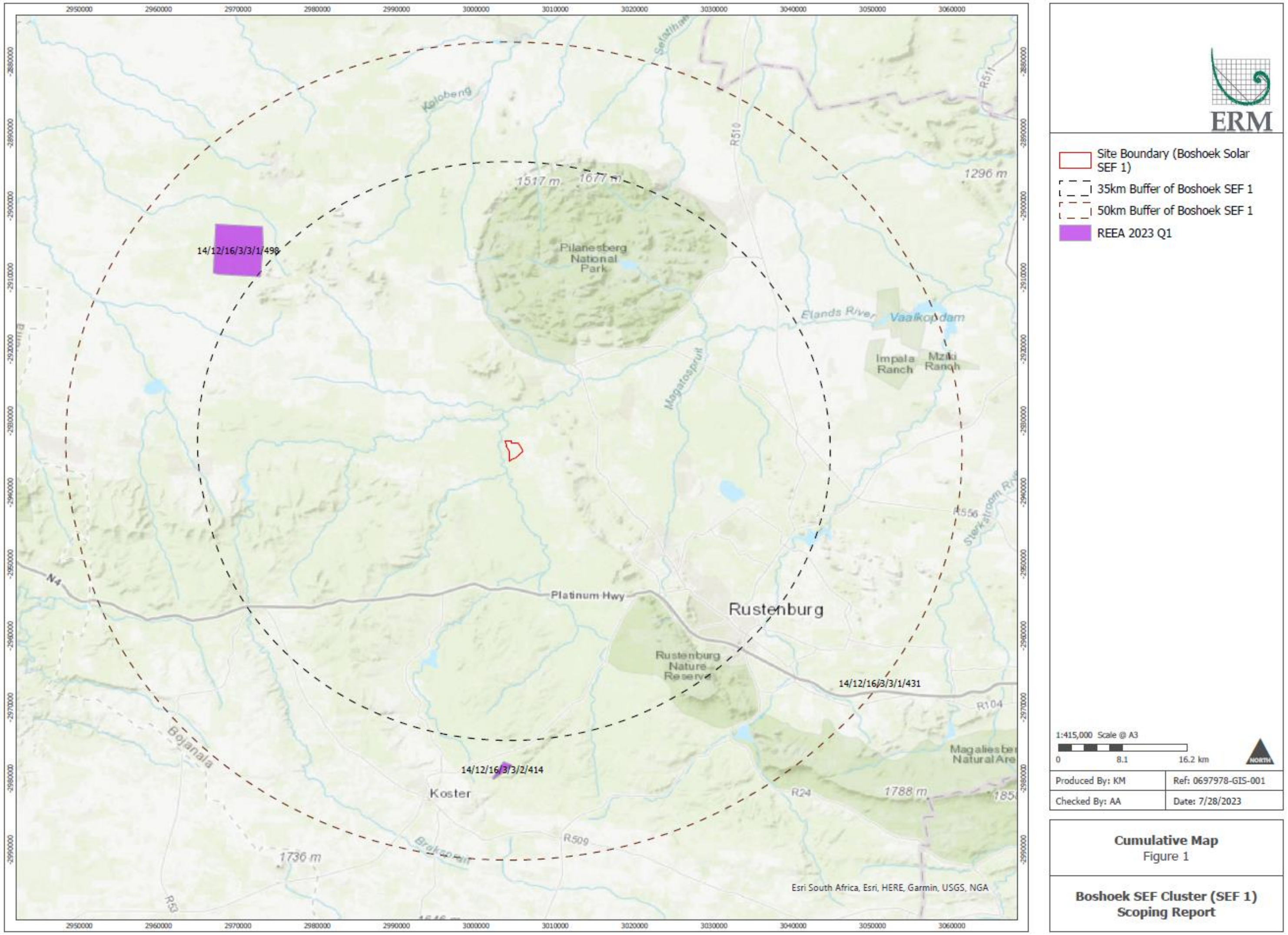

Figure 43: Location Map of the proposed Boshoek Solar 1 Solar Facility relative to the other renewable facilities planned within a 30 km radius (Map provided by ERM).

9.4. Identification of Potential Terrestrial Ecological Impacts and Associated Activities.

Potential ecological impacts resulting from the proposed development would stem from a variety of different activities and risk factors associated with the construction and operation phases of the project, and include the following:

Construction Phase

SEFs require an initial high intensity disturbance of a large surface area including the clearance of the vegetation cover and the levelling of earth on different terraces where necessary and the compaction of local soil within the development footprint. Concrete foundations for the framework on which the PV panels will be mounted. Soil disturbance, vegetation clearance and hardened surfaces will also be associated with the construction of access and internal roads within the PV solar facility. The internal substation would also need to be constructed within the site. Temporary laydown and storage areas would need to be placed within the site for the construction works.

- Human presence and uncontrolled access to the site may result in negative impacts on fauna and flora through poaching of fauna and uncontrolled collection of plants for traditional medicine or other purpose.
- Site clearing and exploration activities for site establishment.
- Vegetation clearing could impact listed plant species and the potential habitat. Vegetation clearing would also lead to the loss of vegetation communities and habitats for fauna and avifauna and potentially the loss of faunal as well as avifaunal species, habitats, and ecosystems. On a larger and cumulative scale (if numerous and uncontrolled developments are allowed to occur in the future) the loss of these vegetation communities and habitats may potentially lead to a change in the conservation status of the affected vegetation type, as well as the ability of this vegetation type and associated features to fulfil its ecological responsibilities (functions). The above impact is most likely to be low due to the fact that most of the development area is situated within an area which has been somewhat degraded due to long term overgrazing.
- Soil compaction and increased erosion risk would occur due to the loss of plant cover and soil disturbance created during the construction phase. This may potentially impact the downstream watercourses, wetlands, and aquatic habitats, mainly due to an increase of surface water and silt inflow from the surrounding disturbed areas (these potential impacts on downslope wetland features have been assessed within the freshwater resource study and assessment). These potential impacts may result in a reduction in the buffering capacities of the landscape during extreme weather events.

- Movement of construction vehicles and placement of infrastructure within the boundary of the drainage line may lead to the disturbance of these habitats, removal of vegetation cover and a potential increase in erosion, which may eventually spread into downstream areas.
- Invasion by alien plants may be attributed to excessive disturbance to vegetation, creating a window of opportunity for the establishment of these alien invasive species. In addition, regenerative material of alien invasive species may be introduced to the study area by machinery traversing through areas with such plants or materials that may contain regenerative materials of such species.
- Presence and operation of construction machinery in the study area. This will create a physical impact as well as generate noise, potential pollution, and other forms of disturbance in the study area.
- Increased human presence can lead to poaching, illegal plant harvesting, and other forms of disturbance such as fire.

Operation Phase

During the operation phase the facilities will operate continuously, mostly unattended and with low maintenance required for the duration of the SEFs lives (±20 years). The SEFs is likely to be monitored and controlled remotely, with maintenance only taking place when required.

The PV panels as well as the hard surfaces created by the development may lead to increased runoff (reduction in infiltration) and the potential interception and channelling of surface runoff, particular on surfaces with a steeper gradient. This may potentially lead to:

- A modification to the surface runoff and infiltration patterns;
- Increased erosion; and
- Sedimentation of the downslope areas.

Subsequently, a localised long-term impact (more than 20 years) of moderate to low intensity could be expected that would have a very low overall significance post-mitigation in terms of its impact on the identified freshwater resource features in the area.

Decommission Phase

- During decommissioning, the potential impacts will be very similar to that of the Construction Phase, although with slightly lower significance.

Cumulative Impacts

- The loss of vegetation types on a cumulative basis from the broad area may impact the countries' ability to meet its conservation targets.
- Transformation of intact, sensitive habitats could compromise the ecological functioning of these habitats and may contribute to the fragmentation of the landscape, and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations.
- The loss of biodiversity may be exacerbated.
- Invasion of exotics and invasive species into the broader area may also potentially be exacerbated.
- The loss of and transformation of the CBAs and ESAs could impact the Province's ability to meet its conservation targets (Not applicable to this SEF, as it is located outside any CBAs and ESAs).

The impacts identified above are assessed below during the construction, operation, and decommissioning phases of the facility, as well as before and after mitigation.

The majority of impacts associated with the development would occur during the construction phase as a result of the disturbance associated with the operation of heavy machinery in the study area and the presence of construction personnel. The major risk factors and contributing activities associated with the development are identified and briefly outlined and summarised below before the impacts are assessed. These are not necessarily a reflection of the impacts that would occur, but rather a discussion on overall potential impacts and/or extent of these potential impacts that would occur if mitigation measures were not considered and/ or sensitive areas not avoided. The assessment of these impacts is outlined in the following section.

Impact 1. Potential impacts on vegetation and listed or protected plant species

As already mentioned, the most likely and significant impact will be on the vegetation located within the development area and development footprint. The proposed development will lead to a direct loss of vegetation. Some loss of vegetation is an inevitable consequence of the development.

<u>At Vegetation Level</u>:

Consequences of the impact occurring may include:

- general loss of habitat for sensitive species;
- loss in variation within sensitive habitats due to loss of portions of it;
- general reduction in biodiversity;
- increased fragmentation (depending on location of impact);
- disturbance to processes maintaining biodiversity and ecosystem goods and services; and
- loss of ecosystem goods and services.

Although the development will impact the described least concern vegetation type, at a relative local scale, it is highly unlikely that this development will impact on the status of this vegetation type (impact on a regional scale) due to the fact that only 4% of the project site resembles near natural Zeerust Thornveld whilst 60% of the project site have been subjected to moderate levels of modifications, most notable bush clearance and overgrazing. A total of 31% of the project site have been subjected to significant levels of modifications and include extensive bush clearance and the planting of palatable grazing grass species (pastures). As for the grid line, due to its linear and small impact nature, the grid line, with applicable mitigation measures in place, will not have a significant impact on the conservation status of this vegetation type.

At species level:

No plant SCC were observed within the study area; however, the following two protected species were observed within the area;

- *Boscia albitrunca* (Nationally Protected Tree)
- *Spirostachys africana* (Provincial Schedule 2)

SoCC are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

Due to the fact that no such plant SoCC were recorded within the study area, any impacts on such species/populations will be avoided.

The protected species recorded within the study area are fairly abundant within the region, and some loss of these species are regarded as acceptable, and will not threaten important populations of these species. Furthermore, the nature and extent of impacts on these species can be evaluated, and the impacts can be mitigated to an extent through avoidance of identified sensitive areas, and the search-and-rescue of some of these protected species, that have the potential to establish successfully after relocation.

Impact 2. Direct Faunal impacts

Faunal species will primarily be affected by the overall loss of habitat. Increased levels of noise, disturbance, potential pollution, and human presence will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species and species confined and dependent on specified habitats would not be able to avoid the construction activities and might be at risk. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. This impact is highly likely to occur during the construction phase and could also potentially occur with resident fauna within the facility after construction.

Threatened species (red data species) include those listed as Critically Endangered, Endangered, or Vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a population or individuals could lead to a direct change in the conservation status of the species and possible extinction. This may arise if the proposed infrastructure is located where it will impact on such individual or populations. Consequences may include:

» fragmentation of populations of affected species;
» reduction in the area of occupancy of affected species; and
» loss of genetic variation within the affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species' overall survival.

As already mentioned, faunal diversity within the study area, and also within the surrounding environment, are very low to low. Larger mammals are livestock (cattle) and/or game species (hunting and intensive breeding programmes). "Natural" fauna that have historically occurred in area have been significantly affected by the anthropogenic impacts and most species now found within the area are highly adaptable, tolerant species with some being capable and small enough to move between the fenced grazing camps. Within the affected farm property very low faunal activity was observed. Species frequently observed within the affected farm properties include:

- Small and medium sized mammals such as: Steenbok (*Raphicerus campestris*), and Slender Mongoose (*Cynictis penicillata*).

No SoCC or highly range restricted animal species were observed within the project site.

There are however some suitable, albeit limited and highly fractured habitat (near natural habitat) for the following Animal SoCC (High to Very High Likelihood of Occurrence (LoO):

» South African Hedgehog - *Atelerix frontalis* (Near Threatened);

Ground truthing furthermore did, however, confirm the occurrence of one (1) natural occurring provincially protected animal species, namely;

- Schedule 4 of the Transvaal Nature Conservation Ordinance (No. 12 of 1983)
    - o Steenbok *(Raphicerus campestris)*

During the construction phase noise generated may cause some temporary disturbances although it is expected that this will not deter these species.

Disturbance of faunal species can be maintained to a minimum and low significance by implementing effective mitigation measures. Livestock will most likely be relocated to other camps with some smaller species such as for example, sheep, goat and smaller antelope species (Steenbok and Duiker) can potentially be allowed to roam and graze the development footprint. Most of the natural occurring species are mobile and will most likely move away from the development area during construction phase with some species likely to return during the operation phase. Less mobile species such as tortoises, snakes and potential amphibian species should be looked out for and where encountered should either be relocated as recommended by the ECO or be left undisturbed if the development will not affect the species (e.g. toads and frogs of nearby wetland habitats).

As already mentioned, the most likely and significant impact will be on the vegetation and as a result a local loss of habitat, within the development area and development footprint of the proposed facility for most of the faunal species.

Impact 3. Soil erosion and associated degradation of ecosystems

This impact, along with the loss of vegetation, is probably the most significant impact that may occur due to the proposed development. Soil erosion is a frequent risk associated with SEFs on account of the vegetation clearing and disturbance associated with the construction phase of the development and will continue occurring throughout the operation phase. Service roads and installed infrastructure will generate increased direct runoff during intense rainfall events and may exacerbate the loss of topsoil and the effects of erosion. These eroded materials may enter nearby watercourses and may potentially impact these systems through siltation and changes in water chemistry and turbidity. Current erosion patterns observed within the affected farm properties were moderate.

With effective mitigation measures in place, including regular monitoring of the occurrence, spread and potential cumulative effects of erosion, may be limited to an absolute minimum.

Impact 4. Alien Plant Invasions

Major factors contributing to invasion by alien invader plants include habitat disturbance and associated destruction of indigenous vegetation. Consequences of this may include:

- change in the vegetation structure leading to change in various habitat characteristics and loss of indigenous vegetation;
- replacement of palatable species with unpalatable species therefore reducing the grazing capacity of the area;
- change in the plant species composition;
- change in soil chemistry properties;
- loss of sensitive habitats (e.g. downstream watercourses and wetlands);

- loss or disturbance to individuals of rare, endangered, endemic, and/or protected species;
- fragmentation of sensitive habitats;
- change in vegetation flammability, depending on alien species; and
- impairment of wetland function.

The affected farm properties mostly contain moderate levels of IAPs. These IAPs may be a threat during the construction phase and throughout the operation phase, and will require regular and careful monitoring. With effective and meticulous mitigation measures in place this can be achieved.

During the survey a total of 20 alien plant species were found within the proposed development site, of which 7 are NEM:BA A&IS Regulations listed invasive species, namely:

- *Cereus jamacaru* (Queen of the night; Category 1b)
- *Datura ferox* (Large thorn apple; Category 1b)
- *Flaveria bidentis* (Smelter's-bush; Category 1b)
- *Malvastrum coromandelianum* (Prickly malvastrum; Category 1b)
- *Opuntia ficus-indica* (Mission prickly pear, Sweet prickly pear; Category Multi)
- *Solanum elaeagnifolium* (Silver-leaf bitter apple; Category 1b)
- *Solanum sisymbriifolium* (Wild tomato, Dense- thorned bitter apple; Category 1b)

Impact 5. Impacts on broad-scale ecological processes

Ecological processes generally occupy larger areas than biodiversity pattern features. They are also more difficult to measure and map. For current purposes, inferred ecological processes are associated with whole habitats, specific habitat patches, or any other part of the landscape that can be spatially defined and mapped.

Important ecological processes operating at the site include:

- Climate-change refuge habitats: These are areas or habitats that have moderated microclimates relative to the broader landscape and allow species to persist in a landscape that has an otherwise incompatible climate. At the site no such important habitats have been identified.

- Climate resilience and the provision of ecological infrastructure and services: Natural grasslands and savannas are regarded as remarkable and irreplaceable biodiversity assets of global significance. In South Africa, grassland and savanna ecosystems provide the natural resources and ecological infrastructure that supports most of South Africa's important economic activities, and millions of rural livelihoods. Ecological infrastructure is the stock of functioning ecosystems that provides a flow of essential system services to human communities — services such as the provision of fresh water, climate regulation, and soil formation. Ecological infrastructure includes features such as healthy mountain catchments, rivers, wetlands, and nodes and corridors of natural habitat which together form a network of interconnected structural elements within the landscape. If this ecological infrastructure is degraded or lost, the flow of ecosystem services will diminish and ecosystems will become vulnerable to shocks and disturbances, such as the impacts of climate change, unsustainable land use change, and natural disasters like floods and droughts. It is important to note that when ecological infrastructure is degraded or fails, the direct monetary cost to society and government is often very high. Ecological infrastructure is, therefore, the nature-based equivalent of hard infrastructure, and is just as important for providing the vital services that underpin social development and economic activity.

Grassland and savanna ecosystems provide many essential ecosystem services, underpinned by rich biodiversity and diverse ecosystem processes. Important local and large-scale ecosystem services provided by grasslands and savannas include:

- Water production, water purification, and flood attenuation.
- Good quality forage for animal production.
- Nutrient-cycling and carbon sequestration and storage.
- Pollination services.
- Support for livelihoods such as thatching and weaving.
- Medicinal and food plants.
- Cultural, heritage, and recreational amenities, often with significant tourism value.
- Deep, nutrient-rich soils.

» Island biogeography. In nature, size matters and larger patches of habitat support more species and are more resilient to ecological perturbation. Within the regions large tracts of natural vegetation have been transformed through cultivation, plantation forestry, mining, and urban settlement and have contributed to landscape fracturing. Within the study area and surrounding area, especially cultivation practices, and to some extent habitat degradation due to overgrazing, have resulted in the cumulative transformation of large tracts of natural habitat. Natural habitats currently have a somewhat patchy distribution within the landscape. Landscape connectivity within the larger area is, however, still regarded as fairly good with fairly large continuous savanna tracts still present. The project site itself is, however, isolated, fractured from these natural, connected areas and as such provide minimal contribution to habitat connectivity.

» Species movement. As previously mentioned, large tracts of land have been transformed, with minimal intact natural vegetation still present, existing as isolated patches and subsequently landscape connectivity are regarded as low, severely impacting species movement. Thus, it appears that this area does not form part of an important biodiversity corridor or habitat linkage. The proposed development will not impact or reduce the ability of important biodiversity corridors, linkages and nodes to provide sufficient landscape connectivity within the region, and in turn facilitate species movement.

The contribution of this development to the impacts on the above described broad-scale ecological processes is regarded as very small, due to:

» the relatively small development footprint, most of the project site located within already transformed and degraded areas, the proximity to agricultural areas, subsequently clustering/restricting developments to already impacted areas and in doing so avoiding development within large natural areas.

9.5. Assessment of Impacts

CONSTRUCTION PHASE

Impact 1: Potential impacts on plant biodiversity and habitats

Vegetation clearing for site preparation will impact local vegetation habitats

Impacts on vegetation and protected plant species would occur due to the construction of the facility and associated infrastructure. This impact is regarded as the most likely and significant impact and will lead to direct loss of vegetation, including protected species.

The most likely consequences include:

» local loss of habitat (to an extent as a natural ground covering will be maintained where possible);
» very small and local disturbance to processes maintaining local biodiversity and ecosystem goods and services; and
» a potential loss of a few local protected species.

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Medium	Low	High	Negative	High	Medium	High
With Mitigation	Medium	Low	Medium	Negative	Medium	Medium	High
Can the impact be reversed?			Partially Reversible. Through a rehabilitation and revegetation program which will be implemented during the decommissioning phase.				
Will impact cause irreplaceable loss or resources?			Only marginal loss of resources.				
Can impact be avoided, managed or mitigated?			The impact cannot be avoided, however the impact can be managed and mitigated (see mitigation measures below).				

Mitigation measures to reduce residual risk or enhance opportunities:

» Preconstruction walk-through of the final development footprint for protected species and species of conservation concern that would be affected.
» Before construction commences individuals of listed species within the development footprint that would be affected, should be counted and marked by the ecologist conducting the pre-construction walk-through survey. Permits from the relevant provincial authorities, will be required to relocate and/or disturb listed plant species.

» Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, remaining within demarcated construction areas etc.
» Demarcate all areas to be cleared with construction tape or similar material where practical. However, caution should be exercised to avoid using material that might entangle fauna.
» ECO and/or Contractor's EO to provide supervision and oversight of vegetation clearing activities and other activities which may cause damage to the environment, especially at the initiation of the project, when the majority of vegetation clearing is taking place.
» Ensure that laydown areas, construction camps and other temporary use areas are located in areas of low sensitivity and are properly fenced or demarcated as appropriate and practically possible.
» All vehicles to remain on demarcated roads and no unnecessary driving in the veld outside these areas should be allowed.
» Regular dust suppression during construction, if deemed necessary, especially along access roads.
» No plants may be translocated or otherwise uprooted or disturbed for rehabilitation or other purpose without express permission from the ECO and or Contractor's EO in consultation with the Botanical Specialist.
» No fires should be allowed on-site.

Residual impact	Vegetation loss within areas where hard engineering surfaces will be constructed will take a very long time, post-decommissioning to restore and as such is regarded as a residual impact.

CONSTRUCTION PHASE

Impact 2: Impact on Faunal Diversity.

Increased levels of noise, pollution, disturbance, and human presence during construction will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction.

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Low	Low	Medium	Negative	High	Medium	High
With Mitigation	Low	Low	Medium	Negative	Medium	Medium	High

Can the impact be reversed?	Partially Reversible. Only a few highly adaptable and opportunistic faunal species may return following the construction phase. It is however unlikely that these animals will permanently reside within the project site, but may potentially move through the area to forage areas. However, the rehabilitation of a stable vegetation cover after the decommissioning of the facility may allow some animals to return to the area, with the area providing suitable habitat for some species.
Will impact cause irreplaceable loss or resources?	Only marginal loss of resources. Faunal diversity was very low and most species will merely move away during the construction phase.
Can impact be avoided, managed or mitigated?	The impact cannot be avoided, however the impact can be managed and mitigated (see mitigation measures below).

Mitigation measures to reduce residual risk or enhance opportunities:
» Site access should be controlled and no unauthorised persons should be allowed onto the site.
» Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person.
» The collection, hunting, or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site.
» Fires should not be allowed on site.

- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel, and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All construction vehicles should adhere to a low speed limit (30 km/h) to avoid collisions with susceptible species such as snakes and tortoises.
- Construction vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).

Residual impact	The altered development area will contain a lower diversity of habitat types and niches for faunal species, however faunal diversity was in any way confirmed to be limited and as such this potential residual impact can be **regarded as low**.

CONSTRUCTION PHASE

Impact 3: Potential impacts on Animal Species of Conservation Concern (SoCC)

The foremost concern revolves around habitat destruction, as this development will likely lead to the loss of habitats utilized these potential animal SoCC for foraging and movement. These species may traverse this area in search of food, making the disruption of their migratory paths and foraging grounds a potential pressing issue.

Moreover, the displacement of these species due to the solar development can disrupt their natural behaviours, potentially leading to increased stress, reduced breeding success, and a heightened risk of predation or competition. This displacement also threatens their food sources, which may result in population declines and a loss of biodiversity in the region.

Another distressing implication is the heightened risk of illegal poaching that could accompany such a development. The disturbance caused by construction and human presence in these areas may attract poachers, targeting these vulnerable and valuable species for trade, further endangering their populations.

During the survey no animal SoCC was recorded within the project site and even though there are some suitable habitat within the Project Site the potential for such animal SoCC to inhabit the area is regarded as low

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	High	Low	High	Negative	Low	Medium	High
With Mitigation	High	Low	Medium	Negative	Low	Low	High

Can the impact be reversed?	Partially Reversible. Most species including SoCC will move away during the construction phase. It is unlikely that these animals will return to the project site during the operational phase, but may potentially move through the area to forage areas. The rehabilitation of a stable vegetation cover after the decommissioning of the facility may some suitable habitat for animal SoCC
Will impact cause irreplaceable loss or resources?	Only marginal loss of resources. No Faunal SoCC was observed within the project site and the project site provide minimal suitable habitat for Faunal SoCC.
Can impact be avoided, managed or mitigated?	The impact can be avoided.

Mitigation measures to reduce residual risk or enhance opportunities:

- Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness regarding potential animal SoCC, and the appropriate procedures to be followed if such a species has been observed during the construction phase.
- Should any faunal SoCC be encountered, construction should be halted, the EO must be notified, and authorisation to relocate such species
- must be obtained from DFFE and/or LEDET.

- No staff member may attempt to handle these species.
- Strict control must be maintained over all activities during construction, in line with an approved construction EMPr.
- Contractors and working staff should stay within the development area and movement outside these areas must be restricted.
- No development should occur beyond the proposed footprint.
- No hunting/trapping or collecting of faunal species is allowed.
- No informal fires by construction personnel are allowed.
- Faunal habitat beyond the demarcated area should not be altered.
- Driving must take place on existing and new access roads and a speed limit of 30km/h must be implemented on all roads traversing the project site during the construction phase.
- Passage ways, of the appropriate size, should be created along the boundary fence of the PV facility, to allow the potential "target" animals to safely move through the PV facility.
- The use of electrical fencing is strongly discouraged.
- If electrical fencing is going to be used, no electrical wires may be placed within a minimum of 1 m from the ground level.

Residual impact	Due to the nature of this development, there will be a permanent loss of habitat and forage for potential fauna SoCC. However, due to the fact that only a small area of potential suitable habitat was found within the footprint and no fauna SoCC was observed during the surveys, this potential residual impact can be **regarded as very low**.

CONSTRUCTION AND OPERATIONAL PHASE

Impact 4: Soil erosion and associated degradation of ecosystems.

During and following construction, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion. Erosion is one of the greater risk factors associated with the development and it is therefore critically important that proper erosion control structures are built and maintained over the lifespan of the project.

Severe cases of erosion may potentially threaten the integrity of local and adjacent ecosystems and impact service provision such as grazing and clean water.

	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Medium	Medium	High	Negative	Medium	High	High
With Mitigation	Low	Low	Low	Negative	Medium	Medium	High

Can the impact be reversed?	Yes. By implementing robust erosion monitoring and management measures, along with diligent execution of the plan, swift identification of erosion features can occur, enabling effective remediation of affected areas and reversal of associated impacts.
Will impact cause irreplaceable loss or resources?	Effective implementation of erosion control, monitoring, and management measures can successfully prevent the irreparable loss of resources caused by erosion.
Can impact be avoided, managed or mitigated?	Impact can be largely avoided and where they occur can be successfully managed/mitigated.

Mitigation measures to reduce residual risk or enhance opportunities:

- Any erosion problems observed along access roads or any hardened/engineered surface should be rectified immediately and monitored thereafter to ensure that they do not re-occur.
- All bare areas (excluding agricultural land and the development footprint), affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable.
- Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible.
- Site rehabilitation should aim to restore surface drainage patterns as far as is feasible.

- » An erosion control management plan should be utilised to prevent erosion
- » Roads and other disturbed areas should be regularly monitored for erosion problems, and problem areas should receive follow-up monitoring by the EO to assess the success of the remediation.
- » Topsoil must be removed and stored separately from subsoil. Topsoil must be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.
- » Erosion control measures such as silt fences (for areas of works) and gravel strips may be considered at the impact zone where water falls from the solar panels onto the soil surface (due to deterioration in natural grassland because of poor maintenance or lack of solar radiation).
- » Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities
- » Stormwater from hardstand areas, buildings and the substation must be managed using appropriate channels and swales when located within steep areas.
- » Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the Solar PV site.

Residual impact	The loss of fertile soil and soil capping resulting in areas which cannot fully rehabilitate itself with a good vegetation cover. With appropriate avoidance and mitigation residual impacts will be **very low**.

OPERATIONAL PHASE

Impact 5: Alien Plant Invasion

Increased alien plant invasion is one of the greatest risk factors associated with this development following the construction phase. The disturbed and bare ground that is likely to be present at the site during and after construction would leave the site vulnerable to alien plant invasion for some time if not managed. Furthermore, the National Environmental Management Biodiversity Act (Act No. 10 of 2004), as well as the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.

Severe cases of Alien Plant Invasion may potentially threaten the integrity of local and adjacent ecosystems and impact service provision such as forage.

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Medium	Medium	High	Negative	Medium	High	High
With Mitigation	Low	Low	Low	Negative	Medium	Medium	High

Can the impact be reversed?	Yes. By implementing robust Alien Invasive Plant (AIP) monitoring and management measures, along with diligent execution of the plan, swift identification of areas that contain signs of alien plant invasion, enabling effective remediation of affected areas and reversal of associated impacts.
Will impact cause irreplaceable loss or resources?	Effective implementation of AIP control, monitoring, and management measures can successfully prevent the irreparable loss of resources caused by Alien Plant Invasion.
Can impact be avoided, managed or mitigated?	Impact can be largely avoided and where they occur can be successfully managed/mitigated.

Mitigation measures to reduce residual risk or enhance opportunities:

- » The successful reduction in the threat (significance) posed by Alien Invasive Plants relies on a detailed;
  - o Site-specific eradication and management programme for alien invasive plants;
  - o Site-specific Vegetation Rehabilitation Management Plan; and
  - o The meticulous implementation of this Management Plan.
- » Such an Alien Invasive and Vegetation Rehabilitation Management Plan must subsequently be included in the Environmental Management Programme (EMPr).
- » Regular monitoring by the operation and maintenance team for alien plants must occur and could be conducted simultaneously with erosion monitoring.

- When alien plants are detected, these must be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels.
- Clearing methods must aim to keep disturbance to a minimum.
- No planting or importing any listed invasive alien plant species (all Category 1a, 1b, 2, and 3 invasive species) to the site for landscaping, rehabilitation or any other purpose must be undertaken.

Residual impact	If the above recommended mitigation measures are strictly implemented, and some re-establishment and rehabilitation of natural vegetation is allowed, the residual impact will be **very low**.

OPERATIONAL PHASE

Impact 6: Direct Faunal Impacts.

Increased levels of noise, pollution, disturbance, and human presence during decommissioning will be detrimental to fauna. Sensitive and shy fauna would move away from the area during this phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction.

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Low	Low	Medium	Negative	Medium	Medium	High
With Mitigation	Low	Low	Low	Negative	Low	Low	High

Can the impact be reversed?	Yes. Only a few highly adaptable and opportunistic faunal species may inhabit the project site during the operational phase. These species will move away during the decommissioning phase with some species returning post-decommissioning phase. However, the rehabilitation of a stable vegetation cover after the decommissioning of the facility may not only allow some of these species that have inhabited the project site during the operational phase to return but may allow faunal species that have inhabited the area post construction phase to return.
Will impact cause irreplaceable loss or resources?	Implementing an effective rehabilitation and re-vegetation plan can prevent any irretrievable loss of resources.
Can impact be avoided, managed or mitigated?	Disturbance of residing faunal species during the decommissioning phase cannot be avoided, however the impact can be managed and mitigated (see mitigation measures below).

Mitigation measures to reduce residual risk or enhance opportunities:

- Site access should be controlled and no unauthorised persons should be allowed onto the site.
- Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site.
- Fires should not be allowed on site.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel, and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All vehicles should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises.
- Vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).

Residual impact	The development site will be rehabilitated and re-vegetated establishing faunal habitat and forage. Thus, there will be **no residual impact**.

OPERATIONAL PHASE

Impact 7: Soil erosion and associated degradation of ecosystems.

During and following decommission, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion. Erosion is one of the greater risk factors associated with the development and it is therefore critically important that proper erosion control structures are built and maintained over the lifespan of the project.

Severe cases of erosion may potentially threaten the integrity of local and adjacent ecosystems and impact service provision such as grazing and clean water.

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Medium	Medium	High	Negative	Medium	High	High
With Mitigation	Low	Low	Low	Negative	Low	Low	High

Can the impact be reversed?	Yes. By implementing a rehabilitation and re-vegetation plan, as well as a robust erosion monitoring and management plan.
Will impact cause irreplaceable loss or resources?	Effective implementation of a rehabilitation and re-seeding plan as well as an erosion control, monitoring, and management plan, irreparable loss of resources caused by erosion can successfully be avoided.
Can impact be avoided, managed or mitigated?	Impact can be largely avoided and where they occur can be successfully managed/mitigated.

Mitigation measures to reduce residual risk or enhance opportunities:

- Any erosion problems observed should be rectified immediately and monitored thereafter to ensure that they do not re-occur.
- There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures.
- All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable.
- Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible.

Residual impact	If the above recommended mitigation measures are strictly implemented, the residual impact will be **very low**.

OPERATIONAL PHASE

Impact 8: Alien Plant Invasion

Increased alien plant invasion is one of the greatest risk factors associated with this development following the decommission phase. The disturbed and bare ground that is likely to be present at the site during and after decommission would leave the site vulnerable to alien plant invasion for some time if not managed. Furthermore, the National Environmental Management Biodiversity Act (Act No. 10 of 2004), as well as the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.

Severe cases of Alien Plant Invasion may potentially threaten the integrity of local and adjacent ecosystems and impact service provision such as forage.

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Medium	Medium	High	Negative	Medium	High	High
With Mitigation	Low	Low	Low	Negative	Low	Low	High

Can the impact be reversed?	Yes. By implementing an effective rehabilitation and re-vegetation plan, as well as a robust erosion monitoring and management plan.
Will impact cause irreplaceable loss or resources?	Effective implementation of a rehabilitation and re-seeding plan as well as a robust Alien Invasive Plant (AIP) monitoring and

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	management plan, irreparable loss of resources caused by Alien Plant Invasion can successfully be avoided.
Can impact be avoided, managed or mitigated?	Impact can be largely avoided and where they occur can be successfully managed/mitigated.

Mitigation measures to reduce residual risk or enhance opportunities:

- The successful reduction in the threat (significance) posed by Alien Invasive Plants relies on a detailed;
  - Site-specific eradication and management programme for alien invasive plants;
  - Site-specific Vegetation Rehabilitation Management Plan; and
  - The meticulous implementation of this Management Plan.
- Such an Alien Invasive and Vegetation Rehabilitation Management Plans must subsequently be included in the Environmental Management Programme (EMPr).
- Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control must be implemented until a cover of indigenous species (ideally climax species) has returned.
- When alien plants are detected, these must be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels.
- Clearing methods must aim to keep disturbance to a minimum.
- No planting or importing of any listed invasive alien plant species (all Category 1a, 1b, 2, and 3 invasive species) to the site for landscaping, rehabilitation or any other purpose must be undertaken.

Residual impact	If the above recommended mitigation measures are strictly implemented, the residual impacts will be **avoided**.

CUMULATIVE IMPACT PHASE

Impact 9: Impact on Critical Biodiversity Areas and broad-scale ecological processes

Transformation of intact habitats could potentially compromise ecological processes, as well as ecological functioning of important habitats, and would contribute to the fragmentation of the landscape and potentially disrupt the connectivity of the landscape for fauna and flora, and impair their ability to respond to environmental fluctuations.

	Severity	Extent	Duration	Status	Probability	Significance	Confidence
Without Mitigation	Low	High	Medium	Negative	Low	Low	High
With Mitigation	Low	High	Medium	Negative	Low	Low	High

Can the impact be reversed?	Moderate reversibility. By implementing an effective rehabilitation and re-vegetation plan during the decommission phase some areas may regain their functions and ecological processes may re-establish within the area, albeit to a sufficient extent
Will impact cause irreplaceable loss or resources?	No irreplaceably loss of resources as this area currently do not significantly contribute to landscape connectivity.
Can impact be avoided, managed or mitigated?	Impact can be largely avoided.

Mitigation measures to reduce residual risk or enhance opportunities:

- The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas.
- An open space management plan should be developed for the site, which should include management of biodiversity within the fenced area, as well as that in the adjacent rangeland.
- Reduce the footprint of the facility within sensitive habitat types as much as possible.
- All disturbed areas that are not used, such as excess road widths, should be rehabilitated with locally occurring plant species after construction to reduce the overall footprint of the development.

Residual impact	If the above recommended mitigation measures are strictly implemented, the residual impacts will be **will be very low,** with most of the areas regaining their functions and ecological processes.

CUMULATIVE IMPACT PHASE							
Impact 10: Impact on Critical Biodiversity Areas and broad-scale ecological processes Transformation of intact habitats could potentially compromise ecological processes, as well as ecological functioning of important habitats, and would contribute to the fragmentation of the landscape and potentially disrupt the connectivity of the landscape for fauna and flora, and impair their ability to respond to environmental fluctuations.							
	Severity	**Extent**	**Duration**	**Status**	**Probability**	**Significance**	**Confidence**
Without Mitigation	Low	High	Medium	Negative	Low	Low	High
With Mitigation	Low	High	Medium	Negative	Low	Low	High
Can the impact be reversed?			Moderate reversibility. By implementing an effective rehabilitation and re-vegetation plan during the decommission phase some areas may regain their functions and ecological processes may re-establish within the area, albeit to a sufficient extent				
Will impact cause irreplaceable loss or resources?			No irreplaceably loss of resources as this area currently do not significantly contribute to landscape connectivity.				
Can impact be avoided, managed or mitigated?			Impact can be largely avoided.				
Mitigation measures to reduce residual risk or enhance opportunities: » The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas. » An open space management plan should be developed for the site, which should include management of biodiversity within the fenced area, as well as that in the adjacent rangeland. » Reduce the footprint of the facility within sensitive habitat types as much as possible. » All disturbed areas that are not used, such as excess road widths, should be rehabilitated with locally occurring plant species after construction to reduce the overall footprint of the development.							
Residual impact	If the above recommended mitigation measures are strictly implemented, the residual impacts will be **will be very low,** with most of the areas regaining their functions and ecological processes.						

10. CONCLUSION

This study aimed to conduct a screening assessment of the projects site to:

- Identify and describe ecological sensitive areas;
- Confirm or dispute the current use of the land and environment sensitivity as identified by the national web-based environmental screening tool;
- Provide motivation and evidence of either the verified or different use of the land and environmental sensitivity;
- Identify sensitive areas to be avoided (including corresponding spatial data);
- Provide recommendations regarding the areas available for the development of the collector substation and powerline;
- Determine and assess impacts associated within the collector substation and powerline development;
- Provide mitigation measures in order to avoid or reduce the impacts to acceptable and manageable levels;
- Compile a detailed terrestrial ecological impact assessment report which adheres to the following:

- The report will be compiled to fulfil the requirement for a Terrestrial Biodiversity Assessment as per the Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of NEMA (GNR 320), as gazetted on 20 March 2020.
- In terms of the Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of sections 24(5)(a) and (h) and 44 of NEMA, gazetted on 30 October 2020, relating to requirements relating specifically to the Terrestrial Plant and Animal (species) themes, this report includes these requirements.

As part of this Assessment detailed field surveys were undertaken over the course of 27th to the 29th of March 2023 (early autumn) and 23rd to 24th of January (summer). During the site visits the vegetation was in optimal survey conditions; and the majority of plants were easily identifiable. The outcome of this report is a terrestrial ecological importance and sensitivity map visually illustrating the findings and results which will then aid in the final planning and design phase of the Boshoek Solar 1 Solar Facility, with the purpose of avoiding any sensitive areas and/or detrimental impacts on the environment.

Habitat sensitivity classification was based on available GIS coverages including various terrestrial ecosystems and biodiversity data, a recent screening survey, and the expert's mapping from Google Earth satellite imagery (altitude 1 to 2 km).

The affected properties are almost entirely used for game ranching with very limited infrastructure, mainly restricted to access roads, bomas, kraals, water and feeding points for game and livestock, and the occasional homestead. Land-use within the surrounding properties are also similarly and predominantly utilized for game ranching.

Livestock farming was historically the main land use practise within the area, with varying stocking rates and grazing regimes implemented. It however appears that the farms were historically fairly small and utilized as grazing for predominantly cattle and occasionally a mixture between cattle and sheep. Stocking rates appears to have varied between moderate to high rates with continuous grazing to rotational grazing systems utilized, with the exclusion of fire (natural or as a management tool). This has likely resulted in the current overgrazed and transformed situation observed on certain properties, with bare, exposed soils locally present and subjected to soil capping and sheet erosion. These historical management practices have also resulted in the encroachment of small to shrubby, thorny bushes, which have been occasionally cleared and thinned out over the last 30 – 50 years (these management practices are present within almost all of the properties). However, since the transition to game breeding, large areas have been subjected to significant modifications, with the areas being cordoned off in small game breeding camps, with large scale bush clearing and in some areas the ripping, tilling and planting of palatable grasses such as Cenchrus ciliaris, *Urochloa mosambicensis, Digitaria argyrograpta* and *Dichanthium annulatum.* These areas should rather be regarded as pastures than natural grazing lands.

Based on the results obtained from the site visit, only 4% of the project site resembles near natural Zeerust Thornveld (vegetation type within which the project site is located) whilst 60% of the project site have been subjected to moderate levels of modifications, most notable bush clearance and overgrazing. A total of 31% of the project site have been subjected to significant levels of modifications and include extensive bush clearance and the planting of palatable grazing grass species (pastures).

According to the National Vegetation Map 2018, Gold Reef Mountain Bushveld (SVcb9) and Zeerust Thornveld (SVcb3) are mapped for the study area (see Figure 13 and section 5.1). Both of these vegetation types are regarded as Least Concern. During the survey it was determined that both of these vegetation types were present on site, as well as smaller scale variations within them, (plant community types). Mapping for this section was therefore carried out on such plant community type level.

According the various national and provincial environmental planning frameworks the following environmental/conservation planning units will be impacted:

» <u>At national level:</u>
  - *NPAES Focus Area:*
    - Small portion of PAOI included as part of a NPAES Focus Area (0.086 ha).

The proposed development won't have any impact on any protected- and/or conservation areas. Subsequently, the development is regarded, in terms of this systematic planning framework, as acceptable.

» <u>At Provincial level:</u>
  - *NWBSP 2015: Critical Biodiversity Areas:*
    - CBA 2: T9 (Biodiversity Node)
      - 4.6 ha (1%) of PAOI
  - *NWBSP 2015: Ecological Support Areas:*
    - ESA 1: T7 (Natural Corridor: Selected Planning Units)
      - 267.3 ha (78%) of PAOI.
    - ESA 2: T7 (Non-Natural Corridor: Selected Planning Units)
      - 70.6 ha of PAOI)
    - ESA 2: T11 (Corridor – Cultivated areas)
      - 7.2 ha of PAOI)

<u>Biological Corridors (Selected planning units and cultivated areas):</u> A very small portion (0.08 ha) of the project site (along the eastern boundary of the project site) falls within this CBA2 Corridor. In terms of this small area being classified as a CBA 2, this is rather due to an error that occurred during the processing of the spatial data used to generate the CBA map. This CBA 2 area is rather associated with the adjacent property to the east but has slightly extended to areas outside of this property and into the effected property. As mentioned above (ESA Corridors), the "naturalness" and connectivity of the affected property, as well as surrounding properties, have been

severely impacted through current and historical land use activities, and current land use activities have resulted in the fragmentation of the landscape, with natural areas being isolated from each other.

A very small portion of the proposed grid connection corridor (4.52 ha) will traverse this biodiversity corridor node.

Taking into account the small extent of this component of the proposed development and the typical nature of such a linear development, as well as the extent of remaining natural and intact biodiversity surrounding the proposed development footprint, the construction and operation of the grid connection infrastructure should not affect the functions and services associated with this biodiversity corridor node (CBA 2), as well as the conservation targets set out for this area..

Important habitats (hills and ridges): The potential of this area to functions as a biological corridor has been severely impacted through agricultural practices. Due to extensive exotic game farming/breeding within the region, natural movement have been significantly impacted, within this corridor, as most of farms in the area (including the affected property) comprise of small game breeding camps cordoned off with high, impenetrable game fences, which also is regularly electrified. These wildlife breeding activities have resulted in significant fracturing of the landscape. Furthermore, historically, large areas have been subjected to extensive tree and shrub removal, ploughing, and subsequent reseeding with pasture grasses, all aimed at enhancing the grazing potential of the area. Follow-up, ripping and reseeding of localised areas within these pastures, occur at irregular intervals.
Subsequently it can be concluded that the proposed development within the affected area will not significantly impact the integrity, functions and services associated with the natural biodiversity corridors within the area..

Overall, no significant terrestrial ecological flaws that could pose a problem to the proposed EGI development were identified during this assessment.

From a botanical and ecological perspective, a total of eight (8) plant community types were identified, namely:

- *Cenchrus ciliaris* Planted Veld: Very Low Sensitivity/Site Ecological Importance
- *Cymbopogon caesius - Heteropogon contortus*: Low Sensitivity/Site Ecological Importance
- *Dichanthium annulatum - Brachiaria brizantha Pasture*: Very Low Sensitivity/Site Ecological Importance
- *Panicum maximum - Urochloa mosambicensis Pasture*: Very Low Sensitivity/Site Ecological Importance
- *Themeda triandra - Ziziphus mucronata*: Medium Sensitivity/Site Ecological Importance

- » *Vachellia tortilis - Heteropogon contortus: A (Eragrostis lehmanniana)*: Low Sensitivity/Site Ecological Importance
- » *Ziziphus mucronata - Cymbopogon caesius: A (Grewia flava)*: Low Sensitivity/Site Ecological Importance
- » *Ziziphus mucronata - Cymbopogon caesius: B (Eragrostis lehmanniana)*: Low Sensitivity/Site Ecological Importance

Development within Very Low and Low sensitivity plant communities is regarded as acceptable. Development in these areas will not threaten their integrity, as well as the services and functions provided by them. Furthermore, impacts on the areas listed as Medium Site Ecological Importance can be mitigated to acceptable levels, or these areas can be avoided since they occupy only a very small area of the proposed development site. No plant SoCC were recorded within the proposed development site.

A total of 178 plant species were found within the proposed development site, which consisted of 158 native, 0 SCC, 3 protected, 20 alien, and 7 NEM:BA listed invasive species. Protected plant species were found in 5 of the plant community types. Care must be taken to avoid any protected plant species, should they be found. It is recommended that a pre-construction walkthrough be undertaken by a qualified botanist prior to commencement of construction. It must be noted that a permit must be obtained from relevant local competent authorities to damage, destroy, or relocate any SCC or protected plant species; any such actions are considered illegal without a permit, in which case such species must be avoided completely.

From a fauna species and habitat perspective, a total of four (4) major faunal habitat types were identified namely:

- Savanna Shrubland occupying deep sandy-loam soils plains (seriously modified): Very Low Sensitivity
- Savanna Grassland occupying sandy-loam plains (critically to seriously modified): Very Low Sensitivity
- Tree Savanna occupying deep to moderately deep sandy-loam plains (mainly moderately modified with some areas being largely modified and small patches still in a near-natural condition): Low Sensitivity
- Pasture or Pure Grassland occupying deep sandy-loam plains soils (completely modified): Very Low Sensitivity

It was found that that the majority of the site can be regarded as of "Low" sensitivity (210.5 ha or 61% of project site) whist the remaining 39% (132.6 ha) are regarded as "Very Low" sensitive (Table 24). None of the areas were scored as "High" or "Very High".

Mammal diversity within the PAOI was considered low. A total of 16 mammal species were observed within the PAOI. However, 6 of these species are larger antelope (Family: Cetartiodactyla) species that has been introduced into the area for "agricultural purposes (intensive game breeding). These species are predominantly larger and scarcer antelope species as well as exotic variation of these antelope species. Furthermore, these species are kept in fairly small grazing camps which is surrounded by tall, impenetrable game fences, restricting any natural movement in and out of these areas (larger mammals). .

During the site visit no mammal SoCC were recorded within the PAOI.

The initial screening report revealed that three mammal SCC have a distribution range that include the project site and may potentially inhabit the project site namely; Sensitive Species 5 (for their protection, the identities of these species will not made public); *Crocidura maquassiensis* (Makwassie musk shrew), and *Lycaon pictus* (African wild dog). Subsequently, the project site has been classified as Medium Sensitive within the screening tool.

During the site survey it was determined that there is a very low likelihood of occurrence (LoOC) for all three mammal species to occur within the project site. Due to livestock and intensive game breeding activities within the area, *Lycaon pictus* (African wild dog) and Species 5 these species will likely also not be tolerated within the area, there movement within the area would also be highly restricted due to numerous impenetrable, and frequently electrified game fences. Furthermore, *Crocidura maquassiensis* (Maquassie Musk Shrew) prefers densely vegetated, moist grassland/wetland habitats, and no such habitats are present within the project site.

It is highly unlikely that the proposed development will have a significant impact on potential SoCC species and their regional populations, as large tracts of natural habitat will still persist outside of the development site.

A very low herpetofaunal diversity was observed during the field assessment, with only five (3) reptile species observed and no amphibian species. Reptile diversity and abundance are anticipated to fairly low to a low habitat and niche diversity and general structural complexity within the project site. The general arid landscape does not lend itself to habitation by amphibians.

During the site visit no Reptile or Amphibian SoCC were recorded through active searching (diurnal and nocturnal surveys), and through random observations.

It is highly unlikely that the proposed development will have a significant impact on potential SoCC species and their regional populations.

There are no impacts associated with the proposed Boshoek Solar PV 1 development that cannot be mitigated to a low level. Its local environmental impact can be reduced to an acceptable magnitude. Likewise, the contribution of the proposed Solar PV facility to the cumulative impact in the area would be low and is acceptable. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. Therefore, it is the opinion of the specialists that the

development may be authorised within the specified area, subject to the implementation of the recommended mitigation measures.

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12. APPENDICES

Appendix 1 Plant Species List (Site and POSA Generated List)

The plant species list presented here is a combination of online databases (e.g., POSA and iNaturalist) and site survey data. Descriptions of colours and symbols are given below:

Species marked with "*":	Protected plant species.
Species marked with "~":	Plant Species of Conservation Concern.
Species highlighted in orange:	Threatened (CR, EN, VU) plant species.
Species highlighted in blue:	Alien plant species.
Species marked with NEM:BA:	Invasive Alien Plant species listed in the NEM:BA A&IS Regulations.
Species marked with NWE:	Limpopo Endemic.
Small letters in []:	Vegetation/plant community type in which the species was found:

- a: *Cenchrus ciliaris Planted Veld*
- *b: Cymbopogon caesius - Heteropogon contortus*
- *c: Dichanthium annulatum - Brachiaria brizantha Pasture*
- *d: Panicum maximum - Urochloa mosambicensis Pasture*
- *e: Themeda triandra - Ziziphus mucronata*
- *f: Vachellia tortilis - Heteropogon contortus: A (Eragrostis lehmanniana)*
- *g: Ziziphus mucronata - Cymbopogon caesius: A (Grewia flava)*
- *h: Ziziphus mucronata - Cymbopogon caesius: B (Eragrostis lehmanniana)*

Family	Species	IUCN	Family	Species	IUCN	Family	Species	IUCN
Cyperaceae	*Abildgaardia ovata*	LC	Zamiaceae	*~Encephalartos eugene-maraisii*	EN	Lamiaceae	*Orthosiphon suffrutescens*	LC
Fabaceae	*Abrus laevigatus*	LC	Sapotaceae	*Englerophytum magalismontanum*	LC	Osmundaceae	*Osmunda hilsenbergii*	
Malvaceae	*Abutilon angulatum* var. *angulatum*	NE	**Poaceae**	***Enneapogon cenchroides*** [df]	**LC**	Osmundaceae	*Osmunda regalis*	LC
Malvaceae	*Abutilon angulatum* var. *macrophyllum*	NE	Poaceae	*Enneapogon pretoriensis*	LC	Asteraceae	*Osteospermum muricatum*	
Malvaceae	*Abutilon austro-africanum*	LC	Poaceae	*Enneapogon scoparius*	LC	**Asteraceae**	***Osteospermum muricatum* subsp. *muricatum*** [bcefgh]	**LC**
Malvaceae	*Abutilon galpinii*	LC	Fabaceae	*Entada elephantina*		Santalaceae	*Osyris compressa*	
Malvaceae	*Abutilon piloso-cinereum*	LC	Poaceae	*Enteropogon macrostachyus*	LC	Santalaceae	*Osyris lanceolata*	LC
Malvaceae	*Abutilon pycnodon*	LC	Entodontaceae	*Entodon cymbifolius*		Fabaceae	*Otholobium nigricans*	LC
Malvaceae	*Abutilon ramosum*	LC	Entodontaceae	*Entodon macropodus*		Asteraceae	*Othonna natalensis*	LC
Malvaceae	*Abutilon sonneratianum*	LC	Onagraceae	*Epilobium capense*	LC	Rubiaceae	*Otiophora calycophylla*	

Fabaceae	Acacia baileyana (NEM:BA)	NE	Onagraceae	Epilobium hirsutum	LC	Rubiaceae	Otiophora calycophylla subsp. calycophylla	LC
Fabaceae	Acacia caffra		Onagraceae	Epilobium salignum	LC	Rubiaceae	Otiophora cupheoides	LC
Fabaceae	Acacia cyclops (NEM:BA)	NE	Equisetaceae	Equisetum ramosissimum		Fabaceae	Otoptera burchellii	LC
Fabaceae	Acacia dealbata (NEM:BA)	NE	Equisetaceae	Equisetum ramosissimum subsp. ramosissimum	LC	Oxalidaceae	Oxalis corniculata	NE
Fabaceae	Acacia decurrens (NEM:BA)	NE	Poaceae	Eragrostis acraea	LC	Oxalidaceae	Oxalis depressa	LC
Fabaceae	Acacia elata (NEM:BA)	NE	Poaceae	Eragrostis aspera	LC	**Oxalidaceae**	**Oxalis latifolia** [e]	**NE**
Fabaceae	*Acacia erioloba		Poaceae	Eragrostis barbinodis	LC	Oxalidaceae	Oxalis obliquifolia	LC
Fabaceae	Acacia erubescens		Poaceae	Eragrostis barrelieri	NE	Oxalidaceae	Oxalis semiloba subsp. semiloba	LC
Fabaceae	Acacia hebeclada subsp. hebeclada		Poaceae	Eragrostis biflora	LC	Oxalidaceae	Oxalis smithiana	LC
Fabaceae	Acacia longifolia (NEM:BA)	NE	Poaceae	Eragrostis capensis	LC	Polygonaceae	Oxygonum alatum var. alatum	LC
Fabaceae	Acacia paradoxa (NEM:BA)		Poaceae	Eragrostis chloromelas	LC	Polygonaceae	Oxygonum delagoense	LC
Fabaceae	Acacia permixta		Poaceae	Eragrostis cilianensis	LC	Polygonaceae	Oxygonum dregeanum subsp. canescens var. canescens	NE
Fabaceae	Acacia tortilis		**Poaceae**	**Eragrostis curvula** [bcdgh]	**LC**	Anacardiaceae	Ozoroa paniculosa	
Fabaceae	Acacia tortilis subsp. heteracantha		Poaceae	Eragrostis cylindriflora	LC	Anacardiaceae	Ozoroa paniculosa var. paniculosa	LC
Euphorbiaceae	Acalypha angustata	LC	Poaceae	Eragrostis gummiflua	LC	Anacardiaceae	Ozoroa paniculosa var. salicina	LC
Euphorbiaceae	Acalypha caperonioides		Poaceae	Eragrostis heteromera	LC	Anacardiaceae	Ozoroa sphaerocarpa	LC
Euphorbiaceae	~Acalypha caperonioides var. caperonioides	DDT	Poaceae	Eragrostis hierniana	LC	Apocynaceae	Pachycarpus concolor subsp. concolor	LC
Euphorbiaceae	Acalypha glabrata		Poaceae	Eragrostis inamoena	LC	Apocynaceae	Pachycarpus schinzianus	LC
Euphorbiaceae	Acalypha glabrata var. glabrata	LC	Poaceae	Eragrostis lappula	LC	Apocynaceae	Pachycymbium keithii	
Euphorbiaceae	Acalypha glabrata var. pilosa	LC	**Poaceae**	**Eragrostis lehmanniana var. lehmanniana** [bcdefh]	**LC**	Rubiaceae	Pachystigma bowkeri	
Euphorbiaceae	Acalypha indica var. indica	LC	Poaceae	Eragrostis mexicana subsp. virescens	NE	Rubiaceae	Pachystigma macrocalyx	
Euphorbiaceae	Acalypha peduncularis	LC	Poaceae	Eragrostis nindensis	LC	Rubiaceae	Pachystigma pygmaeum	
Euphorbiaceae	Acalypha segetalis	LC	Poaceae	Eragrostis pallens	LC	Lycopodiaceae	Palhinhaea cernua	
Euphorbiaceae	Acalypha villicaulis	LC	**Poaceae**	**Eragrostis patentipilosa** [b]	**LC**	Pallaviciniaceae	Pallavicinia lyellii	
Cucurbitaceae	Acanthosicyos naudinianus	LC	Poaceae	Eragrostis phyllacantha		Amaryllidaceae	Pancratium tenuifolium	LC
Asteraceae	Acanthospermum australe	NE	Poaceae	Eragrostis plana	LC	**Poaceae**	**Panicum coloratum** [e]	
Asteraceae	Acanthospermum glabratum	NE	Poaceae	Eragrostis planiculmis	LC	Poaceae	Panicum deustum	LC
Asteraceae	Acanthospermum hispidum	NE	Poaceae	Eragrostis racemosa	LC	**Poaceae**	**Panicum maximum** [bcdefgh]	**LC**
Sapindaceae	Acer negundo (NEM:BA)		**Poaceae**	**Eragrostis rigidior** [abgh]	**LC**	Poaceae	Panicum natalense	LC
Amaranthaceae	Achyranthes aspera		Poaceae	Eragrostis rotifer	LC	Poaceae	Panicum schinzii	LC
Amaranthaceae	**Achyranthes aspera var. aspera** [fg]	**NE**	Poaceae	Eragrostis sarmentosa	LC	Poaceae	Panicum stapfianum	LC
Amaranthaceae	Achyranthes aspera var. sicula	NE	Poaceae	Eragrostis sclerantha subsp. sclerantha	LC	Poaceae	Panicum subalbidum	LC
Amaranthaceae	**Achyropsis leptostachya** [g]	**LC**	Poaceae	Eragrostis stapfii	LC	Poaceae	Panicum volutans	LC
Apocynaceae	Acokanthera oppositifolia	LC	**Poaceae**	**Eragrostis superba** [abh]	**LC**	Papaveraceae	Papaver aculeatum	LC

Lamiaceae	***Acrotome hispida*[h]**	**LC**	Poaceae	*Eragrostis tef*	NE	**Sapindaceae**	***Pappea capensis*[ah]**	**LC**
Lamiaceae	***Acrotome inflata*[fgh]**	**LC**	**Poaceae**	***Eragrostis trichophora*[bfgh]**	**LC**	Apocynaceae	*Parapodium costatum*	LC
Pteridaceae	*Actiniopteris dimorpha* subsp. *dimorpha*	LC	Ericaceae	*Erica alopecurus* var. *glabriflora*	LC	Apocynaceae	*Parapodium simile*	LC
Pteridaceae	*Actiniopteris radiata*	LC	Ericaceae	*Erica drakensbergensis*	LC	Chrysobalanaceae	*Parinari capensis*	
Passifloraceae	*Adenia digitata*	LC	Ericaceae	*Erica woodii*		Chrysobalanaceae	*Parinari capensis* subsp. *capensis*	LC
Passifloraceae	*Adenia glauca*	LC	Ericaceae	*Erica woodii* var. *woodii*	LC	Asteraceae	*Parthenium hysterophorus* (NEM:BA)	NE
Apocynaceae	*Adenium oleifolium*	LC	**Asteraceae**	***Erigeron bonariensis*[bcfgh]**		Poaceae	*Paspalum dilatatum*	NE
Asteraceae	*Adenostemma caffrum*		Rosaceae	*Eriobotrya japonica* (NEM:BA)		Poaceae	*Paspalum distichum*	LC
Pteridaceae	*Adiantum capillus-veneris*	LC	Eriocaulaceae	*Eriocaulon abyssinicum*	LC	Poaceae	*Paspalum notatum*	NE
Pteridaceae	*Adiantum poiretii*	LC	Eriocaulaceae	*Eriocaulon dregei* var. *sonderianum*		Poaceae	*Paspalum scrobiculatum*	LC
Crassulaceae	*Adromischus umbraticola*		Eriocaulaceae	*Eriocaulon sonderianum*	LC	Poaceae	*Paspalum urvillei*	NE
Crassulaceae	*~Adromischus umbraticola* subsp. *umbraticola*	NT	Poaceae	*Eriochloa fatmensis*	LC	Poaceae	*Paspalum vaginatum*	LC
Lamiaceae	*Aeollanthus buchnerianus*	LC	Fabaceae	*Eriosema burkei*		Passifloraceae	*Passiflora caerulea* (NEM:BA)	
Amaranthaceae	*Aerva lanata*	LC	Fabaceae	*Eriosema burkei* var. *burkei*	LC	Passifloraceae	*Passiflora edulis* (NEM:BA)	NE
Amaranthaceae	*Aerva leucura*	LC	Fabaceae	*Eriosema cordatum*	LC	Apiaceae	*Pastinaca sativa*	NE
Asteraceae	*Afroaster peglerae*	LC	Fabaceae	*Eriosema distinctum*	LC	Paulowniaceae	*Paulownia tomentosa* (NEM:BA)	
Asteraceae	*Afroaster serrulatus*	LC	Fabaceae	*Eriosema nutans*	LC	Rubiaceae	*Pavetta eylesii*	LC
Rubiaceae	*Afrocanthium gilfillanii*	LC	Fabaceae	*Eriosema pauciflorum* var. *pauciflorum*	LC	Rubiaceae	*Pavetta gardeniifolia*	
Rubiaceae	*Afrocanthium mundianum*	LC	Fabaceae	*Eriosema psoraleoides*	LC	Rubiaceae	*Pavetta gardeniifolia* var. *gardeniifolia*	LC
Violaceae	*Afrohybanthus serratus*		Fabaceae	*Eriosema salignum*	LC	Rubiaceae	*Pavetta gardeniifolia* var. *subtomentosa*	LC
Apiaceae	*Afrosciadium magalismontanum*	LC	Fabaceae	*Eriosema squarrosum*	LC	Rubiaceae	*Pavetta harborii*	LC
Iridaceae	*Afrosolen sandersonii* subsp. *sandersonii*		Fabaceae	*Eriosema transvaalense*	LC	Rubiaceae	*Pavetta revoluta*	LC
Rubiaceae	*Agathisanthemum bojeri* subsp. *australe* var. *australe*		Asparagaceae	*Eriospermum cooperi*		Rubiaceae	*Pavetta zeyheri*	
Rubiaceae	*Agathisanthemum bojeri* subsp. *bojeri*	LC	Asparagaceae	*Eriospermum cooperi* var. *cooperi*	LC	Rubiaceae	*Pavetta zeyheri* subsp. *zeyheri*	LC
Asparagaceae	*Agave americana*		Asparagaceae	*Eriospermum mackenii* subsp. *galpinii*	NE	Malvaceae	*Pavonia burchellii*	LC
Asparagaceae	*Agave sisalana* (NEM:BA)	NE	Asparagaceae	*Eriospermum mackenii* subsp. *mackenii*	NE	Malvaceae	*Pavonia columella*	LC
Loranthaceae	*Agelanthus natalitius*		Asparagaceae	*Eriospermum porphyrium*	LC	Malvaceae	*Pavonia leptocalyx*	LC
Loranthaceae	*Agelanthus natalitius* subsp. *zeyheri*	LC	Asparagaceae	*Eriospermum porphyrovalve*	LC	Malvaceae	*Pavonia transvaalensis*	LC
Asteraceae	*Ageratina adenophora* (NEM:BA)	NE	Geraniaceae	*Erodium cicutarium*	NE	Fabaceae	*Pearsonia aristata*	LC
Asteraceae	*Ageratum houstonianum* (NEM:BA)	NE	Erpodiaceae	*Erpodium coronatum* subsp. *transvaaliense*		Fabaceae	*~Pearsonia bracteata*	NT
Rosaceae	*Agrimonia bracteata*	LC	Brassicaceae	*Eruca sativa*	NE	Fabaceae	*Pearsonia cajanifolia*	
Rosaceae	*Agrimonia procera* (NEM:BA)	LC	Brassicaceae	*Erucastrum austroafricanum*	LC	Fabaceae	*Pearsonia cajanifolia* subsp. *cajanifolia*	LC
Poaceae	*Agrostis continuata*	LC	Brassicaceae	*Erucastrum strigosum*	LC	Fabaceae	*Pearsonia sessilifolia* subsp. *marginata*	LC

Poaceae	*Agrostis eriantha* var. *eriantha*		Fabaceae	*Erythrina lysistemon*	LC	Fabaceae	*Pearsonia sessilifolia* subsp. *sessilifolia*	LC
Poaceae	*Agrostis lachnantha* var. *lachnantha*	LC	Fabaceae	*Erythrina zeyheri*	LC	Fabaceae	*Pearsonia uniflora*	LC
Simaroubaceae	*Ailanthus altissima* (NEM:BA)		Sapindaceae	**Erythrophysa transvaalensis*	LC	Asteraceae	*Pegolettia senegalensis*	LC
Fabaceae	*Albizia anthelmintica*	LC	Fabaceae	*Erythrostemon gilliesii*		Geraniaceae	*Pelargonium dolomiticum*	LC
Fabaceae	*Albizia brevifolia*	LC	Myrtaceae	*Eucalyptus camaldulensis* (NEM:BA)	NE	Geraniaceae	*Pelargonium luridum*	LC
Fabaceae	*Albizia tanganyicensis* subsp. *tanganyicensis*	LC	Myrtaceae	*Eucalyptus cinerea*		Thuidiaceae	*Pelekium versicolor*	
Asparagaceae	***Albuca glauca***[fgh]	**LC**	Myrtaceae	*Eucalyptus globulus* subsp. *maidenii*	NE	Pteridaceae	*Pellaea calomelanos*	
Asparagaceae	*Albuca pachychlamys*		Myrtaceae	*Eucalyptus grandis* (NEM:BA)	NE	Pteridaceae	*Pellaea calomelanos* var. *calomelanos*	LC
Asparagaceae	*Albuca seineri*	LC	Myrtaceae	*Eucalyptus robusta*		Pteridaceae	*Pellaea dura* var. *dura*	LC
Asparagaceae	*Albuca setosa*	LC	Ebenaceae	*Euclea crispa*		Pteridaceae	*Pellaea pectiniformis*	LC
Asparagaceae	*Albuca virens* subsp. *virens*	LC	**Ebenaceae**	***Euclea crispa* subsp. *crispa***[g]	**LC**	Ranunculaceae	*Peltocalathos baurii*	LC
Orobanchaceae	*Alectra orobanchoides*	LC	Ebenaceae	*Euclea crispa* var. *crispa*		**Fabaceae**	***Peltophorum africanum***[g]	**LC**
Orobanchaceae	*Alectra vogelii*	LC	Ebenaceae	*Euclea natalensis*		Poaceae	*Pennisetum macrourum*	LC
Apiaceae	*Alepidea setifera*	LC	Ebenaceae	*Euclea natalensis* subsp. *angustifolia*	LC	Poaceae	*Pennisetum setaceum* (NEM:BA)	NE
Alismataceae	*Alisma plantago-aquatica* (NEM:BA)	NE	Ebenaceae	*Euclea undulata*	LC	Rubiaceae	*Pentanisia angustifolia*	LC
Poaceae	*Alloteropsis semialata* subsp. *eckloniana*	LC	Asparagaceae	*Eucomis autumnalis*	LC	Apocynaceae	*Pentarrhinum insipidum*	LC
Poaceae	*Alloteropsis semialata* subsp. *semialata*	LC	Asparagaceae	*Eucomis autumnalis* subsp. *autumnalis*	NE	Asteraceae	*Pentzia calcarea*	LC
Didiereaceae	*Alluaudia procera*		Asparagaceae	*Eucomis autumnalis* subsp. *clavata*	NE	Asteraceae	*Pentzia lanata*	LC
Asphodelaceae	*Aloe arborescens*	LC	Asparagaceae	*Eucomis montana*	LC	Asteraceae	*Pentzia monocephala*	LC
Asphodelaceae	*Aloe bergeriana*	LC	Asparagaceae	*Eucomis pallidiflora* subsp. *pallidiflora*	LC	Piperaceae	*Peperomia retusa* var. *retusa*	LC
Asphodelaceae	*Aloe davyana*	LC	Orchidaceae	*Eulophia calanthoides*	LC	Piperaceae	*Peperomia tetraphylla*	LC
Asphodelaceae	*Aloe fosteri*	LC	Orchidaceae	*Eulophia clitellifera*	LC	Cucurbitaceae	*Peponium caledonicum*	LC
Asphodelaceae	***Aloe greatheadii***[fgh]	**LC**	Orchidaceae	*Eulophia cooperi*	LC	**Apocynaceae**	***Pergularia daemia* subsp. *daemia***[bfgh]	**LC**
Asphodelaceae	*Aloe greatheadii* var. *davyana*		Orchidaceae	*Eulophia hereroensis*	LC	Apocynaceae	*Periglossum mackenii*	LC
Asphodelaceae	*Aloe marlothii*		Orchidaceae	*Eulophia hians* var. *hians*	LC	Poaceae	*Perotis patens*	LC
Asphodelaceae	*Aloe marlothii* subsp. *marlothii*	LC	Orchidaceae	*Eulophia hians* var. *inaequalis*	LC	Polygonaceae	*Persicaria attenuata* subsp. *africana*	LC
Asphodelaceae	*Aloe mutabilis*	LC	Orchidaceae	*Eulophia hians* var. *nutans*	LC	Polygonaceae	*Persicaria capitata* (NEM:BA)	NE
Asphodelaceae	*~Aloe peglerae*	CR	Orchidaceae	*Eulophia leontoglossa*		Polygonaceae	*Persicaria decipiens*	LC
Asphodelaceae	*Aloe pienaarii*	LC	Orchidaceae	*Eulophia livingstoneana*	LC	Polygonaceae	*Persicaria hystricula*	LC
Asphodelaceae	*Aloe subspicata*	LC	Orchidaceae	*Eulophia milnei*		Polygonaceae	*Persicaria lapathifolia*	NE
Asphodelaceae	*Aloe transvaalensis*	LC	Orchidaceae	*Eulophia ovalis*		Polygonaceae	*Persicaria limbata*	NE
Asphodelaceae	*Aloe verecunda*	LC	Orchidaceae	*Eulophia ovalis* var. *bainesii*	LC	Polygonaceae	*Persicaria madagascariensis*	
Asphodelaceae	*Aloe zebrina*	LC	Orchidaceae	*Eulophia ovalis* var. *ovalis*	LC	Polygonaceae	*Persicaria meisneriana*	LC
Cyatheaceae	*Alsophila dregei*	LC	Orchidaceae	*Eulophia streptopetala*	LC	Poaceae	*Phalaris arundinacea*	NE
Amaranthaceae	***Alternanthera pungens***[cdfgh]	**NE**	Orchidaceae	*Eulophia tuberculata*	LC	Poaceae	*Phalaris paradoxa*	NE
Amaranthaceae	*Alternanthera sessilis*	NE	Orchidaceae	*Eulophia zeyheri*		Bartramiaceae	*Philonotis africana*	

Fabaceae	_Alysicarpus rugosus_ subsp. _perennirufus_	LC	Euphorbiaceae	_*Euphorbia cooperi_	LC	Bartramiaceae	_Philonotis dregeana_	
Fabaceae	_Alysicarpus zeyheri_	LC	Euphorbiaceae	_*Euphorbia cooperi_ var. _cooperi_		Bartramiaceae	_Philonotis falcata_	
Amaranthaceae	_Amaranthus hybridus_		Euphorbiaceae	_*Euphorbia davyi_	LC	Bartramiaceae	_Philonotis globosa_	
Amaranthaceae	_Amaranthus hybridus_ subsp. _hybridus_ var. _hybridus_	NE	Euphorbiaceae	_*Euphorbia excelsa_	LC	Bartramiaceae	_Philonotis hastata_	
Amaranthaceae	_Amaranthus praetermissus_	LC	Euphorbiaceae	_*Euphorbia heterophylla_	NE	Asteraceae	_Philyrophyllum schinzii_	LC
Amaranthaceae	_Amaranthus spinosus_	NE	Euphorbiaceae	_*Euphorbia hirta_	NE	Arecaceae	_Phoenix reclinata_	LC
Amaranthaceae	_Amaranthus thunbergii_	LC	**Euphorbiaceae**	**_*Euphorbia inaequilatera_**[bh]	**LC**	Poaceae	_Phragmites australis_	LC
Asteraceae	_Ambrosia artemisiifolia_	NE	Euphorbiaceae	_*Euphorbia inaequilatera_ var. _inaequilatera_		Poaceae	_Phragmites mauritianus_	LC
Lythraceae	_Ammannia baccifera_		Euphorbiaceae	_*Euphorbia indica_	NE	Rhamnaceae	_Phylica paniculata_	LC
Lythraceae	_Ammannia rigidula_		Euphorbiaceae	_Euphorbia ingens_	LC	Rhamnaceae	_Phylica rigida_	LC
Lythraceae	_Ammannia sagittifolia_ var. _sagittifolia_		Euphorbiaceae	_*Euphorbia natalensis_	LC	Phyllanthaceae	_Phyllanthus glaucophyllus_	LC
Lythraceae	_Ammannia schinzii_		Euphorbiaceae	_*Euphorbia neopolycnemoides_	LC	**Phyllanthaceae**	**_Phyllanthus incurvus_**[bfgh]	**LC**
Apiaceae	_Ammi majus_ var. _glaucifolium_	NE	Euphorbiaceae	_~*Euphorbia perangusta_	DDT	Phyllanthaceae	_Phyllanthus maderaspatensis_	LC
Amaryllidaceae	**_Ammocharis coranica_**[gh]	**LC**	Euphorbiaceae	_*Euphorbia prostrata_	NE	Phyllanthaceae	_Phyllanthus parvulus_ var. _garipensis_	LC
Anacampserotaceae	_~*Anacampseros decapitata_	VU	Euphorbiaceae	_*Euphorbia pseudotuberosa_	LC	**Phyllanthaceae**	**_Phyllanthus parvulus_ var. _parvulus_**[fgh]	**LC**
Anacampserotaceae	_Anacampseros subnuda_		Euphorbiaceae	_*Euphorbia pubescens_	NE	Phyllanthaceae	_Phyllanthus tenellus_	
Anacampserotaceae	_Anacampseros subnuda_ subsp. _subnuda_	LC	Euphorbiaceae	_*Euphorbia pulcherrima_	NE	Rhamnaceae	_Phyllogeiton zeyheri_	
Myrsinaceae	_Anagallis arvensis_ subsp. _arvensis_	NE	Euphorbiaceae	_*Euphorbia schinzii_	LC	Asteraceae	_Phymaspermum athanasioides_	LC
Boraginaceae	_Anchusa riparia_	LC	Euphorbiaceae	_*Euphorbia schinzii_ subsp. _schinzioides_		Asteraceae	_Phymaspermum bolusii_	
Apocynaceae	_Ancylobothrys capensis_		Euphorbiaceae	_*Euphorbia spartaria_	LC	Solanaceae	_Physalis angulata_	NE
Poaceae	_Andropogon appendiculatus_	LC	Euphorbiaceae	_*Euphorbia striata_	LC	Solanaceae	_Physalis peruviana_	NE
Poaceae	_Andropogon chinensis_	LC	Euphorbiaceae	_*Euphorbia terracina_		Solanaceae	_Physalis viscosa_	NE
Poaceae	_Andropogon eucomus_	LC	Euphorbiaceae	_*Euphorbia tirucalli_	LC	Phytolaccaceae	_Phytolacca dioica_ (NEM:BA)	NE
Poaceae	_Andropogon huillensis_	LC	Euphorbiaceae	_*Euphorbia trichadenia_		Phytolaccaceae	_Phytolacca heptandra_	LC
Poaceae	_Andropogon schirensis_	LC	Asteraceae	_Euryops chrysanthemoides_	LC	Phytolaccaceae	_Phytolacca octandra_ (NEM:BA)	NE
Commelinaceae	_Aneilema hockii_	LC	Asteraceae	_Euryops laxus_	LC	Cucurbitaceae	_Pilogyne scabra_	LC
Apiaceae	_Annesorhiza flagellifolia_	LC	Asteraceae	_Euryops transvaalensis_ subsp. _transvaalensis_	LC	Apiaceae	_Pimpinella transvaalensis_	LC
Bryaceae	_Anomobryum julaceum_		Poaceae	_Eustachys paspaloides_	LC	Pinaceae	_Pinus patula_ var. _patula_	NE
Anomodontaceae	_Anomodon pseudotristis_		**Convolvulaceae**	**_Evolvulus alsinoides_**[bh]	**LC**	Pittosporaceae	_*Pittosporum viridiflorum_	LC
Basellaceae	_Anredera cordifolia_ (NEM:BA)	NE	Gentianaceae	_Exochaenium grande_	LC	Pteridaceae	_Pityrogramma argentea_	LC
Orchidaceae	_Ansellia africana_	LC	Exormothecaceae	_Exormotheca holstii_		Aytoniaceae	_Plagiochasma appendiculatum_	
Poaceae	_Anthephora pubescens_	LC	Exormothecaceae	_Exormotheca pustulosa_		Aytoniaceae	_Plagiochasma microcephalum_ var. _microcephalum_	
Melastomataceae	_Antherotoma debilis_	LC	Fabroniaceae	_Fabronia pilifera_		Aytoniaceae	_Plagiochasma rupestre_	
Anthocerotaceae	_Anthoceros natalensis_		Fabroniaceae	_Fabronia rehmannii_		Aytoniaceae	_Plagiochasma rupestre_ var. _rupestre_	
Rubiaceae	_Anthospermum hispidulum_	LC	Rubiaceae	_Fadogia homblei_	LC	Aytoniaceae	_Plagiochasma rupestre_ var. _volkii_	

Rubiaceae	*Anthospermum rigidum* subsp. *pumilum*	LC	Convolvulaceae	*Falkia oblonga*	LC	Plantaginaceae	*Plantago lanceolata*	LC
Rubiaceae	*Anthospermum rigidum* subsp. *rigidum*	LC	Polygonaceae	*Fallopia convolvulus*	NE	Plantaginaceae	*Plantago longissima*	LC
Rubiaceae	*Anthospermum welwitschii*	LC	Proteaceae	*Faurea saligna*	LC	Plantaginaceae	*Plantago major*	
Menispermaceae	*Antizoma angustifolia*	LC	Asteraceae	*Felicia clavipilosa* subsp. *clavipilosa*	LC	Lamiaceae	*Plectranthus aliciae*	LC
Metteniusaceae	*Apodytes dimidiata*		Asteraceae	*Felicia fascicularis*	LC	Lamiaceae	*Plectranthus caninus*	LC
Metteniusaceae	*Apodytes dimidiata* subsp. *dimidiata*	LC	Asteraceae	*Felicia filifolia* subsp. *filifolia*	LC	Lamiaceae	*Plectranthus cylindraceus*	LC
Aponogetonaceae	*Aponogeton junceus*	LC	Asteraceae	*Felicia fruticosa* subsp. *brevipedunculata*	LC	Lamiaceae	*Plectranthus grallatus*	LC
Aizoaceae	*Aptenia cordifolia*	LC	Asteraceae	*Felicia muricata*		Lamiaceae	*Plectranthus grandidentatus*	LC
Scrophulariaceae	***Aptosimum elongatum***[bfgh]	**LC**	**Asteraceae**	***Felicia muricata* subsp. *muricata***[bgh]	**LC**	Lamiaceae	*Plectranthus hereroensis*	LC
Scrophulariaceae	*Aptosimum indivisum*	LC	Poaceae	*Festuca caprina*	LC	Lamiaceae	*Plectranthus madagascariensis* var. *ramosior*	
Scrophulariaceae	*Aptosimum procumbens*	LC	Cyperaceae	*Ficinia stolonifera*	LC	Lamiaceae	*Plectranthus neochilus*	LC
Apocynaceae	*Araujia sericifera* (NEM:BA)	NE	Moraceae	*Ficus abutilifolia*	LC	Lamiaceae	~*Plectranthus oertendahlii*	Rare
Archidiaceae	*Archidium acanthophyllum*		Moraceae	*Ficus burkei*	LC	Polypodiaceae	*Pleopeltis macrocarpa*	LC
Archidiaceae	*Archidium ohioense*		Moraceae	*Ficus cordata* subsp. *cordata*	LC	Plumbaginaceae	*Plumbago auriculata*	LC
Asteraceae	*Arctotis microcephala*	LC	Moraceae	*Ficus glumosa*	LC	Plumbaginaceae	*Plumbago zeylanica*	NE
Papaveraceae	*Argemone ochroleuca* (NEM:BA)		Moraceae	*Ficus ingens*	LC	Poaceae	*Poa annua*	NE
Papaveraceae	*Argemone ochroleuca* subsp. *ochroleuca*	NE	Moraceae	*Ficus ingens* var. *ingens*		Poaceae	*Pogonarthria squarrosa*	LC
Fabaceae	*Argyrolobium speciosum*	LC	Moraceae	*Ficus ingens* var. *tristis*		Polytrichaceae	*Pogonatum capense*	
Fabaceae	*Argyrolobium tuberosum*	LC	Moraceae	*Ficus salicifolia*	LC	Mniaceae	*Pohlia baronii*	
Iridaceae	*Aristea angolensis* subsp. *angolensis*	LC	Moraceae	*Ficus sur*	LC	Mniaceae	*Pohlia elongata*	
Poaceae	***Aristida adscensionis***[be]	**LC**	Moraceae	*Ficus thonningii*		Caryophyllaceae	*Pollichia campestris*	LC
Poaceae	*Aristida aequiglumis*	LC	Cyperaceae	*Fimbristylis complanata*	LC	Caryophyllaceae	*Polycarpaea corymbosa* var. *corymbosa*	NE
Poaceae	***Aristida bipartita***[g]	**LC**	Cyperaceae	*Fimbristylis dichotoma* subsp. *dichotoma*	LC	Polygalaceae	*Polygala albida* subsp. *albida*	LC
Poaceae	***Aristida canescens* subsp. *canescens***[bcfg]	**LC**	Cyperaceae	*Fimbristylis ferruginea*	LC	Polygalaceae	*Polygala amatymbica*	LC
Poaceae	***Aristida congesta* subsp. *barbicollis***[bfg]	**LC**	Poaceae	*Fingerhuthia africana*	LC	Polygalaceae	*Polygala capillaris*	
Poaceae	***Aristida congesta* subsp. *congesta***[abdfgh]	**LC**	Fissidentaceae	*Fissidens asplenioides*		Polygalaceae	*Polygala gerrardii*	LC
Poaceae	*Aristida diffusa* subsp. *burkei*	LC	Fissidentaceae	*Fissidens bogosicus*		Polygalaceae	*Polygala gracilenta*	LC
Poaceae	*Aristida effusa*	LC	Fissidentaceae	*Fissidens borgenii*		Polygalaceae	*Polygala hottentotta*	LC
Poaceae	*Aristida junciformis* subsp. *junciformis*	LC	Fissidentaceae	*Fissidens bryoides*		Polygalaceae	*Polygala houtboshiana*	LC
Poaceae	*Aristida meridionalis*	LC	Fissidentaceae	*Fissidens curvatus* var. *curvatus*		Polygalaceae	*Polygala krumanina*	LC
Poaceae	*Aristida pilgeri*	LC	Fissidentaceae	*Fissidens erosulus*		Polygalaceae	*Polygala leptophylla* var. *leptophylla*	LC
Poaceae	*Aristida rhiniochloa*	LC	Fissidentaceae	*Fissidens glaucescens*		Polygalaceae	*Polygala ohlendorfiana*	LC
Poaceae	*Aristida scabrivalvis* subsp. *contracta*	LC	Fissidentaceae	*Fissidens ovatus*		Polygalaceae	*Polygala producta*	LC

Poaceae	*Aristida scabrivalvis* subsp. *scabrivalvis*	LC	Fissidentaceae	*Fissidens palmifolius*		Polygalaceae	*Polygala rehmannii*	LC
Poaceae	*Aristida spectabilis*	LC	Fissidentaceae	*Fissidens plumosus*		Polygalaceae	*Polygala schinziana*	LC
Poaceae	*Aristida stipitata* subsp. *graciliflora*	LC	Fissidentaceae	*Fissidens pseudoserratus*		Polygalaceae	*Polygala serpentaria*	LC
Poaceae	***Aristida stipitata* subsp. *stipitata*** [cf]	**LC**	Fissidentaceae	*Fissidens rufescens*		Polygalaceae	*Polygala sphenoptera* var. *sphenoptera*	LC
Poaceae	***Aristida transvaalensis*** [e]	**LC**	Fissidentaceae	*Fissidens sciophyllus*		Polygalaceae	*Polygala transvaalensis* subsp. *transvaalensis*	LC
Asteraceae	*Artemisia afra*		Fissidentaceae	*Fissidens submarginatus*		Polygalaceae	*Polygala uncinata*	LC
Asteraceae	*Artemisia afra* var. *afra*	LC	Salicaceae	*Flacourtia indica*	LC	Polygalaceae	*Polygala virgata* var. *virgata*	LC
Asteraceae	*Artemisia vulgaris*	NE	**Asteraceae**	***Flaveria bidentis*** (NEM:BA)[g]	**NE**	Polygonaceae	*Polygonum aviculare*	NE
Poaceae	*Arundinella nepalensis*	LC	Commelinaceae	*Floscopa glomerata*	LC	Polygonaceae	*Polygonum plebeium*	LC
Poaceae	*Arundo donax* (NEM:BA)	NE	Phyllanthaceae	*Flueggea virosa* subsp. *virosa*	LC	Poaceae	*Polypogon monspeliensis*	NE
Apocynaceae	*Asclepias adscendens*	LC	Apiaceae	*Foeniculum vulgare*		Poaceae	*Polypogon viridis*	NE
Apocynaceae	*Asclepias albens*	LC	Apiaceae	*Foeniculum vulgare* var. *vulgare*	NE	Polytrichaceae	*Polytrichum commune*	
Apocynaceae	*Asclepias aurea*	LC	Fossombroniaceae	*Fossombronia crispa*		Polytrichaceae	*Polytrichum subpilosum*	
Apocynaceae	*Asclepias brevipes*	LC	Fossombroniaceae	*Fossombronia gemmifera*		Pontederiaceae	*Pontederia cordata* var. *ovalis*	NE
Apocynaceae	*Asclepias densiflora*	LC	Fossombroniaceae	*Fossombronia glenii*		Pontederiaceae	*Pontederia crassipes*	
Apocynaceae	*Asclepias eminens*	LC	Fossombroniaceae	*Fossombronia straussiana*		Salicaceae	*Populus deltoides*	
Apocynaceae	*Asclepias fallax*	LC	Iridaceae	*Freesia grandiflora* subsp. *grandiflora*	LC	Salicaceae	*Populus deltoides* subsp. *deltoides*	
Apocynaceae	*Asclepias fulva*	LC	Scrophulariaceae	*Freylinia tropica*	LC	Porellaceae	*Porella vallis-gratiae*	
Apocynaceae	*Asclepias gibba* var. *gibba*	LC	Aizoaceae	*~*Frithia pulchra*	Rare	Portulacaceae	*Portulaca grandiflora*	LC
Apocynaceae	*Asclepias gibba* var. *media*	LC	Aizoaceae	*Frithia pulchra* var. *minor*		Portulacaceae	*Portulaca hereroensis*	LC
Apocynaceae	*Asclepias meliodora* var. *brevicoronata*		Frullaniaceae	*Frullania ericoides*		Portulacaceae	*Portulaca kermesina*	LC
Apocynaceae	*Asclepias sabulosa*		Cyperaceae	*Fuirena pubescens* var. *pubescens*	LC	Portulacaceae	*Portulaca oleracea*	NE
Apocynaceae	*Asclepias stellifera*	LC	Cyperaceae	*Fuirena stricta* var. *stricta*	LC	Portulacaceae	*Portulaca pilosa*	NE
Cyperaceae	*Ascolepis capensis*	LC	Fumariaceae	*Fumaria muralis* subsp. *muralis*	NE	Portulacaceae	*Portulaca quadrifida*	LC
Fabaceae	*Aspalathus divaricata* subsp. *divaricata*	LC	Funariaceae	*Funaria hygrometrica*		Potamogetonaceae	*Potamogeton crispus*	LC
Asparagaceae	*Asparagus aethiopicus*	LC	Funariaceae	*Funaria limbata*		Potamogetonaceae	*Potamogeton nodosus*	LC
Asparagaceae	*Asparagus africanus*	LC	Funariaceae	*Funaria longicollis*		Potamogetonaceae	*Potamogeton octandrus*	LC
Asparagaceae	*Asparagus angusticladus*	LC	Funariaceae	*Funaria rottleri*		Potamogetonaceae	*Potamogeton pectinatus*	LC
Asparagaceae	*Asparagus asparagoides*	LC	Asteraceae	*Galinsoga parviflora*	NE	Potamogetonaceae	*Potamogeton pusillus*	LC
Asparagaceae	*Asparagus buchananii*	LC	Rubiaceae	*Galium capense* subsp. *capense*	LC	Potamogetonaceae	*Potamogeton schweinfurthii*	LC
Asparagaceae	***Asparagus cooperi*** [cg]	**LC**	Rubiaceae	*Galium capense* subsp. *garipense* var. *garipense*	NE	Urticaceae	*Pouzolzia mixta*	
Asparagaceae	*Asparagus flavicaulis*		Rubiaceae	*Galium spurium* subsp. *africanum*	LC	Urticaceae	*Pouzolzia mixta* var. *mixta*	LC
Asparagaceae	*Asparagus flavicaulis* subsp. *flavicaulis*	LC	Rubiaceae	*Galopina circaeoides*	LC	Lamiaceae	*Premna mooiensis*	LC
Asparagaceae	***Asparagus laricinus*** [beh]	**LC**	Asteraceae	*Gamochaeta pensylvanica*	NE	Verbenaceae	*Priva flabelliformis*	LC
Asparagaceae	*Asparagus plumosus*	LC	Rubiaceae	*Gardenia volkensii* subsp. *spatulifolia*	LC	Verbenaceae	*Priva meyeri* var. *meyeri*	LC
Asparagaceae	*Asparagus setaceus*	LC	Rubiaceae	*Gardenia volkensii* subsp. *volkensii* var. *volkensii*	NE	Proteaceae	*Protea caffra*	

Asparagaceae	***Asparagus suaveolens***[g]	**LC**	Asteraceae	*Garuleum woodii*	LC	Proteaceae	*Protea caffra* subsp. *caffra*	LC
Asparagaceae	*Asparagus transvaalensis*	LC	Asteraceae	*Gazania krebsiana* subsp. *serrulata*	LC	Proteaceae	*~Protea compacta*	NT
Asparagaceae	*Asparagus virgatus*	LC	Asteraceae	*Geigeria brevifolia*	LC	Proteaceae	*Protea gaguedi*	LC
Apocynaceae	*Aspidoglossum biflorum*	LC	Asteraceae	*Geigeria burkei*		Proteaceae	*Protea mundii*	LC
Apocynaceae	*Aspidoglossum glabrescens*	LC	**Asteraceae**	***Geigeria burkei* subsp. *burkei* var. *burkei***[bfgh]	**NE**	Proteaceae	*Protea nitida*	LC
Apocynaceae	*Aspidoglossum interruptum*	LC	Asteraceae	*Geigeria burkei* subsp. *burkei* var. *intermedia*	NE	Proteaceae	*Protea roupelliae*	
Apocynaceae	*Aspidoglossum lamellatum*	LC	Asteraceae	*Geigeria burkei* subsp. *burkei* var. *zeyheri*	NE	Proteaceae	*Protea roupelliae* subsp. *roupelliae*	LC
Apocynaceae	*Aspidoglossum ovalifolium*	LC	Asteraceae	*Geigeria elongata*	LC	Proteaceae	*Protea welwitschii*	LC
Apocynaceae	*Aspidoglossum restioides*	LC	Asteraceae	*Geigeria ornativa* subsp. *ornativa*	LC	Rosaceae	*~*Prunus africana*	VU
Asteraceae	*Aspilia mossambicensis*	LC	Lentibulariaceae	*Genlisea hispidula*	LC	Rosaceae	*Prunus persica*	
Aspleniaceae	*Asplenium aethiopicum*	LC	Asteraceae	*Gerbera ambigua*	LC	Rosaceae	*Prunus salicifolia*	
Aspleniaceae	*Asplenium capense*	LC	Asteraceae	*Gerbera piloselloides*	LC	Molluginaceae	*Psammotropha mucronata* var. *foliosa*	LC
Aspleniaceae	*Asplenium cordatum*	LC	Asteraceae	*Gerbera viridifolia*	LC	Molluginaceae	*Psammotropha mucronata* var. *mucronata*	LC
Aspleniaceae	*Asplenium friesiorum*	LC	Gisekiaceae	*Gisekia africana* var. *africana*	LC	Molluginaceae	*Psammotropha myriantha*	LC
Aspleniaceae	*Asplenium inaequilaterale*	LC	Gisekiaceae	*Gisekia africana* var. *pedunculata*	NE	Pottiaceae	*Pseudocrossidium crinitum*	
Aspleniaceae	*Asplenium phillipsianum*	LC	Gisekiaceae	*Gisekia pharnaceoides* var. *pharnaceoides*		Asteraceae	*Pseudognaphalium luteoalbum*	
Aspleniaceae	*Asplenium varians* subsp. *fimbriatum*	LC	Iridaceae	*Gladiolus antholyzoides*	LC	Asteraceae	*Pseudognaphalium oligandrum*	LC
Asteraceae	*Aster harveyanus*		Iridaceae	*Gladiolus crassifolius*	LC	Phyllanthaceae	*Pseudolachnostylis maprouneifolia* var. *glabra*	NE
Asteraceae	*Aster peglerae*		Iridaceae	*Gladiolus dalenii*		Leskeaceae	*Pseudoleskea leskeoides*	
Asteraceae	*Aster squamatus*	NE	Iridaceae	*Gladiolus dalenii* subsp. *dalenii*	LC	Leskeaceae	*Pseudoleskeopsis claviramea*	
Aytoniaceae	*Asterella bachmannii*		Iridaceae	*Gladiolus elliotii*	LC	Leskeaceae	*Pseudoleskeopsis pseudoattenuata*	
Aytoniaceae	*Asterella marginata*		Iridaceae	*Gladiolus longicollis* subsp. *platypetalus*	LC	Asteraceae	*Psiadia punctulata*	LC
Aytoniaceae	*Asterella muscicola*		Iridaceae	*Gladiolus oatesii*	LC	Myrtaceae	*Psidium guajava*(NEM:BA)	NE
Aytoniaceae	*Asterella wilmsii*		Iridaceae	*Gladiolus papilio*	LC	Iridaceae	*Psilosiphon sandersonii* subsp. *sandersonii*	
Fabaceae	*Astragalus atropilosulus* subsp. *burkeanus* var. *burkeanus*	NE	Iridaceae	*Gladiolus permeabilis*		Rubiaceae	*Psychotria capensis*	
Acanthaceae	*Asystasia intrusa*		**Iridaceae**	***Gladiolus permeabilis* subsp. *edulis***[gh]	**LC**	Rubiaceae	*Psydrax livida*	LC
Acanthaceae	*Asystasia schimperi*	LC	Iridaceae	*Gladiolus pretoriensis*	LC	Dennstaedtiaceae	*Pteridium aquilinum* subsp. *capense*	
Asteraceae	*Athrixia elata*	LC	Iridaceae	*Gladiolus rehmannii*	LC	Pteridaceae	*Pteris buchananii*	LC
Polytrichaceae	*Atrichum androgynum*		Iridaceae	*Gladiolus sericeovillosus*		Pteridaceae	*Pteris cretica*	LC
Amaranthaceae	*Atriplex nummularia* subsp. *nummularia*(NEM:BA)	NE	Iridaceae	*Gladiolus sericeovillosus* subsp. *calvatus*	LC	Pteridaceae	*Pteris dentata*	LC
Erpodiaceae	*Aulacopilum trichophyllum*		Iridaceae	*Gladiolus vinosomaculatus*	LC	Pteridaceae	*Pteris friesii*	LC
Poaceae	*Avena fatua*	NE	Iridaceae	*Gladiolus woodii*	LC	Pteridaceae	*Pteris vittata*	LC
Salviniaceae	*Azolla filiculoides*(NEM:BA)	NE	Verbenaceae	*Glandularia aristigera*		Fabaceae	*Pterocarpus rotundifolius*	

Iridaceae	*Babiana bainesii*	LC	Fabaceae	*Gleditsia triacanthos* (NEM:BA)	NE	Fabaceae	*Pterocarpus rotundifolius* subsp. *rotundifolius*	LC
Iridaceae	*Babiana hypogaea*	LC	Gleicheniaceae	*Gleichenia polypodioides*	LC	Celastraceae	*Pterocelastrus echinatus*	LC
Pottiaceae	*Barbula bolleana*		Colchicaceae	*Gloriosa modesta*	LC	Pedaliaceae	*Pterodiscus luridus*	LC
Pottiaceae	*Barbula eubryum*		Colchicaceae	*Gloriosa superba*	LC	**Pedaliaceae**	***Pterodiscus speciosus*** [g]	**LC**
Acanthaceae	*Barleria affinis*	LC	Asteraceae	*Gnaphalium filagopsis*	LC	Marattiaceae	*Ptisana fraxinea* var. *salicifolia*	NE
Acanthaceae	*Barleria bolusii*	LC	Thymelaeaceae	*Gnidia caffra*		Fabaceae	*Ptycholobium plicatum* subsp. *plicatum*	LC
Acanthaceae	*Barleria bremekampii*	LC	Thymelaeaceae	*Gnidia capitata*		Asteraceae	*Pulicaria scabra*	LC
Acanthaceae	*Barleria crossandriformis*	LC	Thymelaeaceae	*Gnidia gymnostachya*	LC	Amaranthaceae	*Pupalia lappacea*	
Acanthaceae	*Barleria heterotricha* subsp. *heterotricha*		Thymelaeaceae	*Gnidia microcephala*	LC	Amaranthaceae	*Pupalia lappacea* var. *lappacea*	LC
Acanthaceae	***Barleria macrostegia*** [bfgh]	**LC**	Thymelaeaceae	*Gnidia nodiflora*	LC	Lamiaceae	*Pycnostachys reticulata*	LC
Acanthaceae	*Barleria obtusa*	LC	Thymelaeaceae	*Gnidia sericocephala*		Cyperaceae	*Pycreus flavescens*	LC
Acanthaceae	*Barleria pretoriensis*	LC	Apocynaceae	*Gomphocarpus fruticosus*		Cyperaceae	*Pycreus macranthus*	LC
Lecythidaceae	**Barringtonia racemosa*	LC	Apocynaceae	*Gomphocarpus fruticosus* subsp. *decipiens*	LC	Cyperaceae	*Pycreus mundii*	LC
Fabaceae	*Bauhinia galpinii*	LC	**Apocynaceae**	***Gomphocarpus fruticosus* subsp. *fruticosus*** [abegh]	**LC**	Cyperaceae	*Pycreus nitidus*	LC
Fabaceae	*Bauhinia petersiana* subsp. *macrantha*	LC	Apocynaceae	*Gomphocarpus glaucophyllus*	LC	Cyperaceae	*Pycreus pumilus*	LC
Fabaceae	*Bauhinia tomentosa*	LC	Apocynaceae	*Gomphocarpus physocarpus*	LC	Cyperaceae	*Pycreus unioloides*	LC
Fabaceae	*Bauhinia variegata* var. *candida*		Apocynaceae	*Gomphocarpus tomentosus* subsp. *tomentosus*	LC	Rubiaceae	*Pygmaeothamnus chamaedendrum* var. *setulosus*	LC
Begoniaceae	*Begonia cucullata*	NE	Scrophulariaceae	*Gomphostigma virgatum*	LC	Rubiaceae	*Pygmaeothamnus zeyheri*	
Rhamnaceae	**Berchemia zeyheri*	LC	**Amaranthaceae**	***Gomphrena celosioides*** [befgh]	**NE**	Rubiaceae	*Pygmaeothamnus zeyheri* var. *zeyheri*	LC
Elatinaceae	*Bergia capensis*	LC	Orobanchaceae	*Graderia subintegra*	LC	Rosaceae	*Pyracantha angustifolia* (NEM:BA)	NE
Elatinaceae	*Bergia decumbens*	LC	Malvaceae	*Grewia bicolor* var. *bicolor*	LC	Rosaceae	*Pyracantha crenulata* (NEM:BA)	NE
Asteraceae	*Berkheya carlinopsis*		**Malvaceae**	***Grewia flava*** [bcfgh]	**LC**	Fagaceae	*Quercus robur*	NE
Asteraceae	*Berkheya carlinopsis* subsp. *magalismontana*	LC	Malvaceae	*Grewia flavescens*	LC	Racopilaceae	*Racopilum capense*	
Asteraceae	*Berkheya insignis*	LC	Malvaceae	*Grewia hexamita*	LC	Ranunculaceae	*Ranunculus dregei*	LC
Asteraceae	*Berkheya latifolia*	LC	Malvaceae	*Grewia monticola*	LC	Ranunculaceae	*Ranunculus multifidus*	LC
Asteraceae	*Berkheya pinnatifida* subsp. *ingrata*	LC	Malvaceae	*Grewia occidentalis*		Myrsinaceae	*Rapanea melanophloeos*	LC
Asteraceae	*Berkheya pinnatifida* subsp. *stobaeoides*	LC	Malvaceae	*Grewia occidentalis* var. *occidentalis*	LC	Brassicaceae	*Raphanus raphanistrum*	NE
Asteraceae	***Berkheya radula*** [e]	**LC**	**Malvaceae**	***Grewia retinervis*** [g]	**LC**	Apocynaceae	*Raphionacme galpinii*	LC
Asteraceae	*Berkheya seminivea*	LC	Malvaceae	*Grewia subspathulata*	LC	Apocynaceae	*Raphionacme hirsuta*	LC
Asteraceae	*Berkheya setifera*	LC	Malvaceae	*Grewia villosa* var. *villosa*	LC	Apocynaceae	*Raphionacme velutina*	LC
Asteraceae	*Berkheya speciosa* subsp. *lanceolata*	LC	Amaranthaceae	*Guilleminea densa*	NE	Brassicaceae	*Rapistrum rugosum*	NE
Asteraceae	*Berkheya zeyheri* subsp. *zeyheri*	LC	Gunneraceae	*Gunnera perpensa*	LC	Apocynaceae	*Rauvolfia caffra*	LC
Apiaceae	*Berula repanda*	LC	Asteraceae	*Gymnanthemum myrianthum*	LC	Poaceae	*Rendlia altera*	LC
Apiaceae	*Berula thunbergii*	LC	**Celastraceae**	***Gymnosporia buxifolia*** [g]	**LC**	Rhamnaceae	*Rhamnus prinoides*	LC
Poaceae	*Bewsia biflora*	LC	Celastraceae	*Gymnosporia glaucophylla*	LC	Bignoniaceae	*Rhigozum brevispinosum*	LC

Asteraceae	*Bidens bipinnata*	NE	Celastraceae	*Gymnosporia maranguensis*	LC	Bryaceae	*Rhodobryum commersonii*	
Asteraceae	*Bidens biternata*	NE	Celastraceae	*Gymnosporia polyacantha* subsp. *vaccinifolia*	LC	Vitaceae	*Rhoicissus revoilii*	LC
Asteraceae	*Bidens formosa*		Celastraceae	*Gymnosporia tenuispina*	LC	**Vitaceae**	***Rhoicissus tridentata***[f]	**LC**
Asteraceae	***Bidens pilosa***[befgh]	**NE**	Orchidaceae	*~Habenaria barbertoni*	NT	Vitaceae	*Rhoicissus tridentata* subsp. *cuneifolia*	NE
Blechnaceae	*Blechnum attenuatum*	LC	Orchidaceae	*Habenaria epipactidea*	LC	Vitaceae	*Rhoicissus tridentata* subsp. *tridentata*	NE
Blechnaceae	*Blechnum australe* subsp. *australe*	LC	Orchidaceae	*Habenaria falcicornis* subsp. *caffra*	LC	Anacardiaceae	*Rhus dentata*	
Blechnaceae	*Blechnum punctulatum* var. *punctulatum*	LC	Orchidaceae	*~Habenaria kraenzliniana*	NT	Anacardiaceae	*Rhus leptodictya*	
Acanthaceae	**Blepharis angusta*	LC	Orchidaceae	*~Habenaria mossii*	EN	Fabaceae	*Rhynchosia adenodes*	LC
Acanthaceae	*Blepharis innocua*	LC	Orchidaceae	*Habenaria nyikana* subsp. *nyikana*	LC	Fabaceae	*Rhynchosia albissima*	LC
Acanthaceae	*Blepharis integrifolia* var. *integrifolia*	LC	Orchidaceae	*Habenaria schimperiana*	LC	Fabaceae	*Rhynchosia atropurpurea*	LC
Acanthaceae	*Blepharis leendertziae*	LC	Orchidaceae	*Habenaria tridens*	LC	Fabaceae	*Rhynchosia caribaea*	LC
Acanthaceae	***Blepharis maderaspatensis***[bgh]	**LC**	Amaryllidaceae	*Haemanthus carneus*	LC	Fabaceae	*Rhynchosia confusa*	
Acanthaceae	*Blepharis serrulata*	LC	Amaryllidaceae	*Haemanthus humilis* subsp. *hirsutus*	LC	Fabaceae	*Rhynchosia crassifolia*	LC
Acanthaceae	*Blepharis squarrosa*	LC	Amaryllidaceae	*Haemanthus humilis* subsp. *humilis*	LC	Fabaceae	*Rhynchosia densiflora* subsp. *chrysadenia*	LC
Acanthaceae	*Blepharis stainbankiae*	LC	Stilbaceae	*Halleria lucida*	LC	Fabaceae	*Rhynchosia hirsuta*	LC
Acanthaceae	*Blepharis subvolubilis*	LC	Asteraceae	*Haplocarpha scaposa*	LC	Fabaceae	*Rhynchosia holosericea*	LC
Asteraceae	*Blumea dregeanoides*	LC	Pedaliaceae	*Harpagophytum zeyheri* subsp. *zeyheri*	LC	**Fabaceae**	***Rhynchosia minima***[gh]	**LC**
Orchidaceae	*Bonatea antennifera*	LC	Anacardiaceae	*Harpephyllum caffrum*	LC	Fabaceae	*Rhynchosia minima* var. *minima*	NE
Orchidaceae	*Bonatea polypodantha*	LC	Poaceae	*Harpochloa falx*	LC	Fabaceae	*Rhynchosia minima* var. *prostrata*	NE
Orchidaceae	*Bonatea saundersioides*	LC	Cactaceae	*Harrisia balansae*(NEM:BA)		Fabaceae	*Rhynchosia monophylla*	LC
Amaryllidaceae	*Boophone disticha*	LC	Orobanchaceae	*Harveya pumila*	LC	Fabaceae	*Rhynchosia nervosa*	LC
Capparaceae	***Boscia albitrunca***[afg]	**LC**	Scrophulariaceae	*Hebenstretia comosa*	LC	Fabaceae	*Rhynchosia nitens*	LC
Capparaceae	*Boscia albitrunca* var. *albitrunca*		Scrophulariaceae	*Hebenstretia dentata*	LC	Fabaceae	*Rhynchosia pedunculata*	
Capparaceae	*Boscia foetida*		Lythraceae	*Heimia myrtifolia*	NE	Fabaceae	*Rhynchosia pentheri* var. *pentheri*	LC
Capparaceae	*Boscia foetida* subsp. *rehmanniana*	LC	Asteraceae	*Helianthus annuus*	NE	Fabaceae	*Rhynchosia reptabunda*	LC
Poaceae	*Bothriochloa bladhii*	LC	Asteraceae	*Helichrysum acutatum*	LC	Fabaceae	*Rhynchosia sordida*	LC
Poaceae	*Bothriochloa insculpta*	LC	**Asteraceae**	***Helichrysum argyrosphaerum***[bgh]	**LC**	Fabaceae	*Rhynchosia totta*	
Poaceae	*Bothriochloa radicans*	LC	Asteraceae	*Helichrysum athrixiifolium*	LC	Fabaceae	*Rhynchosia totta* var. *rigidula*	
Hyacinthaceae	*Bowiea volubilis*		Asteraceae	*Helichrysum aureum* var. *monocephalum*	NE	**Fabaceae**	***Rhynchosia totta* var. *totta***[bfgh]	**LC**
Hyacinthaceae	*~Bowiea volubilis* subsp. *volubilis*	VU	Asteraceae	*Helichrysum auronitens*		Fabaceae	*Rhynchosia totta* var. *venulosa*	
Poaceae	*Brachiaria advena*	NE	Asteraceae	*Helichrysum caespititium*	LC	Fabaceae	*Rhynchosia venulosa*	
Poaceae	***Brachiaria brizantha***[cd]	**LC**	Asteraceae	*Helichrysum callicomum*	LC	Cyperaceae	*Rhynchospora brownii*	LC
Poaceae	*Brachiaria deflexa*	LC	Asteraceae	*Helichrysum candolleanum*	LC	Brachytheciaceae	*Rhynchostegiella zeyheri*	
Poaceae	*Brachiaria eruciformis*	LC	Asteraceae	*Helichrysum cephaloideum*	LC	Brachytheciaceae	*Rhynchostegium brachypterum*	

Poaceae	*Brachiaria nigropedata*	LC	Asteraceae	*Helichrysum cerastioides*		Aneuraceae	*Riccardia fastigiata*	
Poaceae	*Brachiaria serrata*	LC	Asteraceae	*Helichrysum cerastioides* var. *cerastioides*	LC	Ricciaceae	*Riccia albolimbata*	
Poaceae	*Brachiaria xantholeuca*	LC	Asteraceae	*Helichrysum chionosphaerum*	LC	Ricciaceae	*Riccia atropurpurea*	
Malvaceae	*Brachychiton populneus*		Asteraceae	*Helichrysum coriaceum*		Ricciaceae	*Riccia cavernosa*	
Orchidaceae	*~Brachycorythis conica* subsp. *transvaalensis*	CR	Asteraceae	*Helichrysum dasymallum*	LC	Ricciaceae	*Riccia congoana*	
Orchidaceae	*Brachycorythis tenuior*	LC	Asteraceae	*Helichrysum difficile*	LC	Ricciaceae	*Riccia crystallina*	
Asteraceae	*Brachylaena rotundata*	LC	Asteraceae	*Helichrysum epapposum*	LC	Ricciaceae	*Riccia macrocarpa*	
Asteraceae	*Brachylaena transvaalensis*	LC	Asteraceae	*Helichrysum harveyanum*	LC	Ricciaceae	*Riccia microciliata*	
Bryaceae	*Brachymenium acuminatum*		Asteraceae	*Helichrysum kraussii*	LC	Ricciaceae	*Riccia nigrella*	
Poaceae	*Brachypodium flexum*	LC	Asteraceae	*Helichrysum lepidissimum*	LC	Ricciaceae	*Riccia okahandjana*	
Apocynaceae	**Brachystelma barberae*	LC	Asteraceae	*Helichrysum mixtum* var. *mixtum*	NE	Ricciaceae	*Riccia rosea*	
Apocynaceae	**Brachystelma circinatum*	LC	Asteraceae	*Helichrysum mundtii*	LC	Ricciaceae	*Riccia runssorensis*	
Apocynaceae	**Brachystelma foetidum*	LC	Asteraceae	*Helichrysum nudifolium* var. *leiopodium*		Ricciaceae	*Riccia simii*	
Apocynaceae	**Brachystelma gracile*	LC	Asteraceae	*Helichrysum nudifolium* var. *nudifolium*	LC	Ricciaceae	*Riccia volkii*	
Apocynaceae	**Brachystelma oianthum*	LC	Asteraceae	*Helichrysum nudifolium* var. *oxyphyllum*	LC	Rubiaceae	*Richardia brasiliensis*	NE
Brachytheciaceae	*Brachythecium implicatum*		Asteraceae	*Helichrysum oreophilum*	LC	Rubiaceae	*Richardia scabra*	NE
Brassicaceae	*Brassica rapa*	NE	Asteraceae	*Helichrysum paronychioides*	LC	Apocynaceae	*Riocreuxia polyantha*	LC
Bartramiaceae	*Breutelia microdonta*		Asteraceae	*Helichrysum polycladum*	LC	Apocynaceae	*Riocreuxia torulosa* var. *torulosa*	LC
Phyllanthaceae	*Bridelia mollis*	LC	Asteraceae	*Helichrysum rugulosum*	LC	Fabaceae	*Robinia pseudoacacia* (NEM:BA)	NE
Rubiaceae	*Bridsonia chamaedendrum*		Asteraceae	*Helichrysum setosum*	LC	Brassicaceae	*Rorippa fluviatilis* var. *fluviatilis*	LC
Poaceae	*Briza minor*	NE	Asteraceae	*Helichrysum stenopterum*	LC	Brassicaceae	*Rorippa nudiuscula*	LC
Poaceae	*Bromus catharticus*	NE	Asteraceae	*Helichrysum uninervium*	LC	Rosaceae	*Rosa rubiginosa* (NEM:BA)	NE
Poaceae	*Bromus leptoclados*	LC	Asteraceae	*Helichrysum zeyheri*	LC	Lythraceae	*Rotala tenella*	LC
Amaryllidaceae	*Brunsvigia natalensis*	LC	Rhamnaceae	*Helinus integrifolius*	LC	Lamiaceae	*Rotheca hirsuta*	LC
Amaryllidaceae	*Brunsvigia radulosa*	LC	Brassicaceae	*Heliophila magaliesbergensis*		Lamiaceae	*Rotheca louwalbertsii*	LC
Bryaceae	*Bryum alpinum*		Brassicaceae	*Heliophila rigidiuscula*	LC	Lamiaceae	*Rotheca myricoides*	LC
Bryaceae	*Bryum apiculatum*		Boraginaceae	*Heliotropium amplexicaule*	NE	Rubiaceae	*Rothmannia capensis*	LC
Bryaceae	*Bryum argenteum*		Boraginaceae	*Heliotropium ciliatum*	LC	Rubiaceae	*Rubia horrida*	LC
Bryaceae	*Bryum aubertii*		Boraginaceae	*Heliotropium lineare*	LC	Rubiaceae	*Rubia petiolaris*	LC
Bryaceae	*Bryum capillare*		**Boraginaceae**	***Heliotropium nelsonii*** [bcfgh]	**LC**	Rosaceae	*Rubus ï¿½ proteus*	
Bryaceae	*Bryum dichotomum*		**Boraginaceae**	***Heliotropium ovalifolium*** [bh]	**LC**	Rosaceae	*Rubus cuneifolius* (NEM:BA)	NE
Bryaceae	*Bryum pseudotriquetrum*		Boraginaceae	*Heliotropium strigosum*	LC	Rosaceae	*Rubus ludwigii* subsp. *ludwigii*	LC
Bryaceae	*Bryum pycnophyllum*		Poaceae	*Hemarthria altissima*	LC	Rosaceae	*Rubus rigidus*	LC
Bryaceae	*Bryum torquescens*		Araliaceae	*Heptapleurum arboricola*		Acanthaceae	*Ruellia cordata*	LC
Orobanchaceae	*Buchnera reducta*	LC	Malvaceae	*Hermannia adenotricha*		**Acanthaceae**	***Ruellia patula*** [bcfgh]	**LC**
Orobanchaceae	*Buchnera simplex*	LC	Malvaceae	*Hermannia bicolor*	LC	Acanthaceae	*Ruelliopsis setosa*	LC
Scrophulariaceae	*Buddleja saligna*	LC	**Malvaceae**	***Hermannia boraginiflora*** [bcfh]	**LC**	Polygonaceae	*Rumex acetosella* subsp. *angiocarpus*	

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Scrophulariaceae	*Buddleja salviifolia*	LC	Malvaceae	*Hermannia burkei*	LC	Polygonaceae	*Rumex conglomeratus*	LC
Boraginaceae	*Buglossoides arvensis*	NE	Malvaceae	*Hermannia cernua*	LC	Polygonaceae	*Rumex crispus*	NE
Asphodelaceae	*Bulbine abyssinica*	LC	Malvaceae	*Hermannia coccocarpa*	LC	Polygonaceae	*Rumex dregeanus* subsp. *montanus*	LC
Asphodelaceae	*Bulbine angustifolia*	LC	Malvaceae	*Hermannia cordata*	LC	Polygonaceae	*Rumex lanceolatus*	LC
Asphodelaceae	*Bulbine capitata*	LC	**Malvaceae**	***Hermannia depressa*** [cef]	**LC**	Polygonaceae	*Rumex sagittatus*	LC
Asphodelaceae	*Bulbine favosa*	LC	Malvaceae	*Hermannia eenii*	LC	Polygonaceae	*Rumex woodii*	LC
Asphodelaceae	*Bulbine lagopus*	LC	Malvaceae	*Hermannia floribunda*	LC	Acanthaceae	*Ruttya ovata*	LC
Asphodelaceae	*Bulbine narcissifolia*	LC	Malvaceae	*Hermannia grandifolia*	LC	Poaceae	*Sacciolepis chevalieri*	LC
Cyperaceae	*Bulbostylis burchellii*	LC	Malvaceae	*Hermannia grandistipula*	LC	Celastraceae	*Salacia rehmannii*	LC
Cyperaceae	*Bulbostylis contexta*	LC	**Malvaceae**	***Hermannia grisea*** [bcfg]	**LC**	Salicaceae	*Salix babylonica* var. *babylonica*	NE
Cyperaceae	*Bulbostylis hispidula* subsp. *pyriformis*	LC	Malvaceae	*Hermannia lancifolia*	LC	Salicaceae	*Salix mucronata* subsp. *capensis*	
Cyperaceae	*Bulbostylis humilis*	LC	Malvaceae	*Hermannia linnaeoides*	LC	Salicaceae	*Salix mucronata* subsp. *woodii*	LC
Cyperaceae	*Bulbostylis oritrephes*	LC	Malvaceae	*Hermannia marginata*	LC	Amaranthaceae	*Salsola glabrescens*	LC
Cyperaceae	*Bulbostylis scabricaulis*	LC	Malvaceae	*Hermannia modesta*	LC	Amaranthaceae	*Salsola kali* (NEM:BA)	NE
Cyperaceae	*Bulbostylis schoenoides*	LC	Malvaceae	*Hermannia parvula*	LC	Lamiaceae	*Salvia coccinea*	NE
Fabaceae	*Burkea africana*	LC	Malvaceae	*Hermannia quartiniana*	LC	Lamiaceae	*Salvia radula*	LC
Burmanniaceae	*Burmannia madagascariensis*	LC	Malvaceae	*Hermannia stellulata*	LC	Lamiaceae	*Salvia reflexa*	NE
Capparaceae	*Cadaba aphylla*	LC	Malvaceae	*Hermannia tomentosa*	LC	Lamiaceae	*Salvia repens* var. *repens*	LC
Capparaceae	***Cadaba termitaria*** [g]	**LC**	Malvaceae	*Hermannia umbratica*	LC	Lamiaceae	*Salvia runcinata*	LC
Pilotrichaceae	*Callicostella tristis*		**Amaranthaceae**	***Hermbstaedtia fleckii*** [bcgh]	**LC**	Lamiaceae	*Salvia stenophylla*	
Asteraceae	*Callilepis lancifolia*	LC	Amaranthaceae	*Hermbstaedtia odorata* var. *albi-rosea*		Lamiaceae	*Salvia tiliifolia* (NEM:BA)	NE
Asteraceae	*Callilepis leptophylla*	LC	Amaranthaceae	*Hermbstaedtia odorata* var. *aurantiaca*	NE	Salviniaceae	*Salvinia molesta* (NEM:BA)	NE
Asteraceae	*Callilepis salicifolia*	LC	Amaranthaceae	*Hermbstaedtia odorata* var. *odorata*	NE	Adoxaceae	*Sambucus canadensis* (NEM:BA)	
Rutaceae	*Calodendrum capense*	LC	Asteraceae	*Hertia pallens*	LC	Asparagaceae	*Sansevieria aethiopica*	LC
Calypogeiaceae	*Calypogeia arguta*		Iridaceae	*Hesperantha coccinea*	LC	Apocynaceae	*Sarcostemma viminale* subsp. *viminale*	
Asteraceae	*Campuloclinium macrocephalum* (NEM:BA)	NE	Iridaceae	*Hesperantha leucantha*	LC	Lamiaceae	*Satureja biflora*	LC
Leucobryaceae	*Campylopus atroluteus*		Iridaceae	*Hesperantha longicollis*	LC	Orchidaceae	*Satyrium cristatum* var. *cristatum*	LC
Leucobryaceae	*Campylopus flaccidus*		Pontederiaceae	*Heteranthera callifolia*	LC	Orchidaceae	*Satyrium hallackii* subsp. *ocellatum*	LC
Leucobryaceae	*Campylopus introflexus*		Apiaceae	*Heteromorpha arborescens*		Caprifoliaceae	*Scabiosa columbaria*	LC
Leucobryaceae	*Campylopus pilifer* var. *pilifer*		Apiaceae	*Heteromorpha arborescens* var. *abyssinica*	LC	Amaryllidaceae	*Scadoxus puniceus*	LC
Leucobryaceae	*Campylopus pyriformis*		Apiaceae	*Heteromorpha arborescens* var. *arborescens*	LC	Anacardiaceae	*Schinus molle*	NE
Leucobryaceae	*Campylopus robillardei*		**Poaceae**	***Heteropogon contortus*** [abcdefgh]	**LC**	Asteraceae	*Schistostephium crataegifolium*	LC
Leucobryaceae	*Campylopus savannarum*		Heteropyxidaceae	*Heteropyxis natalensis*	LC	Poaceae	*Schizachyrium jeffreysii*	LC
Leucobryaceae	*Campylopus thwaitesii*		Malvaceae	*Hibiscus aethiopicus*		Poaceae	*Schizachyrium sanguineum*	LC
Cannaceae	*Canna indica* (NEM:BA)	NE	**Malvaceae**	***Hibiscus aethiopicus* var. *aethiopicus*** [bh]	**LC**	Poaceae	*Schizachyrium ursulus*	LC
Cannabaceae	*Cannabis sativa* var. *sativa*	NE	Malvaceae	*Hibiscus aethiopicus* var. *ovatus*	LC	Asparagaceae	*Schizocarphus nervosus*	LC

Rubiaceae	*Canthium suberosum*	LC	Malvaceae	*Hibiscus caesius* var. *caesius*	NE	Apocynaceae	*Schizoglossum nitidum*	LC
Cyperaceae	*Carex acutiformis*	NE	**Malvaceae**	***Hibiscus calyphyllus***[bcfgh]	**LC**	**Asteraceae**	***Schkuhria pinnata***[bcdfgh]	**NE**
Cyperaceae	*Carex cognata*	LC	**Malvaceae**	***Hibiscus cannabinus***[c]	**LC**	Poaceae	*Schmidtia pappophoroides*	LC
Cyperaceae	*Carex glomerabilis*	LC	Malvaceae	*Hibiscus engleri*	LC	Cyperaceae	*Schoenoplectus brachyceras*	LC
Cyperaceae	*Carex rhodesiaca*	LC	Malvaceae	*Hibiscus lunariifolius*		Cyperaceae	*Schoenoplectus corymbosus*	LC
Cyperaceae	*Carex spartea*		Malvaceae	*Hibiscus marlothianus*	LC	Cyperaceae	*Schoenoplectus muricinux*	LC
Cyperaceae	*Carex spicatopaniculata*		Malvaceae	*Hibiscus meyeri* subsp. *transvaalensis*	LC	Cyperaceae	*Schoenoplectus muriculatus*	LC
Cyperaceae	*Carex uhligii*		Malvaceae	*Hibiscus micranthus* var. *micranthus*	LC	Cyperaceae	*Schoenoxiphium madagascariense*	LC
Apocynaceae	***Carissa bispinosa***[g]	**LC**	Malvaceae	*Hibiscus microcarpus*	LC	Cyperaceae	*Schoenoxiphium sparteum*	LC
Celastraceae	*Cassine burkeana*		Malvaceae	*Hibiscus mutatus*	LC	Fabaceae	*Schotia brachypetala*	LC
Icacinaceae	*Cassinopsis ilicifolia*	LC	Malvaceae	*Hibiscus nigricaulis*	LC	Cyperaceae	*Scirpoides burkei*	LC
Casuarinaceae	*Casuarina cunninghamiana* (NEM:BA)	NE	Malvaceae	*Hibiscus pusillus*	LC	Cyperaceae	*Scleria bulbifera*	LC
Apocynaceae	*Catharanthus roseus* (NEM:BA)	NE	Malvaceae	*Hibiscus rosa-sinensis*		Cyperaceae	*Scleria distans*	LC
Cannabaceae	***Celtis africana***[g]	**LC**	Malvaceae	*Hibiscus sabdariffa*	NE	Cyperaceae	*Scleria dregeana*	LC
Poaceae	*Cenchrus caudatus*		Malvaceae	*Hibiscus sidiformis*	LC	Anacardiaceae	*Sclerocarya birrea*	
Poaceae	***Cenchrus ciliaris***[abdefh]	**LC**	Malvaceae	*Hibiscus subreniformis*	LC	Anacardiaceae	**Sclerocarya birrea* subsp. *caffra*	LC
Poaceae	*Cenchrus setaceus*		**Malvaceae**	***Hibiscus trionum***[bcfgh]		Salicaceae	*Scolopia mundii*	LC
Asteraceae	*Centaurea melitensis*	NE	Malvaceae	*Hibiscus vitifolius* subsp. *vitifolius*	LC	Salicaceae	*Scolopia zeyheri*	LC
Apiaceae	*Centella asiatica*	LC	Malvaceae	*Hibiscus vitifolius* subsp. *vulgaris*	LC	Lamiaceae	*Scutellaria racemosa*	NE
Caprifoliaceae	*Cephalaria zeyheriana*	LC	Asteraceae	*Hilliardiella aristata*	LC	Anacardiaceae	*Searsia chirindensis*	LC
Caryophyllaceae	*Cerastium arabidis*	LC	Asteraceae	*Hilliardiella elaeagnoides*	LC	Anacardiaceae	*Searsia dentata*	LC
Caryophyllaceae	*Cerastium capense*	LC	Asteraceae	*Hilliardiella hirsuta*	LC	Anacardiaceae	*Searsia discolor*	LC
Ditrichaceae	*Ceratodon purpureus* subsp. *stenocarpus*		Asteraceae	*Hilliardiella oligocephala*		Anacardiaceae	*Searsia dregeana*	LC
Pedaliaceae	***Ceratotheca triloba***[h]	**LC**	Asteraceae	*Hilliardiella sutherlandii*	LC	Anacardiaceae	*Searsia gracillima*	
Cactaceae	*Cereus hildmannianus* (NEM:BA)		**Asteraceae**	***Hirpicium bechuanense***[bch]	**LC**	**Anacardiaceae**	***Searsia lancea***[befgh]	**LC**
Cactaceae	***Cereus jamacaru*** (NEM:BA)[fg]	**NE**	Orchidaceae	*~Holothrix randii*	NT	Anacardiaceae	*Searsia leptodictya*	LC
Apocynaceae	*Ceropegia conrathii*	LC	Pedaliaceae	*Holubia saccata*	LC	Anacardiaceae	*Searsia leptodictya* forma. *leptodictya*	
Apocynaceae	*Ceropegia crassifolia* var. *crassifolia*	LC	Apocynaceae	*Huernia insigniflora*		Anacardiaceae	*Searsia lucida* forma. *lucida*	
Apocynaceae	*Ceropegia haygarthii*	LC	Apocynaceae	*Huernia longituba*	LC	Anacardiaceae	*Searsia magalismontana*	
Apocynaceae	*~*Ceropegia insignis*	EN	Apocynaceae	*Huernia stapelioides*	LC	Anacardiaceae	*Searsia magalismontana* subsp. *magalismontana*	LC
Apocynaceae	*Ceropegia multiflora* subsp. *multiflora*	LC	Apocynaceae	*Huernia transvaalensis*	LC	Anacardiaceae	*Searsia pallens*	LC
Apocynaceae	*Ceropegia rendallii*	LC	Araliaceae	*Hydrocotyle verticillata*	LC	Anacardiaceae	*Searsia pyroides*	
Solanaceae	*Cestrum aurantiacum* (NEM:BA)	NE	Pottiaceae	*Hyophila involuta*		Anacardiaceae	*Searsia pyroides* var. *gracilis*	LC
Solanaceae	*Cestrum parqui* (NEM:BA)		Poaceae	*Hyparrhenia anamesa*	LC	Anacardiaceae	*Searsia pyroides* var. *integrifolia*	LC
Scrophulariaceae	*Chaenostoma floribundum*	LC	Poaceae	*Hyparrhenia dregeana*	LC	**Anacardiaceae**	***Searsia pyroides* var. *pyroides***[gh]	**LC**

Scrophulariaceae	*Chaenostoma leve*	LC	Poaceae	*Hyparrhenia filipendula* var. *filipendula*	LC	Anacardiaceae	*Searsia rigida*	
Scrophulariaceae	*Chaenostoma patrioticum*	LC	Poaceae	*Hyparrhenia filipendula* var. *pilosa*	LC	Anacardiaceae	*Searsia rigida* var. *dentata*	LC
Acanthaceae	*Chaetacanthus burchellii*		**Poaceae**	***Hyparrhenia hirta*** [beh]	**LC**	Anacardiaceae	*Searsia rigida* var. *margaretae*	LC
Acanthaceae	***Chaetacanthus costatus*** [bg]		Poaceae	*Hyparrhenia newtonii* var. *newtonii*	LC	Anacardiaceae	*Searsia rigida* var. *rigida*	LC
Acanthaceae	*Chaetacanthus setiger*		Poaceae	*Hyparrhenia poecilotricha*	LC	Anacardiaceae	*Searsia undulata*	LC
Cannabaceae	*Chaetachme aristata*		Poaceae	*Hyparrhenia quarrei*	LC	Anacardiaceae	*Searsia zeyheri*	LC
Fabaceae	*Chamaecrista absus*	LC	Poaceae	*Hyparrhenia schimperi*	LC	Gentianaceae	*Sebaea bojeri*	LC
Fabaceae	*Chamaecrista biensis*	LC	Poaceae	*Hyparrhenia tamba*	LC	Gentianaceae	*Sebaea exigua*	LC
Fabaceae	*Chamaecrista capensis* var. *flavescens*	LC	Rubiaceae	*Hyperacanthus amoenus*	LC	Gentianaceae	*Sebaea junodii*	LC
Fabaceae	*Chamaecrista comosa* var. *capricornia*	LC	Hypericaceae	*Hypericum aethiopicum* subsp. *aethiopicum*	LC	Gentianaceae	*Sebaea leiostyla*	LC
Fabaceae	***Chamaecrista comosa* var. *comosa*** [bfgh]	**LC**	Hypericaceae	*Hypericum aethiopicum* subsp. *sonderi*	LC	Gentianaceae	*Sebaea sedoides* var. *confertiflora*	LC
Fabaceae	*Chamaecrista mimosoides*	LC	Hypericaceae	*Hypericum lalandii*	LC	Gentianaceae	*Sebaea sedoides* var. *schoenlandii*	LC
Fabaceae	*Chamaecrista stricta*	LC	Hypericaceae	*Hypericum revolutum* subsp. *revolutum*	LC	Apocynaceae	*Secamone alpini*	LC
Arecaceae	*Chamaerops humilis*		Poaceae	*Hyperthelia dissoluta*	LC	Apocynaceae	*Secamone filiformis*	LC
Arecaceae	*Chamaerops humilis* var. *argentea*		Asteraceae	*Hypochaeris brasiliensis*	NE	Apocynaceae	*Secamone parvifolia*	LC
Verbenaceae	*Chascanum adenostachyum*	LC	Asteraceae	*Hypochaeris microcephala* var. *albiflora*	NE	Polygalaceae	*Securidaca longepedunculata	
Verbenaceae	***Chascanum hederaceum* var. *hederaceum*** [bg]	**LC**	Asteraceae	*Hypochaeris radicata*	NE	Polygalaceae	*Securidaca longepedunculata* var. *longepedunculata*	LC
Verbenaceae	*Chascanum pinnatifidum* var. *pinnatifidum*	LC	Hypodontiaceae	*Hypodontium dregei*		**Convolvulaceae**	***Seddera capensis*** [bgh]	**LC**
Pteridaceae	*Cheilanthes contracta*	LC	Acanthaceae	*Hypoestes forskaolii*	LC	Convolvulaceae	*Seddera suffruticosa*	LC
Pteridaceae	*Cheilanthes dolomiticola*	LC	Acanthaceae	*Hypoestes phyllostachya*		Poaceae	*Sehima galpinii*	LC
Pteridaceae	*Cheilanthes eckloniana*	LC	Acanthaceae	*Hypoestes triflora*	LC	Selaginellaceae	*Selaginella caffrorum* var. *caffrorum*	LC
Pteridaceae	*Cheilanthes hirta* var. *brevipilosa*	LC	Hypoxidaceae	*Hypoxis acuminata*	LC	Selaginellaceae	*Selaginella dregei*	LC
Pteridaceae	*Cheilanthes hirta* var. *brevipilosa* forma. *brevipilosa*		Hypoxidaceae	*Hypoxis angustifolia* var. *angustifolia*	LC	Selaginellaceae	*Selaginella mittenii*	LC
Pteridaceae	*Cheilanthes hirta* var. *brevipilosa* forma. *laxa*		Hypoxidaceae	*Hypoxis argentea*		Scrophulariaceae	*Selago capitellata*	LC
Pteridaceae	*Cheilanthes hirta* var. *hirta*	LC	Hypoxidaceae	*Hypoxis argentea* var. *argentea*	LC	**Scrophulariaceae**	***Selago densiflora*** [bh]	**LC**
Pteridaceae	*Cheilanthes inaequalis*		Hypoxidaceae	*Hypoxis argentea* var. *sericea*	LC	Scrophulariaceae	*Selago lacunosa*	LC
Pteridaceae	*Cheilanthes involuta* var. *involuta*	LC	Hypoxidaceae	*Hypoxis filiformis*	LC	Scrophulariaceae	*Selago mixta*	LC
Pteridaceae	*Cheilanthes involuta* var. *obscura*	LC	Hypoxidaceae	*Hypoxis galpinii*	LC	Sematophyllaceae	*Sematophyllum brachycarpum*	
Pteridaceae	*Cheilanthes marlothii*	LC	Hypoxidaceae	*Hypoxis hemerocallidea*	LC	Sematophyllaceae	*Sematophyllum sphaeropyxis*	
Pteridaceae	*Cheilanthes multifida* subsp. *lacerata*	LC	Hypoxidaceae	*Hypoxis interjecta*	LC	Sematophyllaceae	*Sematophyllum subpinnatum*	
Pteridaceae	*Cheilanthes multifida* var. *multifida*		Hypoxidaceae	*Hypoxis iridifolia*		Sematophyllaceae	*Sematophyllum wageri*	
Pteridaceae	*Cheilanthes nielsii*	LC	Hypoxidaceae	*Hypoxis oblonga*		Sematophyllaceae	*Sematophyllum zuluense*	
Pteridaceae	*Cheilanthes pentagona*	LC	Hypoxidaceae	*Hypoxis rigidula*	LC	Asteraceae	*Senecio achilleifolius*	LC
Pteridaceae	*Cheilanthes viridis*		Hypoxidaceae	*Hypoxis rigidula* var. *pilosissima*	NE	Asteraceae	*Senecio affinis*	LC

Pteridaceae	*Cheilanthes viridis* var. *glauca*	LC	Hypoxidaceae	*Hypoxis rigidula* var. *rigidula*	NE	Asteraceae	*Senecio albanensis* var. *doroniciflorus*	LC
Pteridaceae	*Cheilanthes viridis* var. *macrophylla*	LC	Aquifoliaceae	*Ilex mitis*		Asteraceae	*Senecio apiifolius*	
Pteridaceae	*Cheilanthes viridis* var. *viridis*	LC	Aquifoliaceae	*Ilex mitis* var. *mitis*	LC	Asteraceae	*Senecio barbertonicus*	LC
Amaranthaceae	*Chenopodiastrum murale*		Poaceae	*Imperata cylindrica*	LC	Asteraceae	*Senecio burchellii*	LC
Amaranthaceae	***Chenopodium album*** [e]	**NE**	Fabaceae	*Indigastrum burkeanum*	LC	Asteraceae	*Senecio consanguineus*	LC
Amaranthaceae	*Chenopodium mucronatum*	LC	Fabaceae	*Indigastrum costatum* subsp. *macrum*	LC	Asteraceae	*Senecio coronatus*	LC
Lophocoleaceae	*Chiloscyphus dubius*		Fabaceae	*Indigastrum fastigiatum*	LC	Asteraceae	*Senecio erubescens* var. *crepidifolius*	NE
Oleaceae	*Chionanthus foveolatus* subsp. *foveolatus*	LC	Fabaceae	*Indigastrum parviflorum* subsp. *parviflorum* var. *parviflorum*	NE	Asteraceae	*Senecio erubescens* var. *erubescens*	NE
Gentianaceae	*Chironia palustris* subsp. *palustris*	LC	Fabaceae	*Indigofera adenoides*	LC	Asteraceae	*Senecio gerrardii*	LC
Gentianaceae	*Chironia palustris* subsp. *transvaalensis*	LC	Fabaceae	*Indigofera alternans* var. *alternans*	LC	Asteraceae	*Senecio glanduloso-pilosus*	LC
Gentianaceae	*Chironia purpurascens* subsp. *humilis*	LC	Fabaceae	*Indigofera arrecta*	LC	Asteraceae	*Senecio gregatus*	LC
Poaceae	*Chloris gayana*	LC	Fabaceae	*Indigofera atrata*	LC	Asteraceae	*Senecio harveianus*	LC
Poaceae	*Chloris pycnothrix*	LC	Fabaceae	*Indigofera circinnata*	LC	Asteraceae	*Senecio hieracioides*	LC
Poaceae	***Chloris virgata*** [bcefgh]	**LC**	**Fabaceae**	***Indigofera comosa*** [bh]	**LC**	Asteraceae	*Senecio inaequidens*	LC
Agavaceae	*Chlorophytum bowkeri*	LC	Fabaceae	*Indigofera confusa*	LC	Asteraceae	*Senecio inornatus*	LC
Agavaceae	***Chlorophytum cooperi*** [g]	**LC**	Fabaceae	*Indigofera cryptantha* var. *cryptantha*	LC	Asteraceae	*Senecio isatideus*	LC
Agavaceae	*Chlorophytum fasciculatum*	LC	Fabaceae	*Indigofera daleoides*	LC	Asteraceae	*Senecio laevigatus* var. *integrifolius*	LC
Agavaceae	***Chlorophytum galpinii* var. *galpinii*** [g]	**LC**	Fabaceae	*Indigofera daleoides* var. *daleoides*	NE	Asteraceae	*Senecio laevigatus* var. *laevigatus*	LC
Agavaceae	*Chlorophytum krookianum*	LC	**Fabaceae**	***Indigofera delagoaensis*** [fg]	**LC**	Asteraceae	*Senecio latifolius*	LC
Agavaceae	*Chlorophytum recurvifolium*	LC	Fabaceae	*Indigofera dimidiata*	LC	Asteraceae	*Senecio lydenburgensis*	LC
Agavaceae	*Chlorophytum transvaalense*	LC	Fabaceae	*Indigofera egens*	LC	Asteraceae	*Senecio lygodes*	
Agavaceae	*Chlorophytum trichophlebium*	LC	Fabaceae	*Indigofera filipes*	LC	Asteraceae	*Senecio matricariifolius*	LC
Apiaceae	*Choritaenia capensis*	LC	Fabaceae	*Indigofera frondosa*	LC	Asteraceae	*Senecio orbicularis*	
Thelypteridaceae	*Christella dentata*	LC	Fabaceae	*Indigofera glaucescens*	LC	Asteraceae	*Senecio othonniflorus*	LC
Thelypteridaceae	*Christella gueintziana*		Fabaceae	*Indigofera hedyantha*	LC	Asteraceae	*Senecio oxyriifolius*	LC
Asteraceae	*Chrysanthellum indicum*	NE	Fabaceae	*Indigofera heterotricha*	LC	Asteraceae	*Senecio oxyriifolius* subsp. *oxyriifolius*	
Asteraceae	*Chrysocoma ciliata*	LC	Fabaceae	*Indigofera hilaris*		Asteraceae	*Senecio pentactinus*	LC
Poaceae	*Chrysopogon serrulatus*	LC	**Fabaceae**	***Indigofera hilaris* var. *hilaris*** [bfgh]	**LC**	Asteraceae	*Senecio pleistocephalus*	LC
Asteraceae	*Cichorium intybus* subsp. *intybus*	NE	Fabaceae	*Indigofera hochstetteri* subsp. *streyana*	LC	Asteraceae	*Senecio pterophorus*	LC
Asteraceae	*Cineraria albicans*	LC	**Fabaceae**	***Indigofera holubii*** [fg]	**LC**	Asteraceae	*Senecio purpureus*	LC
Asteraceae	*Cineraria alchemilloides*		Fabaceae	*~Indigofera hybrida*	VU	Asteraceae	*Senecio retrorsus*	LC
Asteraceae	*~Cineraria alchemilloides* subsp. *alchemilloides*	Rare	Fabaceae	*~Indigofera leendertziae*	DDT	Asteraceae	*Senecio rhomboideus*	LC
Asteraceae	*Cineraria aspera*	LC	Fabaceae	*Indigofera melanadenia*	LC	Asteraceae	*Senecio ruwenzoriensis*	LC
Asteraceae	*~*Cineraria austrotransvaalensis*	NT	Fabaceae	*Indigofera mollicoma*	LC	Asteraceae	*Senecio scitus*	LC
Asteraceae	*Cineraria burkei*		Fabaceae	*Indigofera nebrowniana*	LC	Asteraceae	*Senecio serratuloides*	LC

Asteraceae	*Cineraria lobata* subsp. *lobata*	LC	Fabaceae	*Indigofera ormocarpoides*	LC	Asteraceae	*Senecio striatifolius*	LC
Asteraceae	*Cineraria parvifolia*	LC	Fabaceae	*Indigofera oxalidea*	LC	Asteraceae	*Senecio subcoriaceus*	LC
Asteraceae	*Cirsium vulgare* (NEM:BA)	NE	**Fabaceae**	***Indigofera oxytropis*** [ef]	**LC**	Asteraceae	*Senecio urophyllus*	LC
Vitaceae	*Cissus cactiformis*	LC	Fabaceae	*Indigofera praticola*	LC	Asteraceae	*Senecio venosus*	LC
Vitaceae	*Cissus quadrangularis*		Fabaceae	*Indigofera rostrata*	LC	Fabaceae	*Senegalia ataxacantha*	LC
Cucurbitaceae	*Citrullus lanatus*	LC	Fabaceae	*Indigofera sanguinea*	LC	Fabaceae	*Senegalia burkei*	LC
Cyperaceae	*Cladium mariscus* subsp. *jamaicense*	LC	Fabaceae	*Indigofera setiflora*	LC	**Fabaceae**	***Senegalia caffra*** [gh]	**LC**
Ranunculaceae	***Clematis brachiata*** [bcfgh]	**LC**	Fabaceae	*Indigofera sordida*	LC	Fabaceae	*Senegalia erubescens*	LC
Ranunculaceae	*Clematis oweniae*		Fabaceae	*Indigofera spicata* var. *spicata*		Fabaceae	*Senegalia galpinii*	LC
Ranunculaceae	*Clematis villosa* subsp. *stanleyi*	LC	Fabaceae	*Indigofera subulata*		Fabaceae	*Senegalia hereroensis*	LC
Cleomaceae	*Cleome angustifolia* subsp. *petersiana*	LC	Fabaceae	*Indigofera torulosa* var. *torulosa*	LC	Fabaceae	*Senegalia mellifera*	
Cleomaceae	~**Cleome conrathii*	NT	Fabaceae	*Indigofera vicioides* subsp. *vicioides*		**Fabaceae**	***Senegalia mellifera* subsp. *detinens*** [befgh]	**LC**
Cleomaceae	*Cleome gynandra*	LC	Fabaceae	*Indigofera vicioides* var. *rogersii*	LC	Fabaceae	*Senegalia senegal* var. *leiorhachis*	LC
Cleomaceae	*Cleome hassleriana*	NE	**Fabaceae**	***Indigofera zeyheri*** [bgh]	**LC**	Fabaceae	*Senegalia senegal* var. *rostrata*	LC
Cleomaceae	*Cleome macrophylla*	LC	Convolvulaceae	*Ipomoea albivenia*	LC	Fabaceae	*Senna corymbosa*	NE
Cleomaceae	*Cleome maculata*	LC	Convolvulaceae	*Ipomoea bathycolpos*	LC	Fabaceae	*Senna italica*	
Cleomaceae	*Cleome monophylla*	LC	**Convolvulaceae**	***Ipomoea bolusiana*** [g]	**LC**	**Fabaceae**	***Senna italica* subsp. *arachoides*** [bh]	**LC**
Cleomaceae	*Cleome oxyphylla* var. *oxyphylla*	LC	Convolvulaceae	*Ipomoea cairica* var. *cairica*	LC	Fabaceae	*Senna occidentalis* (NEM:BA)	NE
Cleomaceae	*Cleome rubella*	LC	Convolvulaceae	*Ipomoea carnea* subsp. *fistulosa* (NEM:BA)	NE	Fabaceae	*Senna septemtrionalis* (NEM:BA)	NE
Lamiaceae	*Clerodendrum glabrum*		Convolvulaceae	*Ipomoea coscinosperma*	LC	Amaranthaceae	*Sericorema remotiflora*	LC
Lamiaceae	*Clerodendrum ternatum*	LC	Convolvulaceae	*Ipomoea crassipes*		Asteraceae	*Seriphium plumosum*	
Rosaceae	*Cliffortia linearifolia*	LC	Convolvulaceae	*Ipomoea crassipes* var. *crassipes*	LC	Pedaliaceae	*Sesamum alatum*	LC
Rosaceae	*Cliffortia nitidula* subsp. *pilosa*	NE	Convolvulaceae	*Ipomoea dichroa*	LC	Pedaliaceae	*Sesamum triphyllum*	
Amaryllidaceae	*Clivia miniata*		Convolvulaceae	*Ipomoea gracilisepala*	LC	Pedaliaceae	*Sesamum triphyllum* var. *triphyllum*	LC
Peraceae	*Clutia abyssinica* var. *abyssinica*	LC	Convolvulaceae	*Ipomoea holubii*	LC	Fabaceae	*Sesbania bispinosa* var. *bispinosa*	NE
Peraceae	*Clutia cordata*	LC	Convolvulaceae	*Ipomoea indica* (NEM:BA)	NE	Fabaceae	*Sesbania punicea* (NEM:BA)	NE
Peraceae	*Clutia natalensis*	LC	**Convolvulaceae**	***Ipomoea magnusiana*** [g]	**LC**	Fabaceae	*Sesbania transvaalensis*	LC
Peraceae	*Clutia pulchella*		Convolvulaceae	*Ipomoea oblongata*	LC	Poaceae	*Setaria incrassata*	LC
Peraceae	*Clutia pulchella* var. *franksiae*	LC	Convolvulaceae	*Ipomoea obscura*		Poaceae	*Setaria lindenbergiana*	LC
Peraceae	*Clutia pulchella* var. *pulchella*	LC	**Convolvulaceae**	***Ipomoea obscura* var. *obscura*** [bh]	**LC**	Poaceae	*Setaria megaphylla*	LC
Cucurbitaceae	*Coccinia adoensis*	LC	Convolvulaceae	*Ipomoea oenotherae* var. *oenotherae*	LC	Poaceae	*Setaria nigrirostris*	LC
Cucurbitaceae	*Coccinia hirtella*	LC	Convolvulaceae	*Ipomoea ommanneyi*	LC	Poaceae	*Setaria plicatilis*	LC
Cucurbitaceae	*Coccinia rehmannii*	LC	Convolvulaceae	*Ipomoea papilio*	LC	Poaceae	*Setaria pumila*	LC
Cucurbitaceae	*Coccinia sessilifolia*	LC	Convolvulaceae	*Ipomoea purpurea* (NEM:BA)	NE	Poaceae	*Setaria sphacelata*	
Cucurbitaceae	*Coccinia sessilifolia* var. *sessilifolia*		Convolvulaceae	*Ipomoea simplex*	LC	Poaceae	*Setaria sphacelata* var. *sericea*	LC

Colchicaceae	*Colchicum melanthioides* subsp. *melanthioides*		Convolvulaceae	*Ipomoea transvaalensis*	LC	Poaceae	*Setaria sphacelata* var. *sphacelata*	LC
Cyperaceae	*Coleochloa setifera*	LC	Convolvulaceae	*Ipomoea wightii* var. *wightii*	LC	**Poaceae**	***Setaria sphacelata* var. *torta***[bgh]	**LC**
Lamiaceae	*Coleus hadiensis*		Iridaceae	*Iris pseudacorus* (NEM:BA)		Poaceae	*Setaria verticillata*	LC
Lamiaceae	*Coleus neochilus*		Poaceae	*Ischaemum afrum*	LC	Malvaceae	*Sida alba*	LC
Araceae	*Colocasia esculenta*		Poaceae	*Ischaemum fasciculatum*	LC	**Malvaceae**	***Sida chrysantha***[bcf]	**LC**
Combretaceae	*Combretum apiculatum*		Acanthaceae	*Isoglossa glandulosissima*		Malvaceae	*Sida cordifolia*	
Combretaceae	*Combretum apiculatum* subsp. *apiculatum*	LC	Acanthaceae	*Isoglossa grantii*	LC	**Malvaceae**	***Sida cordifolia* subsp. *cordifolia***[f]	**LC**
Combretaceae	*Combretum erythrophyllum*	LC	Acanthaceae	*Isoglossa origanoides*	LC	**Malvaceae**	***Sida dregei***[bcefh]	**LC**
Combretaceae	*Combretum hereroense*		Cyperaceae	*Isolepis cernua* var. *cernua*	LC	Malvaceae	*Sida pseudocordifolia*	LC
Combretaceae	***Combretum hereroense* subsp. *hereroense***[f]		Cyperaceae	*Isolepis costata*	LC	**Malvaceae**	***Sida rhombifolia***[c]	
Combretaceae	**Combretum imberbe*	LC	Cyperaceae	*Isolepis fluitans* var. *fluitans*	LC	Malvaceae	*Sida rhombifolia* subsp. *rhombifolia*	LC
Combretaceae	*Combretum kraussii*	LC	Cyperaceae	*Isolepis sepulcralis*	LC	Malvaceae	*Sida spinosa* var. *spinosa*	LC
Combretaceae	*Combretum molle*	LC	Pylaisiadelphaceae	*Isopterygium leucophanes*		Malvaceae	*Sida ternata*	LC
Combretaceae	*Combretum zeyheri*	LC	Pylaisiadelphaceae	*Isopterygium leucopsis*		Caryophyllaceae	*Silene burchellii* subsp. *modesta*	LC
Commelinaceae	*Commelina africana*		Pylaisiadelphaceae	*Isopterygium punctulatum*		Caryophyllaceae	*Silene burchellii* subsp. *pilosellifolia*	LC
Commelinaceae	*Commelina africana* var. *africana*	LC	Bignoniaceae	*Jacaranda mimosifolia* (NEM:BA)	NE	Caryophyllaceae	*Silene gallica*	NE
Commelinaceae	*Commelina africana* var. *barberae*	LC	Scrophulariaceae	*Jamesbrittenia atropurpurea* subsp. *atropurpurea*	LC	Caryophyllaceae	*Silene undulata*	
Commelinaceae	***Commelina africana* var. *krebsiana***[bfgh]	**LC**	Scrophulariaceae	*Jamesbrittenia aurantiaca*	LC	Caryophyllaceae	*Silene undulata* subsp. *undulata*	LC
Commelinaceae	*Commelina africana* var. *lancispatha*	LC	Scrophulariaceae	*Jamesbrittenia burkeana*	LC	Brassicaceae	*Sisymbrium burchellii* var. *burchellii*	LC
Commelinaceae	~**Commelina bella*	DDT	Scrophulariaceae	*Jamesbrittenia grandiflora*	LC	Brassicaceae	*Sisymbrium officinale*	NE
Commelinaceae	***Commelina benghalensis***[fg]	**LC**	Scrophulariaceae	*Jamesbrittenia montana*	LC	Brassicaceae	*Sisymbrium orientale*	NE
Commelinaceae	*Commelina diffusa* subsp. *scandens*	LC	Oleaceae	*Jasminum angulare*	LC	Apocynaceae	*Sisyranthus randii*	LC
Commelinaceae	*Commelina eckloniana*	LC	Oleaceae	*Jasminum breviflorum*	LC	Apiaceae	*Sium repandum*	
Commelinaceae	*Commelina erecta*	LC	Oleaceae	*Jasminum multipartitum*	LC	Solanaceae	*Solanum aculeatissimum*	NE
Commelinaceae	*Commelina imberbis*	LC	Oleaceae	*Jasminum quinatum*	LC	Solanaceae	*Solanum americanum*	NE
Commelinaceae	*Commelina livingstonii*	LC	Euphorbiaceae	*Jatropha curcas* (NEM:BA)	NE	**Solanaceae**	***Solanum campylacanthum***[bcdfgh]	
Commelinaceae	*Commelina modesta*	LC	Euphorbiaceae	*Jatropha schlechteri* subsp. *setifera*	LC	Solanaceae	*Solanum campylacanthum* subsp. *campylacanthum*	
Commelinaceae	*Commelina subulata*	LC	Euphorbiaceae	*Jatropha zeyheri*	LC	Solanaceae	*Solanum campylacanthum* subsp. *panduriforme*	LC
Nyctaginaceae	*Commicarpus pentandrus*	LC	Juncaceae	*Juncus dregeanus* subsp. *dregeanus*	LC	Solanaceae	*Solanum capense*	LC
Nyctaginaceae	*Commicarpus plumbagineus* var. *plumbagineus*	LC	Juncaceae	*Juncus effusus*	LC	Solanaceae	*Solanum catombelense*	LC
Burseraceae	*Commiphora angolensis*	LC	Juncaceae	*Juncus exsertus*	LC	Solanaceae	*Solanum chenopodioides*	NE
Burseraceae	*Commiphora glandulosa*	LC	Juncaceae	*Juncus lomatophyllus*	LC	Solanaceae	*Solanum coccineum*	

Burseraceae	*Commiphora mollis*	LC	Juncaceae	*Juncus oxycarpus*	LC	**Solanaceae**	***Solanum elaeagnifolium*** (NEM:BA)[bh]	**NE**
Burseraceae	*Commiphora neglecta*	LC	Juncaceae	*Juncus punctorius*	LC	Solanaceae	*Solanum giganteum*	LC
Burseraceae	*Commiphora pyracanthoides*	LC	Juncaceae	*Juncus rigidus*	LC	**Solanaceae**	***Solanum lichtensteinii***[bcfgh]	**LC**
Burseraceae	*Commiphora schimperi*	LC	Acanthaceae	*Justicia anagalloides*	LC	Solanaceae	*Solanum mauritianum* (NEM:BA)	NE
Apiaceae	*Conium chaerophylloides*	LC	Acanthaceae	*Justicia betonica*	LC	Solanaceae	*Solanum melongena*	
Convolvulaceae	*Convolvulus aschersonii*	LC	**Acanthaceae**	***Justicia flava***[g]	**LC**	Solanaceae	*Solanum nigrum*	NE
Convolvulaceae	*Convolvulus farinosus*	LC	Acanthaceae	*Justicia heterocarpa* subsp. *dinteri*	LC	Solanaceae	*Solanum panduriforme*	
Convolvulaceae	*Convolvulus multifidus*	LC	Acanthaceae	*Justicia odora*	LC	Solanaceae	*Solanum pseudocapsicum* (NEM:BA)	NE
Convolvulaceae	*Convolvulus ocellatus* var. *ocellatus*	LC	Acanthaceae	*Justicia orchioides* subsp. *glabrata*	LC	Solanaceae	*Solanum retroflexum*	LC
Convolvulaceae	***Convolvulus sagittatus***[h]	**LC**	Acanthaceae	*Justicia protracta* subsp. *rhodesiana*	LC	Solanaceae	*Solanum rigescens*	NE
Convolvulaceae	*Convolvulus thunbergii*	LC	Acanthaceae	*Justicia rhodesiana*		Solanaceae	*Solanum rubetorum*	LC
Asteraceae	*Conyza aegyptiaca*		Crassulaceae	*Kalanchoe delagoensis*		Solanaceae	*Solanum seaforthianum* (NEM:BA)	
Asteraceae	*Conyza bonariensis*	NE	**Crassulaceae**	***Kalanchoe lanceolata***[g]	**LC**	Solanaceae	*Solanum seaforthianum* var. *disjunctum*	NE
Asteraceae	*Conyza canadensis*	NE	Crassulaceae	*Kalanchoe paniculata*	LC	**Solanaceae**	***Solanum sisymbriifolium*** (NEM:BA)[c]	**NE**
Asteraceae	*Conyza chilensis*	NE	Crassulaceae	*Kalanchoe rotundifolia*	LC	Solanaceae	*Solanum viarum*	NE
Asteraceae	*Conyza podocephala*		Crassulaceae	*Kalanchoe thyrsiflora*	LC	Asteraceae	*Sonchus asper* subsp. *asper*	NE
Asteraceae	*Conyza scabrida*		Cucurbitaceae	*Kedrostis africana*	LC	Asteraceae	*Sonchus dregeanus*	LC
Asteraceae	*Conyza ulmifolia*		Cucurbitaceae	*Kedrostis foetidissima*	LC	Asteraceae	*Sonchus friesii* var. *friesii*	LC
Rubiaceae	*Coptosperma supra-axillare*	LC	Cucurbitaceae	*Kedrostis hirtella*		Asteraceae	*Sonchus integrifolius* var. *integrifolius*	LC
Corbichoniaceae	***Corbichonia decumbens***[bfg]	**LC**	Rubiaceae	*Keetia gueinzii*	LC	Asteraceae	*Sonchus nanus*	LC
Malvaceae	*Corchorus argillicola*		Aizoaceae	*Khadia acutipetala*	LC	Asteraceae	*Sonchus oleraceus*	NE
Malvaceae	***Corchorus asplenifolius***[bcfgh]	**LC**	Bignoniaceae	*Kigelia africana*	LC	Asteraceae	*Sonchus wilmsii*	LC
Malvaceae	*Corchorus aspleniifolius*		Achariaceae	*Kiggelaria africana*	LC	Orobanchaceae	*Sopubia cana* var. *cana*	LC
Malvaceae	*Corchorus confusus*	LC	Kirkiaceae	*Kirkia wilmsii*	LC	Orobanchaceae	*Sopubia cana* var. *glabrescens*	LC
Malvaceae	***Corchorus kirkii***[fg]	**LC**	**Asteraceae**	***Kleinia longiflora***[g]	**LC**	Poaceae	*Sorghum bicolor*	
Malvaceae	*Corchorus schimperi*	LC	Asphodelaceae	*Kniphofia ensifolia* subsp. *ensifolia*	LC	Poaceae	*Sorghum bicolor* subsp. *arundinaceum*	LC
Malvaceae	*Corchorus tridens*	NE	Asphodelaceae	*Kniphofia porphyrantha*	LC	Poaceae	*Sorghum bicolor* subsp. *drummondii*	LC
Malvaceae	*Corchorus trilocularis*	NE	Asphodelaceae	~*Kniphofia typhoides	NT	Poaceae	*Sorghum halepense* (NEM:BA)	NE
Boraginaceae	*Cordia caffra*	LC	Poaceae	*Koeleria capensis*	LC	Poaceae	*Sorghum versicolor*	LC
Rubiaceae	***Cordylostigma longifolium***[gh]	**LC**	Rubiaceae	*Kohautia amatymbica*	LC	Bignoniaceae	*Spathodea campanulata* (NEM:BA)	
Asteraceae	*Coreopsis lanceolata* (NEM:BA)	NE	Rubiaceae	*Kohautia caespitosa* subsp. *brachyloba*	LC	Rubiaceae	*Spermacoce natalensis*	LC
Brassicaceae	*Coronopus integrifolius*	NE	Rubiaceae	*Kohautia cynanchica*	LC	Rubiaceae	*Spermacoce senensis*	LC
Caryophyllaceae	*Corrigiola litoralis* subsp. *litoralis* var. *litoralis*	NE	Cyperaceae	*Kyllinga alata*	LC	Sphagnaceae	*Sphagnum capense*	
Poaceae	*Cortaderia selloana* (NEM:BA)	NE	Cyperaceae	*Kyllinga alba*	LC	Sphagnaceae	*Sphagnum truncatum*	

Rosaceae	*Cotoneaster pannosus* (NEM:BA)	NE	Cyperaceae	*Kyllinga erecta* var. *erecta*	LC	Malpighiaceae	*Sphedamnocarpus pruriens*	
Asteraceae	*Cotula anthemoides*	LC	Cyperaceae	*Kyllinga melanosperma*	LC	Malpighiaceae	*Sphedamnocarpus pruriens* subsp. *galphimiifolius*	LC
Asteraceae	*Cotula australis*	LC	Fabaceae	*Lablab purpureus* subsp. *uncinatus*	LC	Malpighiaceae	*Sphedamnocarpus pruriens* subsp. *pruriens*	LC
Asteraceae	*Cotula hispida*	LC	Asteraceae	*Lactuca inermis*	LC	Fabaceae	*Sphenostylis angustifolia*	LC
Asteraceae	*Cotula nigellifolia* var. *nigellifolia*	LC	Hydrocharitaceae	*Lagarosiphon major*	LC	Araceae	*Spirodela punctata*	LC
Crassulaceae	*Cotyledon orbiculata* var. *ausana*		Hydrocharitaceae	*Lagarosiphon muscoides*	LC	**Euphorbiaceae**	***Spirostachys africana**[g]	**LC**
Crassulaceae	*Cotyledon orbiculata* var. *oblonga*	LC	Cucurbitaceae	*Lagenaria siceraria*	LC	Poaceae	*Sporobolus africanus*	LC
Acanthaceae	***Crabbea angustifolia***[fg]	**LC**	Asteraceae	*Laggera crispata*	LC	Poaceae	*Sporobolus centrifugus*	LC
Acanthaceae	***Crabbea hirsuta***[g]	**LC**	Asteraceae	*Laggera decurrens*	LC	Poaceae	*Sporobolus congoensis*	LC
Acanthaceae	*Crabbea ovalifolia*	LC	Anacardiaceae	*Lannea discolor*	LC	Poaceae	*Sporobolus conrathii*	LC
Asteraceae	*Crassocephalum ï¿½ picridifolium*		Anacardiaceae	*Lannea edulis*		Poaceae	*Sporobolus discosporus*	LC
Crassulaceae	*Crassula alba* var. *alba*	NE	Anacardiaceae	*Lannea edulis* var. *edulis*	LC	Poaceae	*Sporobolus festivus*	LC
Crassulaceae	*Crassula capitella*		Verbenaceae	*Lantana camara*	NE	Poaceae	*Sporobolus fimbriatus*	LC
Crassulaceae	~*Crassula cymbiformis*	Critically Rare	Verbenaceae	*Lantana rugosa*	LC	Poaceae	*Sporobolus ioclados*	LC
Crassulaceae	*Crassula expansa* subsp. *expansa*	LC	Thymelaeaceae	*Lasiosiphon caffer*	LC	Poaceae	*Sporobolus natalensis*	LC
Crassulaceae	*Crassula lanceolata* subsp. *lanceolata*	LC	Thymelaeaceae	*Lasiosiphon canoargenteus*	LC	Poaceae	*Sporobolus nitens*	LC
Crassulaceae	*Crassula lanceolata* subsp. *transvaalensis*	LC	Thymelaeaceae	*Lasiosiphon capitatus*	LC	Poaceae	*Sporobolus panicoides*	LC
Crassulaceae	*Crassula natans* var. *natans*	LC	Thymelaeaceae	*Lasiosiphon kraussianus*		Poaceae	*Sporobolus pectinatus*	LC
Crassulaceae	*Crassula nodulosa* var. *nodulosa* forma. *nodulosa*		Thymelaeaceae	*Lasiosiphon microcephalus*		Poaceae	*Sporobolus pyramidalis*	LC
Crassulaceae	*Crassula obovata* var. *obovata*	LC	Thymelaeaceae	*Lasiosiphon polycephalus*	LC	Poaceae	*Sporobolus stapfianus*	LC
Crassulaceae	*Crassula setulosa*	LC	Thymelaeaceae	*Lasiosiphon sericocephalus*	LC	Brachytheciaceae	*Squamidium brasiliense*	
Crassulaceae	*Crassula setulosa* var. *jenkinsii*	NE	Thymelaeaceae	*Lasiosiphon splendens*	LC	Lamiaceae	*Stachys hyssopoides*	LC
Crassulaceae	*Crassula setulosa* var. *setulosa* forma. *setulosa*		Asteraceae	*Lasiospermum bipinnatum*	LC	Lamiaceae	*Stachys natalensis* var. *galpinii*	LC
Crassulaceae	*Crassula swaziensis*	LC	Asteraceae	*Launaea rarifolia* var. *rarifolia*	LC	Lamiaceae	*Stachys natalensis* var. *natalensis*	LC
Crassulaceae	*Crassula swaziensis* var. *swaziensis* forma. *swaziensis*		Haloragaceae	*Laurembergia repens* subsp. *brachypoda*	LC	Lamiaceae	*Stachys spathulata*	LC
Crassulaceae	*Crassula vaginata* subsp. *vaginata*	LC	Asparagaceae	*Ledebouria atrobrunnea	LC	Apocynaceae	*Stapelia gigantea*	LC
Linderniaceae	*Craterostigma plantagineum*	LC	Asparagaceae	*Ledebouria burkei*		Apocynaceae	*Stapelia leendertziae*	LC
Linderniaceae	*Craterostigma wilmsii*	LC	Asparagaceae	*Ledebouria confusa	LC	Caryophyllaceae	*Stellaria pallida*	NE
Asteraceae	*Crepis hypochaeridea*	NE	Asparagaceae	*Ledebouria cooperi*	LC	Apocynaceae	*Stenostelma capense*	LC
Amaryllidaceae	*Crinum graminicola*	LC	Asparagaceae	*Ledebouria inquinata*	LC	Apocynaceae	*Stenostelma corniculatum*	LC
Amaryllidaceae	*Crinum lugardiae*	LC	Asparagaceae	*Ledebouria leptophylla*	LC	Apocynaceae	~*Stenostelma umbelluliferum	NT
Amaryllidaceae	*Crinum macowanii*	LC	**Asparagaceae**	***Ledebouria luteola***[gh]	**LC**	Malvaceae	*Sterculia rogersii*	LC
Amaryllidaceae	*Crinum paludosum*	LC	**Asparagaceae**	***Ledebouria marginata***[h]	**LC**	Stereophyllaceae	*Stereophyllum natalense*	
Acanthaceae	*Crossandra fruticulosa*	LC	Asparagaceae	*Ledebouria ovatifolia*		Poaceae	*Stiburus alopecuroides*	LC

Acanthaceae	*Crossandra greenstockii*	LC	Asparagaceae	*Ledebouria papillata*	LC	Poaceae	*Stipa dregeana* var. *elongata*	LC
Fabaceae	*Crotalaria barkae* subsp. *barkae*	LC	Asparagaceae	*Ledebouria revoluta*	LC	Poaceae	*Stipagrostis uniplumis* var. *neesii*	LC
Fabaceae	*Crotalaria distans* subsp. *distans*	LC	Poaceae	*Leersia hexandra*	LC	Poaceae	*Stipagrostis uniplumis* var. *uniplumis*	LC
Fabaceae	*Crotalaria distans* subsp. *mediocris*	LC	Araceae	*Lemna gibba*	LC	Poaceae	*Stipagrostis zeyheri* subsp. *sericans*	LC
Fabaceae	*Crotalaria eremicola* subsp. *eremicola*	LC	Fabaceae	*~Leobordea adpressa* subsp. *leptantha*	DDT	Asteraceae	*Stoebe plumosa*	LC
Fabaceae	*Crotalaria laburnifolia* subsp. *australis*	LC	Fabaceae	*Leobordea carinata*	LC	Asteraceae	*Stoebe vulgaris*	
Fabaceae	***Crotalaria lotoides*** **[bcgh]**	**LC**	Fabaceae	*Leobordea corymbosa*	LC	Apocynaceae	*Stomatostemma monteiroae*	LC
Fabaceae	*Crotalaria magaliesbergensis*	LC	**Fabaceae**	***Leobordea divaricata*** **[g]**	**LC**	Strelitziaceae	*Strelitzia nicolai*	LC
Fabaceae	*Crotalaria obscura*	LC	Fabaceae	*Leobordea eriantha*	LC	Strelitziaceae	*Strelitzia reginae*	
Fabaceae	***Crotalaria sphaerocarpa*** **subsp.** ***sphaerocarpa*** **[d]**	**LC**	Fabaceae	*Leobordea foliosa*	LC	Gesneriaceae	*Streptocarpus vandeleurii*	LC
Fabaceae	*Crotalaria virgulata* subsp. *grantiana*	LC	Fabaceae	*Leobordea hirsuta*	LC	Orobanchaceae	*Striga asiatica*	LC
Euphorbiaceae	*Croton gratissimus*		Fabaceae	*Leobordea mucronata*		Orobanchaceae	*Striga bilabiata*	
Euphorbiaceae	*Croton gratissimus* var. *gratissimus*	LC	Fabaceae	*Leobordea pulchra*	LC	Orobanchaceae	*Striga bilabiata* subsp. *bilabiata*	LC
Euphorbiaceae	*Croton gratissimus* var. *subgratissimus*	LC	**Lamiaceae**	***Leonotis glabrata*** **var.** ***glabrata*** **[b]**	**LC**	Orobanchaceae	*Striga elegans*	LC
Apocynaceae	*Cryptolepis cryptolepioides*		Lamiaceae	*Leonotis leonurus*	LC	Orobanchaceae	*Striga forbesii*	LC
Apocynaceae	*Cryptolepis oblongifolia*	LC	Lamiaceae	*Leonotis martinicensis*	LC	Orobanchaceae	*Striga gesnerioides*	LC
Asteraceae	*Crystallopollen angustifolium*		Lamiaceae	*Leonotis nepetifolia*	LC	Loganiaceae	*Strychnos madagascariensis*	LC
Cucurbitaceae	*Cucumis africanus*	LC	Lamiaceae	*Leonotis nepetifolia* var. *nepetifolia*		Loganiaceae	*Strychnos pungens*	LC
Cucurbitaceae	*Cucumis anguria* var. *longaculeatus*	LC	Lamiaceae	*Leonotis ocymifolia*	LC	Loganiaceae	*Strychnos usambarensis*	LC
Cucurbitaceae	*Cucumis heptadactylus*	LC	Lamiaceae	*Leonotis ocymifolia* var. *raineriana*		Fabaceae	*Stylosanthes fruticosa*	LC
Cucurbitaceae	*Cucumis hirsutus*	LC	Lamiaceae	*Leonotis ocymifolia* var. *schinzii*		Scrophulariaceae	*Sutera burkeana*	
Cucurbitaceae	*Cucumis melo* subsp. *melo*	LC	Lamiaceae	*Leonotis pentadentata*	LC	Scrophulariaceae	*Sutera griquensis*	LC
Cucurbitaceae	*Cucumis melo* var. *agrestis*		Lamiaceae	*Leonotis randii*	LC	Pallaviciniaceae	*Symphyogyna brasiliensis*	
Cucurbitaceae	*Cucumis metuliferus*	LC	Lamiaceae	*Leonotis sexdentata*	LC	Pallaviciniaceae	*Symphyogyna podophylla*	
Cucurbitaceae	*Cucumis myriocarpus* subsp. *myriocarpus*	LC	Brassicaceae	*Lepidium africanum* subsp. *africanum*	LC	Lamiaceae	*Syncolostemon canescens*	LC
Cucurbitaceae	*Cucumis prophetarum* subsp. *zeyheri*		Brassicaceae	*Lepidium africanum* subsp. *divaricatum*	LC	Lamiaceae	*Syncolostemon elliottii*	LC
Cucurbitaceae	*Cucumis zeyheri*	LC	Brassicaceae	*Lepidium bonariense*	NE	Lamiaceae	*Syncolostemon pretoriae*	LC
Fabaceae	*~Cullen holubii*	VU	Brassicaceae	*Lepidium transvaalense*	LC	Pottiaceae	*Syntrichia ammonsiana*	
Cupressaceae	*Cupressus arizonica* var. *arizonica*	NE	Polypodiaceae	*Lepisorus schraderi*	LC	Pottiaceae	*Syntrichia laevipila*	
Convolvulaceae	*Cuscuta campestris* (NEM:BA)	NE	Poaceae	*Leptochloa eleusine*	LC	Pottiaceae	*Syntrichia pagorum*	
Araliaceae	*Cussonia paniculata*		Poaceae	*Leptochloa fusca*	LC	Myrtaceae	*Syzygium guineense* subsp. *guineense*	LC
Araliaceae	*Cussonia paniculata* subsp. *paniculata*	LC	Leptodontaceae	*Leptodon smithii*		Apocynaceae	*Tabernaemontana elegans*	LC
Araliaceae	*Cussonia paniculata* subsp. *sinuata*	LC	Myrtaceae	*Leptospermum laevigatum* (NEM:BA)	NE	**Asteraceae**	***Tagetes minuta*** **[bcdfgh]**	**NE**
Araliaceae	*Cussonia spicata*	LC	Fabaceae	*Lespedeza cuneata*	NE	Talinaceae	*Talinum arnotii*	LC

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Araliaceae	*Cussonia transvaalensis*	LC	Fabaceae	*Lessertia depressa*	LC	Talinaceae	*Talinum caffrum*	LC
Commelinaceae	*Cyanotis lapidosa*	LC	Fabaceae	*Lessertia frutescens* subsp. *frutescens*	LC	Talinaceae	*Talinum paniculatum*	LC
Commelinaceae	*Cyanotis speciosa*	LC	Fabaceae	*Lessertia frutescens* subsp. *microphylla*	LC	Tamaricaceae	*Tamarix ramosissima* (NEM:BA)	NE
Cyatheaceae	*Cyathea dregei*		Fabaceae	*Lessertia pauciflora* var. *pauciflora*	LC	Loranthaceae	*Tapinanthus natalitius* subsp. *zeyheri*	
Amaranthaceae	*Cyathula cylindrica* var. *cylindrica*	LC	Fabaceae	*Lessertia perennans* var. *perennans*	NE	Loranthaceae	*Tapinanthus oleifolius*	LC
Amaranthaceae	*Cyathula lanceolata*	LC	Fabaceae	*Lessertia perennans* var. *polystachya*	NE	Loranthaceae	*Tapinanthus quequensis*	LC
Amaranthaceae	*Cyathula uncinulata*	LC	Fabaceae	*Lessertia stricta*	LC	Loranthaceae	*Tapinanthus rubromarginatus*	LC
Pilotrichaceae	*Cyclodictyon vallis-gratiae*		Fabaceae	*Leucaena leucocephala* subsp. *leucocephala*	NE	Fabaceae	*Tara spinosa*	
Apiaceae	*Cyclospermum leptophyllum*		Lamiaceae	*Leucas capensis*		**Asteraceae**	***Tarchonanthus camphoratus***[bfg]	**LC**
Orobanchaceae	*Cycnium adonense*	LC	Lamiaceae	*Leucas glabrata* var. *glabrata*		Asteraceae	*Tarchonanthus parvicapitulatus*	LC
Orobanchaceae	*Cycnium tubulosum* subsp. *tubulosum*	LC	Lamiaceae	*Leucas martinicensis*		Targioniaceae	*Targionia hypophylla*	
Poaceae	***Cymbopogon caesius***[bcefgh]	**LC**	Rosaceae	*Leucosidea sericea*	LC	Poaceae	*Tarigidia aequiglumis*	LC
Poaceae	*Cymbopogon excavatus*		Proteaceae	*~Leucospermum saxosum*	EN	Bignoniaceae	*Tecoma stans* (NEM:BA)	
Poaceae	*Cymbopogon marginatus*	LC	Oleaceae	*Ligustrum japonicum* (NEM:BA)	NE	Bignoniaceae	*Tecoma stans* var. *stans*	NE
Poaceae	*Cymbopogon nardus*	LC	Oleaceae	*Ligustrum sinense* (NEM:BA)	NE	Fabaceae	*Tephrosia acaciifolia*	LC
Poaceae	*Cymbopogon pospischilii*	NE	Limeaceae	*Limeum fenestratum* var. *fenestratum*	LC	Fabaceae	*Tephrosia burchellii*	LC
Poaceae	*Cymbopogon prolixus*	LC	Limeaceae	*Limeum pauciflorum*	LC	Fabaceae	*Tephrosia capensis* var. *capensis*	LC
Poaceae	*Cymbopogon validus*		**Limeaceae**	***Limeum sulcatum* var. *sulcatum***[h]	**LC**	Fabaceae	*Tephrosia elongata* var. *elongata*	LC
Apocynaceae	*Cynanchum ellipticum*	LC	Limeaceae	*Limeum viscosum* subsp. *transvaalense*	LC	**Fabaceae**	***Tephrosia longipes***[h]	
Apocynaceae	*Cynanchum viminale*		Limeaceae	*Limeum viscosum* subsp. *viscosum* var. *glomeratum*	NE	Fabaceae	*Tephrosia lupinifolia*	LC
Apocynaceae	*Cynanchum viminale* subsp. *viminale*	LC	Limeaceae	*Limeum viscosum* subsp. *viscosum* var. *kraussii*	NE	Fabaceae	*Tephrosia multijuga*	LC
Apocynaceae	*Cynanchum virens*	LC	Limeaceae	*Limeum viscosum* subsp. *viscosum* var. *viscosum*	NE	Fabaceae	*Tephrosia polystachya* var. *hirta*	LC
Poaceae	***Cynodon dactylon***[bdegh]	**LC**	Scrophulariaceae	*Limosella longiflora*	LC	Fabaceae	*Tephrosia purpurea* subsp. *leptostachya* var. *leptostachya*	NE
Poaceae	*Cynodon hirsutus*	LC	Scrophulariaceae	*Limosella maior*	LC	Fabaceae	*Tephrosia rhodesica* var. *evansii*	LC
Poaceae	*Cynodon transvaalensis*	LC	Leskeaceae	*Lindbergia haplocladioides*		Fabaceae	*Tephrosia rhodesica* var. *rhodesica*	LC
Boraginaceae	*Cynoglossum hispidum*	LC	Leskeaceae	*Lindbergia viridis*		Fabaceae	*Tephrosia semiglabra*	LC
Boraginaceae	*Cynoglossum lanceolatum*	LC	Linaceae	*Linum thunbergii*	LC	Fabaceae	*Tephrosia villosa* subsp. *ehrenbergiana* var. *ehrenbergiana*	NE
Orchidaceae	*Cynorkis kassneriana*	LC	Asteraceae	*Linzia glabra*	LC	Fabaceae	*Teramnus labialis* subsp. *labialis*	LC
Cyperaceae	*Cyperus albostriatus*	LC	Orchidaceae	*Liparis bowkeri*	LC	Combretaceae	*Terminalia sericea*	LC
Cyperaceae	*Cyperus articulatus*	LC	Cyperaceae	*Lipocarpha chinensis*	LC	Lamiaceae	*Tetradenia brevispicata*	LC
Cyperaceae	*Cyperus ascocapensis*		Cyperaceae	*Lipocarpha nana*	LC	**Lamiaceae**	***Teucrium trifidum***[g]	**LC**
Cyperaceae	*Cyperus austro-africanus*	LC	**Verbenaceae**	***Lippia javanica***[fgh]	**LC**	Thelypteridaceae	*Thelypteris confluens*	LC
Cyperaceae	*Cyperus capensis*	LC	Verbenaceae	*Lippia rehmannii*	LC	**Poaceae**	***Themeda triandra***[begh]	**LC**

Cyperaceae	*Cyperus congestus*	LC	Verbenaceae	*Lippia scaberrima*	LC	Santalaceae	*Thesium burkei*	
Cyperaceae	*Cyperus cristatus*		Verbenaceae	*Lippia wilmsii*	LC	Santalaceae	*Thesium costatum* var. *costatum*	LC
Cyperaceae	*Cyperus cuspidatus*	LC	Fabaceae	*Listia bainesii*	LC	Santalaceae	*Thesium costatum* var. *juniperinum*	LC
Cyperaceae	*Cyperus cyperoides* subsp. *pseudoflavus*	LC	Fabaceae	*Listia heterophylla*	LC	Santalaceae	*Thesium cytisoides*	
Cyperaceae	*Cyperus decurvatus*	LC	Aizoaceae	~**Lithops lesliei* subsp. *lesliei*	NT	Santalaceae	*Thesium deceptum*	LC
Cyperaceae	*Cyperus denudatus*	LC	Boraginaceae	*Lithospermum cinereum*	LC	Santalaceae	*Thesium goetzeanum*	LC
Cyperaceae	*Cyperus difformis*	LC	Asteraceae	*Litogyne gariepina*	LC	Santalaceae	*Thesium gracilarioides*	LC
Cyperaceae	*Cyperus dives*	LC	Campanulaceae	*Lobelia angolensis*		Santalaceae	*Thesium gracile*	LC
Cyperaceae	*Cyperus dubius* var. *dubius*		Campanulaceae	*Lobelia erinus*	LC	Santalaceae	*Thesium impeditum*	LC
Cyperaceae	*Cyperus eragrostis*	NE	Campanulaceae	*Lobelia flaccida* subsp. *mossiana*	LC	Santalaceae	*Thesium junceum*	
Cyperaceae	*Cyperus esculentus* var. *esculentus*	LC	Campanulaceae	*Lobelia thermalis*	LC	Santalaceae	*Thesium magalismontanum*	LC
Cyperaceae	*Cyperus fastigiatus*	LC	Poaceae	*Lolium multiflorum*	NE	Santalaceae	*Thesium megalocarpum*	
Cyperaceae	*Cyperus glaucophyllus*	LC	Poaceae	*Lolium perenne*	NE	Santalaceae	*Thesium multiramulosum*	LC
Cyperaceae	*Cyperus indecorus* var. *indecorus*	NE	Caprifoliaceae	*Lonicera japonica*		Santalaceae	*Thesium procerum*	LC
Cyperaceae	*Cyperus indecorus* var. *inflatus*	NE	Poaceae	*Lophacme digitata*	LC	Santalaceae	*Thesium racemosum*	LC
Cyperaceae	*Cyperus kyllingiella*	LC	Lophiocarpaceae	*Lophiocarpus tenuissimus*	LC	Santalaceae	*Thesium rasum*	LC
Cyperaceae	*Cyperus leptocladus*	LC	Asteraceae	*Lopholaena coriifolia*	LC	Santalaceae	*Thesium resedoides*	LC
Cyperaceae	*Cyperus longus* var. *tenuiflorus*	NE	Fabaceae	*Lotononis burchellii*	LC	Santalaceae	*Thesium translucens*	LC
Cyperaceae	*Cyperus margaritaceus* var. *margaritaceus*	LC	Fabaceae	*Lotononis laxa*	LC	Santalaceae	*Thesium transvaalense*	LC
Cyperaceae	*Cyperus marginatus*	LC	Fabaceae	*Lotononis macrosepala*	LC	Santalaceae	*Thesium utile*	LC
Cyperaceae	*Cyperus obtusiflorus* var. *flavissimus*	LC	Fabaceae	*Lotononis tenella*	LC	Acanthaceae	*Thunbergia amoena*	LC
Cyperaceae	*Cyperus obtusiflorus* var. *obtusiflorus*	LC	Fabaceae	*Lotus discolor* subsp. *discolor*	LC	Acanthaceae	*Thunbergia atriplicifolia*	LC
Cyperaceae	*Cyperus polystachyos* subsp. *polystachyos*		Poaceae	*Loudetia flavida*	LC	Acanthaceae	*Thunbergia neglecta*	LC
Cyperaceae	*Cyperus procerus*	LC	Poaceae	*Loudetia pedicellata*	LC	Timmiellaceae	*Timmiella pelindaba*	
Cyperaceae	*Cyperus rotundus* subsp. *rotundus*	LC	Poaceae	*Loudetia simplex*	LC	Fabaceae	*Tipuana tipu* (NEM:BA)	
Cyperaceae	*Cyperus rubicundus*	LC	Onagraceae	*Ludwigia adscendens*		Asteraceae	*Tithonia diversifolia* (NEM:BA)	NE
Cyperaceae	*Cyperus rupestris* var. *rupestris*	LC	Onagraceae	*Ludwigia adscendens* subsp. *diffusa*	LC	Asteraceae	*Tithonia rotundifolia* (NEM:BA)	NE
Cyperaceae	*Cyperus semitrifidus*	LC	Onagraceae	*Ludwigia octovalvis*	LC	Asteraceae	*Tolpis capensis*	LC
Cyperaceae	*Cyperus sexangularis*	LC	Lunulariaceae	*Lunularia cruciata*		Pottiaceae	*Tortella humilis*	
Cyperaceae	*Cyperus sphaerospermus*	LC	Solanaceae	*Lycium cinereum*	LC	Pottiaceae	*Tortella xanthocarpa*	
Cyperaceae	*Cyperus textilis*	LC	Solanaceae	*Lycium horridum*	LC	Asphodelaceae	*Trachyandra asperata* var. *basutoensis*	LC
Cyperaceae	*Cyperus turrillii*	LC	**Solanaceae**	***Lycium schizocalyx*** [bcfgh]	**LC**	Asphodelaceae	*Trachyandra asperata* var. *nataglencoensis*	LC
Cyperaceae	*Cyperus uitenhagensis*	LC	Lycopodiaceae	*Lycopodiella cernua*	LC	Asphodelaceae	*Trachyandra asperata* var. *swaziensis*	LC
Campanulaceae	*Cyphia rogersii* subsp. *rogersii*	LC	Lycopodiaceae	*Lycopodiella sarcocaulon*	LC	Asphodelaceae	*Trachyandra saltii* var. *saltii*	LC
Campanulaceae	*Cyphia rogersii* subsp. *winteri*	LC	Asteraceae	*Macledium zeyheri* subsp. *zeyheri*	LC	Asphodelaceae	*Trachyandra saltii* var. *secunda*	LC
Campanulaceae	*Cyphia stenopetala*	LC	Capparaceae	*Maerua angolensis*		Pterigynandraceae	*Trachyphyllum gastrodes*	
Amaranthaceae	***Cyphocarpa angustifolia*** [g]		Capparaceae	*Maerua angolensis* subsp. *angolensis*	LC	Poaceae	*Trachypogon spicatus*	LC

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Vitaceae	*Cyphostemma cirrhosum* subsp. *transvaalense*	LC	Capparaceae	*Maerua cafra*	LC	Commelinaceae	*Tradescantia pallida*	
Vitaceae	*Cyphostemma juttae*		Capparaceae	*Maerua juncea* subsp. *crustata*	LC	**Euphorbiaceae**	***Tragia dioica*** **[g]**	**LC**
Vitaceae	***Cyphostemma lanigerum*** **[g]**	**LC**	Aizoaceae	*Malephora thunbergii*	LC	Euphorbiaceae	*Tragia incisifolia*	LC
Vitaceae	*Cyphostemma puberulum*	LC	Malvaceae	*Malva neglecta*	NE	Euphorbiaceae	*Tragia minor*	LC
Vitaceae	*Cyphostemma sandersonii*	LC	Malvaceae	*Malva parviflora* var. *parviflora*	NE	Euphorbiaceae	*Tragia okanyua*	LC
Vitaceae	*Cyphostemma simulans*	LC	**Malvaceae**	***Malvastrum coromandelianum*** **(NEM:BA)[bh]**	**NE**	Euphorbiaceae	*~Tragia physocarpa*	DDT
Vitaceae	*Cyphostemma spinosopilosum*	LC	Aytoniaceae	*Mannia capensis*		Euphorbiaceae	*Tragia prionoides*	LC
Vitaceae	*Cyphostemma sulcatum*	LC	Scrophulariaceae	*Manulea paniculata*	LC	Euphorbiaceae	*Tragia rupestris*	LC
Vitaceae	*Cyphostemma woodii*	LC	Scrophulariaceae	*Manulea parviflora* var. *parviflora*	LC	**Poaceae**	***Tragus berteronianus*** **[bcgh]**	**LC**
Amaryllidaceae	*Cyrtanthus breviflorus*	LC	Marchantiaceae	*Marchantia debilis*		Poaceae	*Tragus koelerioides*	LC
Poaceae	*Dactyloctenium aegyptium*	LC	Marchantiaceae	*Marchantia pappeana* subsp. *pappeana*		Poaceae	*Tragus racemosus*	LC
Poaceae	***Dactyloctenium giganteum*** **[dg]**	**LC**	Marchantiaceae	*Marchantia polymorpha* subsp. *ruderalis*		Cannabaceae	*Trema orientalis*	LC
Thymelaeaceae	*Dais cotinifolia*	LC	Apocynaceae	*Marsdenia sylvestris*	LC	Bruchiaceae	*Trematodon intermedius*	
Fabaceae	*Dalbergia sissoo*	NE	Marsileaceae	*Marsilea capensis*	LC	Bruchiaceae	*Trematodon longicollis*	
Euphorbiaceae	*Dalechampia capensis*	LC	Celastraceae	*Maytenus albata*	LC	Aizoaceae	*Trianthema salsoloides* var. *salsoloides*	
Euphorbiaceae	*Dalechampia galpinii*	LC	Celastraceae	*Maytenus undata*	LC	Malpighiaceae	*Triaspis glaucophylla*	LC
Solanaceae	***Datura ferox*** **(NEM:BA)[g]**	**NE**	Fabaceae	*Medicago sativa*	NE	**Zygophyllaceae**	***Tribulus terrestris*** **[fgh]**	**LC**
Solanaceae	*Datura innoxia* (NEM:BA)		Scrophulariaceae	*Melanospermum foliosum*	LC	Meliaceae	*Trichilia dregeana*	LC
Solanaceae	*Datura inoxia*	NE	Orobanchaceae	*Melasma scabrum* var. *scabrum*	LC	Cactaceae	*Trichocereus macrogonus* var. *pachanoi*	
Solanaceae	*Datura stramonium* (NEM:BA)	NE	Malvaceae	*Melhania acuminata* var. *acuminata*	LC	Boraginaceae	*Trichodesma angustifolium*	
Apiaceae	*Daucus carota*	NE	Malvaceae	*Melhania acuminata* var. *agnosta*	LC	Boraginaceae	*Trichodesma angustifolium* subsp. *angustifolium*	LC
Fabaceae	*Decorsea galpinii*	LC	Malvaceae	*Melhania prostrata*	LC	Boraginaceae	*Trichodesma physaloides*	LC
Aizoaceae	*Delosperma herbeum*	LC	Malvaceae	*Melhania transvaalensis*	LC	Poaceae	*Tricholaena monachne*	LC
Aizoaceae	*~*Delosperma leendertziae*	NT	Meliaceae	*Melia azedarach* (NEM:BA)	NE	Poaceae	*Trichoneura grandiglumis*	LC
Asteraceae	*Denekia capensis*	LC	Poaceae	*Melica racemosa*	LC	Pottiaceae	*Trichostomum brachydontium*	
Fabaceae	*Desmodium repandum*	LC	Fabaceae	*Melilotus alba*		Fabaceae	*Trifolium africanum* var. *africanum*	NE
Fabaceae	*Desmodium tortuosum*	NE	Fabaceae	*Melilotus albus*	NE	Fabaceae	*Trifolium repens*	NE
Apiaceae	*Deverra burchellii*	LC	Fabaceae	*Melilotus indicus*	NE	Poaceae	*Tripogon minimus*	LC
Poaceae	*Diandrochloa namaquensis*	LC	Poaceae	*Melinis nerviglumis*	LC	Asteraceae	*Tripteris aghillana*	
Caryophyllaceae	*Dianthus mooiensis*	LC	Poaceae	*Melinis repens*		Asteraceae	*Tripteris aghillana* var. *aghillana*	
Caryophyllaceae	*Dianthus mooiensis* subsp. *kirkii*	NE	Poaceae	*Melinis repens* subsp. *grandiflora*	LC	Poaceae	*Triraphis andropogonoides*	LC
Caryophyllaceae	*Dianthus mooiensis* subsp. *mooiensis*		**Poaceae**	***Melinis repens*** **subsp.** ***repens*** **[bcefgh]**	**LC**	Poaceae	*Triraphis schinzii*	LC
Caryophyllaceae	*Dianthus mooiensis* subsp. *mooiensis* var. *mooiensis*	NE	Fabaceae	*Melolobium candicans*	LC	Poaceae	*Trisetopsis imberbis*	

Caryophyllaceae	*Dianthus transvaalensis*	LC	Fabaceae	*Melolobium microphyllum*	LC	Poaceae	*Tristachya biseriata*	LC
Caryophyllaceae	*Dianthus zeyheri* subsp. *zeyheri*	NE	Fabaceae	*~Melolobium subspicatum*	VU	Poaceae	*Tristachya leucothrix*	LC
Scrophulariaceae	*Diascia barberae*	LC	Oleaceae	*Menodora africana*	LC	Poaceae	*Tristachya rehmannii*	LC
Scrophulariaceae	*Diascia integerrima*	LC	Oleaceae	*Menodora heterophylla* var. *australis*	LC	Iridaceae	*Tritonia nelsonii*	LC
Scrophulariaceae	*Diascia patens*	LC	Lamiaceae	*Mentha aquatica*	LC	Malvaceae	*Triumfetta angolensis*	LC
Pedaliaceae	*Dicerocaryum eriocarpum*	LC	Lamiaceae	*Mentha longifolia* subsp. *capensis*	LC	Malvaceae	*Triumfetta annua* forma. *annua*	
Pedaliaceae	*Dicerocaryum senecioides*	LC	Lamiaceae	*Mentha longifolia* subsp. *polyadena*	LC	Malvaceae	*Triumfetta annua* forma. *piligera*	
Poaceae	***Dichanthium annulatum* var. *papillosum*[cdg]**	**LC**	Convolvulaceae	*Merremia palmata*	LC	Malvaceae	*Triumfetta pilosa*	LC
Poaceae	*Dichanthium aristatum*	NE	Convolvulaceae	*Merremia verecunda*	LC	Malvaceae	*Triumfetta pilosa* var. *effusa*	NE
Dichapetalaceae	*Dichapetalum cymosum*	LC	Metzgeriaceae	*Metzgeria furcata*		Malvaceae	*Triumfetta pilosa* var. *tomentosa*	NE
Fabaceae	*Dichilus lebeckioides*	LC	Metzgeriaceae	*Metzgeria nudifrons*		Malvaceae	*Triumfetta rhomboidea* var. *rhomboidea*	LC
Fabaceae	*Dichilus pilosus*	LC	Poaceae	*Microchloa caffra*	LC	Malvaceae	*Triumfetta sonderi*	LC
Fabaceae	*Dichilus strictus*	LC	Poaceae	*Microchloa kunthii*	LC	Cucurbitaceae	*Trochomeria debilis*	LC
Convolvulaceae	*Dichondra micrantha*	NE	Dennstaedtiaceae	*Microlepia speluncae*	LC	**Cucurbitaceae**	***Trochomeria macrocarpa* subsp. *macrocarpa*[h]**	**LC**
Asteraceae	*Dichrocephala integrifolia* subsp. *integrifolia*	LC	Mniaceae	*Mielichhoferia bryoides*		Alliaceae	*Tulbaghia acutiloba*	LC
Fabaceae	*Dichrostachys cinerea*		Phrymaceae	*Mimulus gracilis*	LC	Alliaceae	*Tulbaghia leucantha*	LC
Fabaceae	***Dichrostachys cinerea* subsp. *africana*[f]**	**LC**	Sapotaceae	*Mimusops zeyheri*	LC	Alliaceae	*Tulbaghia transvaalensis*	LC
Fabaceae	*Dichrostachys cinerea* subsp. *africana* var. *africana*	NE	Nyctaginaceae	*Mirabilis jalapa* (NEM:BA)	NE	Meliaceae	*Turraea floribunda*	LC
Acanthaceae	*Dicliptera eenii*	LC	Poaceae	*Miscanthus junceus*	LC	Meliaceae	*Turraea obtusifolia*	LC
Acanthaceae	*Dicliptera minor*		Malvaceae	*Modiola caroliniana*	NE	Apocynaceae	*~Tylophora coddii*	Rare
Acanthaceae	***Dicliptera minor* subsp. *minor*[g]**	**LC**	Anemiaceae	*Mohria caffrorum*	LC	Fabaceae	*Tylosema esculentum*	LC
Scrophulariaceae	*Diclis petiolaris*	LC	Anemiaceae	*Mohria vestita*	LC	Typhaceae	*Typha capensis*	LC
Scrophulariaceae	*Diclis rotundifolia*	LC	Molluginaceae	*Mollugo nudicaulis*		Ulmaceae	*Ulmus parvifolia*	NE
Asteraceae	*Dicoma anomala*		**Cucurbitaceae**	***Momordica balsamina*[gh]**	**LC**	Poaceae	*Urelytrum agropyroides*	LC
Asteraceae	*Dicoma anomala* subsp. *anomala*	LC	Cucurbitaceae	*Momordica cardiospermoides*	LC	Poaceae	*Urochloa brachyura*	LC
Asteraceae	*Dicoma anomala* subsp. *anomala*	LC	Acanthaceae	*Monechma debile*		**Poaceae**	***Urochloa mosambicensis*[bcdfgh]**	**LC**
Asteraceae	*Dicoma anomala* subsp. *gerrardii*	LC	Acanthaceae	*Monechma divaricatum*		Poaceae	*Urochloa oligotricha*	LC
Asteraceae	*Dicoma galpinii*	LC	Poaceae	*Monocymbium ceresiiforme*	LC	**Poaceae**	***Urochloa panicoides*[g]**	**LC**
Asteraceae	*Dicoma macrocephala*	LC	Lobeliaceae	*Monopsis decipiens*	LC	Asteraceae	*Ursinia nana*	
Asteraceae	*Dicoma tomentosa*	LC	Geraniaceae	*Monsonia angustifolia*	LC	Asteraceae	*Ursinia nana* subsp. *leptophylla*	LC
Pottiaceae	*Didymodon tophaceus*		Geraniaceae	*Monsonia attenuata*	LC	Asteraceae	*Ursinia nana* subsp. *nana*	LC
Urticaceae	*Didymodoxa caffra*	LC	Geraniaceae	*Monsonia burkeana*	LC	Asteraceae	*Ursinia tenuiloba*	LC
Iridaceae	*Dierama mossii*	LC	Geraniaceae	*Monsonia grandifolia*	LC	Lentibulariaceae	*Utricularia livida*	LC
Iridaceae	*Dietes grandiflora*	LC	Geraniaceae	*Monsonia transvaalensis*	LC	Lentibulariaceae	*Utricularia stellaris*	LC
Poaceae	*Digitaria argyrograpta*	LC	Araceae	*Monstera deliciosa*		Lentibulariaceae	*Utricularia welwitschii*	LC

Poaceae	*Digitaria brazzae*	LC	Iridaceae	*Moraea pallida*	LC	Fabaceae	_*Vachellia erioloba_	LC
Poaceae	*Digitaria ciliaris*	NE	Iridaceae	*Moraea stricta*	LC	Fabaceae	*Vachellia hebeclada* subsp. *hebeclada*	LC
Poaceae	*Digitaria diagonalis* var. *diagonalis*	LC	Myricaceae	*Morella pilulifera*	LC	**Fabaceae**	***Vachellia karroo***[eh]	**LC**
Poaceae	***Digitaria eriantha***[bdefgh]	**LC**	Myricaceae	*Morella serrata*	LC	Fabaceae	*Vachellia luederitzii* var. *retinens*	LC
Poaceae	*Digitaria eylesii*	LC	Moraceae	*Morus alba*(NEM:BA)		Fabaceae	*Vachellia nilotica*	
Poaceae	*Digitaria longiflora*	LC	Poaceae	*Mosdenia leptostachys*	LC	Fabaceae	*Vachellia nilotica* subsp. *kraussiana*	LC
Poaceae	*Digitaria monodactyla*	LC	Fabaceae	*Mundulea sericea*		Fabaceae	*Vachellia permixta*	LC
Poaceae	*Digitaria ternata*	LC	Fabaceae	*Mundulea sericea* subsp. *sericea*	LC	Fabaceae	*Vachellia robusta*	
Poaceae	*Digitaria tricholaenoides*	LC	Haloragaceae	*Myriophyllum aquaticum*(NEM:BA)	NE	Fabaceae	*Vachellia robusta* subsp. *clavigera*	LC
Poaceae	*Digitaria velutina*	LC	Myrothamnaceae	*~Myrothamnus flabellifolius*	DDT	**Fabaceae**	***Vachellia robusta* subsp. *robusta***[abfgh]	**LC**
Poaceae	*Diheteropogon amplectens*		Primulaceae	*Myrsine africana*	LC	**Fabaceae**	***Vachellia tenuispina***[g]	**LC**
Poaceae	*Diheteropogon amplectens* var. *amplectens*	LC	Primulaceae	*Myrsine pillansii*	LC	Fabaceae	*Vachellia tortilis*	
Asteraceae	*Dimorphotheca spectabilis*	LC	Cactaceae	*Myrtillocactus geometrizans*(NEM:BA)		**Fabaceae**	***Vachellia tortilis* subsp. *heteracantha***[abcdefgh]	**LC**
Poaceae	*Dinebra retroflexa* var. *condensata*	LC	Celastraceae	*Mystroxylon aethiopicum* subsp. *aethiopicum*	LC	Fabaceae	*Vachellia xanthophloea*	LC
Dioscoreaceae	*Dioscorea dregeana*	LC	Celastraceae	*Mystroxylon aethiopicum* subsp. *burkeanum*	LC	Vahliaceae	*Vahlia capensis* subsp. *capensis*	LC
Dioscoreaceae	*Dioscorea quartiniana*	LC	Hydrocharitaceae	*Najas horrida*		Vahliaceae	*Vahlia capensis* subsp. *ellipticifolia*	LC
Dioscoreaceae	*Dioscorea retusa*	LC	Apiaceae	*~Nanobubon hypogaeum*	EN	Vahliaceae	*Vahlia capensis* subsp. *vulgaris* var. *linearis*	NE
Dioscoreaceae	*Dioscorea sylvatica* var. *sylvatica*	NE	Brassicaceae	*Nasturtium officinale*(NEM:BA)	NE	Valerianaceae	*Valeriana capensis* var. *capensis*	LC
Ebenaceae	*Diospyros austroafricana* var. *microphylla*		Neckeraceae	*Neckera valentiniana*		Rubiaceae	*Vangueria infausta*	
Ebenaceae	*Diospyros lycioides*		Scrophulariaceae	*Nemesia fruticans*	LC	Rubiaceae	*Vangueria infausta* subsp. *infausta*	LC
Ebenaceae	*Diospyros lycioides* subsp. *guerkei*	LC	Scrophulariaceae	*Nemesia rupicola*	LC	Rubiaceae	*Vangueria parvifolia*	LC
Ebenaceae	***Diospyros lycioides* subsp. *lycioides***[bgh]	**LC**	Fabaceae	*Neonotonia wightii*	LC	Rutaceae	*Vepris lanceolata*	LC
Ebenaceae	*Diospyros whyteana*	LC	Fabaceae	*Neorautanenia ficifolia*	LC	Verbenaceae	*Verbena aristigera*	NE
Hyacinthaceae	***Dipcadi gracillimum***[g]	**LC**	Amaryllidaceae	*Nerine angustifolia*	LC	Verbenaceae	*Verbena bonariensis*(NEM:BA)	NE
Hyacinthaceae	*Dipcadi marlothii*	LC	Amaryllidaceae	*Nerine frithii*	LC	Verbenaceae	*Verbena brasiliensis*(NEM:BA)	NE
Hyacinthaceae	*Dipcadi papillatum*	LC	Amaryllidaceae	*Nerine gaberonensis*	LC	Verbenaceae	*Verbena litoralis*	NE
Hyacinthaceae	*Dipcadi rigidifolium*	LC	Amaryllidaceae	*Nerine krigei*	LC	**Verbenaceae**	***Verbena officinalis***[bh]	**NE**
Hyacinthaceae	*Dipcadi viride*	LC	Amaryllidaceae	*Nerine laticoma*	LC	Asteraceae	*Verbesina encelioides* subsp. *encelioides*	
Apocynaceae	*Diplorhynchus condylocarpon*	LC	Apocynaceae	*Nerium oleander*(NEM:BA)	NE	Asteraceae	*Vernonia fastigiata*	
Brassicaceae	*Diplotaxis muralis*	NE	Lythraceae	*Nesaea dinteri* subsp. *elata*	LC	Asteraceae	*Vernonia galpinii*	
Orchidaceae	*Disa aconitoides* subsp. *aconitoides*	LC	Solanaceae	*Nicandra physalodes*(NEM:BA)	NE	Asteraceae	*Vernonia poskeana*	

Orchidaceae	*Disa patula* var. *transvaalensis*	LC	Asteraceae	*Nicolasia stenoptera* subsp. *stenoptera*	LC	Asteraceae	*Vernonia poskeana* var. *botswanica*	
Orchidaceae	*Disa polygonoides*	LC	Solanaceae	*Nicotiana glauca* (NEM:BA)	NE	Asteraceae	*Vernonia staehelinoides*	LC
Orchidaceae	*Disperis anthoceros* var. *anthoceros*	LC	Asteraceae	*Nidorella anomala*	LC	Asteraceae	*Vernonia sutherlandii*	
Orchidaceae	*Disperis micrantha*	LC	Asteraceae	*Nidorella auriculata*	LC	Plantaginaceae	*Veronica anagallis-aquatica*	LC
Ditrichaceae	*Ditrichum brachypodum*		Asteraceae	*Nidorella hottentotica*	LC	Fabaceae	*Vigna frutescens* subsp. *frutescens* var. *frutescens*	NE
Ditrichaceae	*Ditrichum difficile*		Asteraceae	*Nidorella microcephala*	LC	Fabaceae	*Vigna oblongifolia* var. *oblongifolia*	LC
Sapindaceae	*Dodonaea angustifolia*		**Asteraceae**	***Nidorella resedifolia* subsp. *resedifolia*** [bcefghj]	**LC**	Fabaceae	*Vigna schlechteri*	LC
Sapindaceae	*Dodonaea viscosa*		Solanaceae	*Nierembergia linariifolia* var. *glabriuscula*	NE	Fabaceae	*Vigna unguiculata*	
Sapindaceae	*Dodonaea viscosa* var. *angustifolia*	LC	Asteraceae	*Nolletia ciliaris*	LC	Fabaceae	*Vigna unguiculata* subsp. *stenophylla*	LC
Asteraceae	*Doellia cafra*	LC	Asteraceae	*Nolletia jeanettae*	LC	Fabaceae	*Vigna unguiculata* subsp. *unguiculata* var. *unguiculata*	NE
Fabaceae	*Dolichos angustifolius*	LC	Asteraceae	*Nolletia rarifolia*	LC	Fabaceae	*Vigna vexillata* var. *davyi*	LC
Fabaceae	*Dolichos falciformis*	LC	Stilbaceae	*Nuxia congesta*	LC	Fabaceae	*Vigna vexillata* var. *vexillata*	LC
Fabaceae	*Dolichos linearis*	LC	Stilbaceae	**Nuxia glomerulata*	LC	Apocynaceae	*Vinca major* (NEM:BA)	NE
Malvaceae	*Dombeya pulchra*	LC	Nymphaeaceae	*Nymphaea lotus*	LC	Santalaceae	*Viscum combreticola*	LC
Malvaceae	*Dombeya rotundifolia*		Nymphaeaceae	*Nymphaea nouchali* var. *caerulea*	LC	Santalaceae	*Viscum rotundifolium*	LC
Malvaceae	*Dombeya rotundifolia* var. *rotundifolia*	LC	Nymphaeaceae	*Nymphaea nouchali* var. *zanzibariensis*	LC	Santalaceae	*Viscum spragueanum*	
Pteridaceae	*Doryopteris concolor*	LC	Menyanthaceae	*Nymphoides indica* subsp. *occidentalis*		Santalaceae	*Viscum verrucosum*	LC
Salicaceae	*Dovyalis caffra*	LC	Urticaceae	*Obetia tenax*	LC	Lamiaceae	*Vitex pooara*	LC
Salicaceae	*Dovyalis zeyheri*	LC	Ochnaceae	*Ochna holstii*	LC	Lamiaceae	*Vitex rehmannii*	LC
Asparagaceae	*Dracaena fragrans*		Ochnaceae	*Ochna inermis*	LC	Lamiaceae	*Vitex zeyheri*	LC
Cyperaceae	*Dracoscirpoides surculosa*	LC	Ochnaceae	*Ochna natalitia*	LC	Campanulaceae	*Wahlenbergia androsacea*	LC
Asparagaceae	*Drimia altissima*	LC	Ochnaceae	*Ochna pretoriensis*	LC	Campanulaceae	*Wahlenbergia banksiana*	LC
Asparagaceae	*Drimia calcarata*	LC	Ochnaceae	*Ochna pulchra*	LC	Campanulaceae	*Wahlenbergia caledonica*	
Asparagaceae	*Drimia depressa*	LC	Lamiaceae	*Ocimum americanum*		Campanulaceae	*Wahlenbergia denticulata* var. *denticulata*	LC
Asparagaceae	*~Drimia elata*	DDT	**Lamiaceae**	***Ocimum americanum* var. *americanum*** [g]	**LC**	Campanulaceae	*Wahlenbergia denticulata* var. *transvaalensis*	LC
Asparagaceae	*Drimia intricata*	LC	**Lamiaceae**	***Ocimum angustifolium*** [bfh]	**LC**	Campanulaceae	*Wahlenbergia lycopodioides*	LC
Asparagaceae	*Drimia multisetosa*	LC	Lamiaceae	*Ocimum filamentosum*	LC	Campanulaceae	*Wahlenbergia magaliesbergensis*	LC
Asparagaceae	*Drimia physodes*	LC	Lamiaceae	*Ocimum gratissimum* subsp. *gratissimum*	LC	Campanulaceae	*Wahlenbergia undulata*	LC
Asparagaceae	*~*Drimia sanguinea*	NT	Lamiaceae	*Ocimum gratissimum* subsp. *gratissimum* var. *gratissimum*	NE	Campanulaceae	*Wahlenbergia virgata*	LC
Asparagaceae	*Drimia uniflora*	LC	Lamiaceae	*Ocimum labiatum*	LC	Tecophilaeaceae	*Walleria nutans*	LC
Asparagaceae	*Drimiopsis burkei* subsp. *burkei*		**Lamiaceae**	***Ocimum obovatum*** [eg]		**Malvaceae**	***Waltheria indica*** [fg]	**LC**
Droseraceae	*Drosera burkeana*	LC	Lamiaceae	*Ocimum obovatum* subsp. *obovatum* var. *obovatum*	NE	Asteraceae	*Wedelia glauca*	NE
Droseraceae	*Drosera collinsiae*	LC	Calymperaceae	*Octoblepharum albidum*		Pottiaceae	*Weissia latiuscula*	
Droseraceae	*Drosera curvipes*		Onagraceae	*Oenothera affinis*	NE	Fabaceae	*Wiborgia fusca* subsp. *fusca*	LC

Droseraceae	*Drosera madagascariensis*	LC	Onagraceae	*Oenothera indecora*	NE	Boraginaceae	*Wigandia urens* var. *caracasana* (NEM:BA)	
Dryopteridaceae	*Dryopteris athamantica*	LC	Onagraceae	*Oenothera jamesii*	NE	Solanaceae	*Withania somnifera*	LC
Dryopteridaceae	*Dryopteris inaequalis*	LC	Onagraceae	*Oenothera laciniata*	NE	Asteraceae	*Xanthium spinosum* (NEM:BA)	NE
Dryopteridaceae	*Dryopteris pentheri*	LC	Onagraceae	*Oenothera lindheimeri*		Asteraceae	*Xanthium strumarium* (NEM:BA)	NE
Rosaceae	*Duchesnea indica* (NEM:BA)	NE	**Onagraceae**	***Oenothera rosea*** [e]	**NE**	Convolvulaceae	*Xenostegia tridentata*	
Fabaceae	*Dumasia villosa* var. *villosa*	LC	Onagraceae	*Oenothera stricta* subsp. *stricta*	NE	Convolvulaceae	*Xenostegia tridentata* subsp. *angustifolia*	LC
Dumortieraceae	*Dumortiera hirsuta*		Onagraceae	*Oenothera tetraptera*	NE	Fabaceae	*Xerocladia viridiramis*	LC
Verbenaceae	*Duranta erecta* (NEM:BA)	NE	Rubiaceae	*Oldenlandia herbacea*		Velloziaceae	*Xerophyta humilis*	LC
Apocynaceae	*Duvalia polita*	LC	Rubiaceae	*Oldenlandia herbacea* var. *herbacea*	LC	Velloziaceae	*Xerophyta retinervis*	LC
Acanthaceae	***Dyschoriste setigera*** [g]	**LC**	Rubiaceae	*Oldenlandia rupicola* var. *rupicola*	LC	Velloziaceae	*Xerophyta viscosa*	LC
Acanthaceae	*Dyschoriste transvaalensis*	LC	Rubiaceae	*Oldenlandia tenella*	LC	Olacaceae	*Ximenia americana* var. *microphylla*	LC
Amaranthaceae	*Dysphania carinata*		Oleaceae	*Olea capensis* subsp. *enervis*	LC	Olacaceae	*Ximenia caffra*	
Amaranthaceae	*Dysphania pumilio*		Oleaceae	*Olea europaea*		Olacaceae	*Ximenia caffra* var. *caffra*	LC
Amaranthaceae	*Dysphania schraderiana*		**Oleaceae**	***Olea europaea* subsp. *africana*** [gh]	**LC**	Xyridaceae	*Xyris capensis*	LC
Poaceae	*Echinochloa colona*	LC	Oleaceae	*Olea europaea* subsp. *cuspidata*		Xyridaceae	*Xyris congensis*	LC
Poaceae	*Echinochloa crus-galli*	LC	Oleandraceae	*Oleandra distenta*	LC	Xyridaceae	*Xyris gerrardii*	LC
Poaceae	*Echinochloa haploclada*	LC	Resedaceae	*Oligomeris dregeana*	LC	Apocynaceae	*Xysmalobium acerateoides*	LC
Poaceae	*Echinochloa holubii*	LC	Penaeaceae	*Olinia emarginata*	LC	Apocynaceae	*Xysmalobium brownianum*	LC
Poaceae	*Echinochloa jubata*	LC	Salicaceae	*Oncoba spinosa*		Apocynaceae	*Xysmalobium undulatum* var. *ensifolium*	LC
Poaceae	*Echinochloa stagnina*	LC	Ophioglossaceae	*Ophioglossum polyphyllum* var. *polyphyllum*		Apocynaceae	*Xysmalobium undulatum* var. *undulatum*	LC
Poaceae	*Echinochloa ugandensis*	LC	Ophioglossaceae	*Ophioglossum reticulatum*	LC	Aizoaceae	*Zaleya pentandra*	LC
Boraginaceae	*Ehretia alba*	LC	Fabaceae	*Ophrestia oblongifolia* var. *oblongifolia*	LC	Scrophulariaceae	*Zaluzianskya elongata*	LC
Boraginaceae	*Ehretia rigida*		Poaceae	*Oplismenus hirtellus*	LC	Scrophulariaceae	*Zaluzianskya katharinae*	LC
Boraginaceae	*Ehretia rigida* subsp. *nervifolia*	LC	Cactaceae	*Opuntia engelmannii* (NEM:BA)		Potamogetonaceae	*Zannichellia palustris*	LC
Boraginaceae	*Ehretia rigida* subsp. *rigida*	LC	**Cactaceae**	***Opuntia ficus-indica*** (NEM:BA)[cfg]	**NE**	Rutaceae	*Zanthoxylum capense*	LC
Poaceae	*Ehrharta erecta* var. *erecta*	LC	Cactaceae	*Opuntia robusta* (NEM:BA)	NE	Cucurbitaceae	*Zehneria marlothii*	
Poaceae	*Ehrharta erecta* var. *natalensis*	LC	Cactaceae	*Opuntia salmiana* (NEM:BA)	NE	Cucurbitaceae	*Zehneria scabra* subsp. *scabra*	
Pontederiaceae	*Eichhornia crassipes* (NEM:BA)	NE	Apocynaceae	*Orbea carnosa* subsp. *carnosa*	LC	Amaryllidaceae	*Zephyranthes carinata*	
Celastraceae	*~*Elaeodendron transvaalense*	NT	Apocynaceae	*Orbea lutea*		Amaryllidaceae	*Zephyranthes robusta*	
Elatinaceae	*Elatine ambigua*	LC	Apocynaceae	*Orbea lutea* subsp. *lutea*	LC	**Asteraceae**	***Zinnia peruviana*** [bfgh]	**NE**
Cyperaceae	*Eleocharis dregeana*	LC	Apocynaceae	*Orbeopsis lutea* subsp. *lutea*		Rhamnaceae	*Ziziphus mucronata*	
Cyperaceae	*Eleocharis limosa*	LC	Hyacinthaceae	*Ornithogalum juncifolium* var. *juncifolium*	NE	**Rhamnaceae**	***Ziziphus mucronata* subsp. *mucronata*** [abcdefgh]	**LC**
Fabaceae	*Elephantorrhiza burkei*	LC	Colchicaceae	*Ornithoglossum viride*	LC	Rhamnaceae	*Ziziphus zeyheriana*	LC
Fabaceae	*Elephantorrhiza elephantina*	LC	Colchicaceae	*Ornithoglossum vulgare*	LC	Fabaceae	*Zornia capensis* subsp. *capensis*	LC

Fabaceae	*Elephantorrhiza obliqua* var. *glabra*	LC	Poaceae	*Oropetium capense*	LC	Fabaceae	*Zornia glochidiata*	LC
Poaceae	*Eleusine coracana* subsp. *africana*	LC	Apocynaceae	*Orthanthera jasminiflora*	LC	Fabaceae	*Zornia linearis*	LC
Poaceae	*Elionurus muticus*	LC	Orchidaceae	*Orthochilus leontoglossus*	LC	Fabaceae	*Zornia milneana*	LC
Polygonaceae	*Emex australis*	LC	Orchidaceae	*Orthochilus milnei*	LC			
Rubiaceae	*Empogona lanceolata*	LC	Orchidaceae	*Orthochilus welwitschii*	LC			

Appendix 2 Specialist Curriculum Vitae

CURRICULUM VITAE:

Gerhard Botha

Name:	:	Gerhardus Alfred Botha
Date of Birth	:	11 April 1986
Identity Number	:	860411 5136 088
Postal Address	:	PO Box 12500 Brandhof 9324
Residential Address	:	3 Jock Meiring Street Park West Bloemfontein 9301
Cell Phone Number	:	084 207 3454
Email Address	:	gabotha11@gmail.com
Profession/Specialisation	:	Ecological and Biodiversity Consultant
Nationality:	:	South African
Years Experience:	:	8
Bilingualism	:	Very good – English and Afrikaans

Professional Profile:

Gerhard is a Managing Director of Nkurenkuru Ecology and Biodiversity (Pty) Ltd. He has a BSc Honours degree in Botany from the University of the Free State Province and is currently completing a MSc Degree in Botany. He began working as an environmental specialist in 2010 and has since gained extensive experience in conducting ecological and biodiversity assessments in various development field, especially in the fields of conventional as well as renewable energy generation, mining and infrastructure development. Gerhard is a registered Professional Natural Scientist (Pr. Sci. Nat.)

Key Responsibilities:

Specific responsibilities as an Ecological and Biodiversity Specialist include, inter alia, professional execution of specialist consulting services (including flora, wetland and fauna studies, where required), impact assessment reporting, walk through surveys/ground-truthing to inform final design, compilation of management plans, compliance monitoring and audit reporting, in-house ecological awareness training to on-site personnel, and the development of project proposals for procuring new work/projects.

Skills Base and Core Competencies

- Research Project Management
- Botanical researcher in projects involving the description of terrestrial and coastal ecosystems.

- Broad expertise in the ecology and conservation of grasslands, savannahs, karroid wetland, and aquatic ecosystems.
- Ecological and Biodiversity assessments for developmental purposes (BAR, EIA), with extensive knowledge and experience in the renewable energy field (Refer to Work Experiences and References)
- Over 3 years of avifaunal monitoring and assessment experience.
- Mapping and Infield delineation of wetlands, riparian zones and aquatic habitats (according to methods stipulated by DWA, 2008) within various South African provinces of KwaZulu-Natal, Mpumalanga, Free State, Gauteng and Northern Cape Province for inventory and management purposes.
- Wetland and aquatic buffer allocations according to industry best practice guidelines.
- Working knowledge of environmental planning policies, regulatory frameworks, and legislation
- Identification and assessment of potential environmental impacts and benefits.
- Assessment of various wetland ecosystems to highlight potential impacts, within current and proposed landscape settings, and recommend appropriate mitigation and offsets based on assessing wetland ecosystem service delivery (functions) and ecological health/integrity.
- Development of practical and achievable mitigation measures and management plans and evaluation of risk to execution
- Qualitative and Quantitative Research
- Experienced in field research and monitoring
- Working knowledge of GIS applications and analysis of satellite imagery data
- Completed projects in several Provinces of South Africa and include a number of projects located in sensitive and ecological unique regions.

Education and Professional Status

Degrees:

- *2015:* Currently completing a M.Sc. degree in Botany (Vegetation Ecology), University of the Free State, Bloemfontein, RSA.
- *2009:* B.Sc. Hons in Botany (Vegetation Ecology), University of the Free State, Bloemfontein, RSA.
- *2008:* B.Sc. in Zoology and Botany, University of the Free State, University of the Free State, Bloemfontein, RSA.

Courses:

- *2013*: Wetland Management (ecology, hydrology, biodiversity, and delineation) – University of the Free State accredited course.
- *2014*: Introduction to GIS and GPS (Code: GISA 1500S) – University of the Free State accredited course.

Professional Society Affiliations:

- The South African Council of Natural Scientific Professions: Pr. Sci. Nat. Reg. No. 400502/14 (Botany and Ecology).

Employment History

- December 2017 – Current: Nkurenkuru Ecology and Biodiversity (Pty) Ltd
- 2016 – November 2017: ECO-CARE Consultancy
- *2015 - 2016*: Ecologist, Savannah Environmental (Pty) Ltd
- *2013 – 2014*: Working as ecologist on a freelance basis, involved in part-time and contractual positions for the

following companies

- Enviroworks (Pty) Ltd
- GreenMined (Pty) Ltd
- Eco-Care Consultancy (Pty) Ltd
- Enviro-Niche Consulting (Pty) Ltd
- Savannah Environmental (Pty) Ltd
- Esicongweni Environmental Services (EES) cc

- *2010 - 2012*: Enviroworks (Pty) Ltd

Publications

Publications:

- Botha, G.A. & Du Preez, P.J. 2015. A description of the wetland and riparian vegetation of the Nxamasere palaeo-river's backflooded section, Okavango Delta, Botswana. S. *Afr. J. Bot*., **98**: 172-173.

Congress papers/posters/presentations:

- Botha, G.A. 2015. A description of the wetland and riparian vegetation of the Nxamasere palaeo-river's backflooded section, Okavango Delta, Botswana. 41st Annual Congress of South African Association of Botanists (SAAB). Tshipise, 11-15 Jan. 2015.
- Botha, G.A. 2014. A description of the vegetation of the Nxamasere floodplain, Okavango Delta, Botswana. 10st Annual University of Johannesburg (UJ) Postgraduate Botany Symposium. Johannesburg, 28 Oct. 2014.

Other

- Guest speaker at IAIAsa Free State Branch Event (29 March 2017)
- Guest speaker at the University of the Free State Province: Department of Plant Sciences (3 March 2017):

References:

- Christine Fouché
  Manager: GreenMined (Pty) LTD
  Cell: 084 663 2399
- Professor J du Preez
  Senior lecturer: Department of Plant Sciences
  University of the Free State
  Cell: 082 376 4404

Appendix 3 Specialist Curriculum Vitae

WORK EXPERIENCES

&

References

Gerhard Botha

ECOLOGICAL RELATED STUDIES AND SURVEYS

Date Completed	Project Description	Type of Assessment/Study	Client
2019	Sirius Three Solar PV Facility near Upington, Northern Cape	Ecological Assessment (Basic Assessment)	Aurora Power Solutions
2019	Sirius Four Solar PV Facility near Upington, Northern Cape	Ecological Assessment (Basic Assessment)	Aurora Power Solutions
2019	Lichtenburg 1 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Lichtenburg 2 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Lichtenburg 3 100MW Solar PV Facility, Lichtenburg, North-West Province	Ecological Assessment (Scoping and EIA Phase Assessments)	Atlantic Renewable Energy Partners
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Ecological Assessment (Basic Assessment)	Moeding Solar
2019	Expansion of the Raumix Aliwal North Quarry, Eastern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	GreenMined
2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Faunal and Flora Rescue and Protection Plan	Zevobuzz
2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Zevobuzz
2018	Proposed Kruisvallei Hydroelectric Power Generation Scheme in the Ash River, Free State Province	Ecological Assessment (Basic Assessment)	Zevobuzz
2018	Proposed Zonnebloem Switching Station (132/22kV) and 2X Loop-in Loop-out Power Lines (132kV), Mpumalanga Province	Ecological Assessment (Basic Assessment)	Eskom

2018	Clayville Thermal Plant within the Clayville Industrial Area, Gauteng Province	Ecological Comments Letter	Savannah Environmental
2018	Iziduli Emoyeni Wind Farm near Bedford, Eastern Cape Province	Ecological Assessment (Re-assessment)	Emoyeni Wid Farm Renewable Energy
2018	Msenge Wind Farm near Bedford, Eastern Cape Province	Ecological Assessment (Re-assessment)	Amakhala Emoyeni Renewable Energy
2017	H2 Energy Power Station near Kwamhlanga, Mpumalanga Province	Ecological Assessment (Scoping and EIA phase assessments)	Eskom
2017	Karusa Wind Farm (Phase 1 of the Hidden Valley Wind Energy Facility near Sutherland, Northern Cape Province)	Ecological Assessment (Re-assessment)	ACED Renewables Hidden Valley
2017	Soetwater Wind Farm (Phase 2 of the Hidden Valley Wind Energy Facility near Sutherland, Northern Cape Province)	Ecological Assessment (Re-assessment)	ACED Renewables Hidden Valley
2017	S24G for the unlawful commencement or continuation of activities within a watercourse, Honeydew, Gauteng Province	Ecological Assessment	Savannah Environmental
2016 - 2017	Noupoort CSP Facility near Noupoort, Northern Cape Province	Ecological Assessment (Scoping and EIA phase assessments)	Cresco
2016	Buffels Solar 2 PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Kabi Solar
2016	Buffels Solar 1 PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Kabi Solar
2016	132kV Power Line and On-Site Substation for the Authorised Golden Valley II Wind Energy Facility near Bedford, Eastern Cape Province	Ecological Assessment (Basic Assessment)	Terra Wind Energy
2016	Kalahari CSP Facility: 132kV Ferrum–Kalahari–UNTU & 132kV Kathu IPP–Kathu 1 Overhead Power Lines, Kathu, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Kathu Solar Park
2016	Kalahari CSP Facility: Access Roads, Kathu, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Kathu Solar Park
2016	Karoshoek Solar Valley Development – Additional CSP Facility including tower infrastructure associated with authorised CSP Site 2 near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Karoshoek Solar Valley Development –Ilanga CSP 7 and 8 Facilities near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Karoshoek Solar Valley Development –Ilanga CSP 9 Facility near Upington, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Emvelo
2016	Lehae Training Academy and Fire Station, Gauteng Province	Ecological Assessment	Savannah Environmental
2016	Metal Industrial Cluster and Associated Infrastructure near Kuruman, Northern Cape Province	Ecological Assessment (Scoping Assessment)	Northern Cape Department of Economic Development and Tourism
2016	Semonkong Wind Energy Facility near Semonkong, Maseru District, Lesotho	Ecological Pre-Feasibility Study	Savannah Environmental
2015 - 2016	Orkney Solar PV Facility near Orkney, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Genesis Eco-Energy
2015 - 2016	Woodhouse 1 and Woodhouse 2 PV Facilities near Vryburg, North West Province	Ecological Assessment (Scoping and EIA phase assessments)	Genesis Eco-Energy

2015	CAMCO Clean Energy 100kW PV Solar Facility, Thaba Eco Lodge near Johannesburg, Gauteng Province	Ecological Assessment (Basic Assessment)	CAMCO Clean Energy
2015	CAMCO Clean Energy 100kW PV Solar Facility, Thaba Eco Lodge near Johannesburg, Gauteng Province	Ecological Assessment (Basic Assessment)	CAMCO Clean Energy
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Aurora Power Solutions
2015	Sirius 2 Solar PV Project near Upington, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Invasive Plant Management Plan	Aurora Power Solutions
2015	Sirius 2 Solar PV Project near Upington, Northern Cape Province	Invasive Plant Management Plan	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Plant Rehabilitation Management Plan	Aurora Power Solutions
2015	Sirius Phase 2 Solar PV Project near Upington, Northern Cape Province	Plant Rehabilitation Management Plan	Aurora Power Solutions
2015	Sirius 1 Solar PV Project near Upington, Northern Cape Province	Plant Rescue and Protection Plan	Aurora Power Solutions
2015	Sirius Phase 2 Solar PV Project near Upington, Northern Cape Province	Plant Rescue and Protection Plan	Aurora Power Solutions
2015	Expansion of the existing Komsberg Main Transmission Substation near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ESKOM
2015	Karusa Wind Farm near Sutherland, Northern Cape Province)	Invasive Plant Management Plan	ACED Renewables Hidden Valley
2015	Proposed Karusa Facility Substation and Ancillaries near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ACED Renewables Hidden Valley
2015	Eskom Karusa Switching Station and 132kV Double Circuit Overhead Power Line near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ESKOM
2015	Karusa Wind Farm near Sutherland, Northern Cape Province)	Plant Search and Rescue and Rehabilitation Management Plan	ACED Renewables Hidden Valley
2015	Karusa Wind Energy Facility near Sutherland, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	ACED Renewables Hidden Valley
2015	Soetwater Facility Substation, 132kV Overhead Power Line and Ancillaries, near Sutherland, Northern Cape Province	Ecological Assessment (Basic Assessment)	ACED Renewables Hidden Valley
2015	Soetwater Wind Farm near Sutherland, Northern Cape Province)	Invasive Plant Management Plan	ACED Renewables Hidden Valley
2015	Soetwater Wind Energy Facility near Sutherland, Northern Cape Province	Fauna and Flora Pre-Construction Walk-Through Assessment	ACED Renewables Hidden Valley
2015	Soetwater Wind Farm near Sutherland, Northern Cape Province	Plant Search and Rescue and Rehabilitation Management Plan	ACED Renewables Hidden Valley
2015	Expansion of the existing Scottburgh quarry near Amandawe, KwaZulu-Natal	Botanical Assessment (for EIA)	GreenMined Environmental
2015	Expansion of the existing AFRIMAT quarry near Hluhluwe, KwaZulu-Natal	Botanical Assessment (for EIA)	GreenMined Environmental
2014	Tshepong 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy
2014	Nyala 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy
2014	Eland 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Ecological Assessment (Basic Assessment)	BBEnergy

2014	Transalloys circulating fluidised bed power station near Emalahleni, Mpumalanga Province	Ecological Assessment (for EIA)	Trans-Alloys
2014	Umbani circulating fluidised bed power station near Kriel, Mpumalanga Province	Ecological Assessment (Scoping and EIA)	Eskom
2014	Gihon 75MW Solar Farm: Bela-Bela, Limpopo Province	Ecological Assessment (for EIA)	NETWORX Renewables
2014	Steelpoort Integration Project & Steelpoort to Wolwekraal 400kV Power Line	Fauna and Flora Pre-Construction Walk-Through Assessment	Eskom
2014	Audit of protected *Acacia erioloba* trees within the Assmang Wrenchville housing development footprint area	Botanical Audit	Eco-Care Consultancy
2014	Rehabilitation of the N1 National Road between Sydenham and Glen Lyon	Peer review of the ecological report	EKO Environmental
2014	Rehabilitation of the N6 National Road between Onze Rust and Bloemfontein	Peer review of the ecological report	EKO Environmental
2011	Illegally ploughed land on the Farm Wolwekop 2353, Bloemfontein	Vegetation Rehabilitation Plan	EnviroWorks
2011	Rocks Farm chicken broiler houses	Botanical Assessment (for EIA)	EnviroWorks
2011	Botshabelo 132 kV line	Ecological Assessment (for EIA)	CENTLEC
2011	De Aar Freight Transport Hub	Ecological Scoping and Feasibility Study	EnviroWorks
2011	The proposed establishment of the Tugela Ridge Eco Estate on the farm Kruisfontein, Bergville	Ecological Assessment (for EIA)	EnviroWorks
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Vegetation Rehabilitation Plan for illegally cleared areas	NEOTEL
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Invasive Plant Management Plan	NEOTEL
2010 - 2011	National long-haul optic fibre infrastructure network project, Bloemfontein to Beaufort West	Protected and Endangered Species Walk-Through Survey	NEOTEL
2011	Optic Fibre Infrastructure Network, Swartland Municipality	Botanical Assessment (for EIA) - Assisted Dr. Dave McDonald	Dark Fibre Africa
2011	Optic Fibre Infrastructure Network, City of Cape Town Municipality	Botanical Assessment (for EIA) - Assisted Dr. Dave McDonald	Dark Fibre Africa
2010	Construction of an icon at the southernmost tip of Africa, Agulhas National Park	Botanical Assessment (for EIA)	SANPARKS
2010	New boardwalk from Suiderstrand Gravel Road to Rasperpunt, Agulhas National Park	Botanical Assessment (for EIA)	SANPARKS
2010	Farm development for academic purposes (Maluti FET College) on the Farm Rosedale 107, Harrismith	Ecological Assessment (Screening and Feasibility Study)	Agri Development Solutions
2010	Basic Assessment: Barcelona 88/11kV substation and 88kV loop-in lines	Botanical Assessment (for EIA)	Eskom Distribution
2011	Illegally ploughed land on the Farm Wolwekop 2353, Bloemfontein	Vegetation Rehabilitation Plan	EnviroWorks

WETLAND DELINEATION AND HYDROLOGICAL ASSESSMENTS

Date Completed	Project Description	Type of Assessment/Study	Client
In progress	Steynsrus PV 1 & 2 Solar Energy Facilities near Steynsrus, Free State Province	Wetland Assessment	Cronimet Mining Power Solutions
2019	Lichtenburg 1 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Lichtenburg 2 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Lichtenburg 3 100MW Solar PV Facility, Lichtenburg, North-West Province	Surface Hydrological Assessment (Scoping and EIA Phase)	Atlantic Renewable Energy Partners
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Wetland Assessment (Basic Assessment)	Moeding Solar

2018	Kruisvallei Hydroelectric 22kV Overhead Power Line, Clarens, Free State Province	Wetland Assessment (Basic Assessment	Zevobuzz
2017	Nyala 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Wetland Assessment	BBEnergy
2017	Eland 5MW PV facility within Harmony Gold's mining rights areas, Odendaalsrus	Wetland Assessment	BBEnergy
2017	Olifantshoek 10MVA 132/11kV Substation and 31km Power Line	Surface Hydrological Assessment (Basic Assessment)	Eskom
2017	Expansion of the Elandspruit Quarry near Ladysmith, KwaZulu-Natal Province	Wetland Assessment	Raumix
2017	S24G for the unlawful commencement or continuation of activities within a watercourse, Honeydew, Gauteng Province	Aquatic Assessment & Flood Plain Delineation	Savannah Environmental
2017	Noupoort CSP Facility near Noupoort, Northern Cape Province	Surface Hydrological Assessment (EIA phase)	Cresco
2016	Wolmaransstad Municipality 75MW PV Solar Energy Facility in the North West Province	Wetland Assessment (Basic Assessment)	BlueWave Capital
2016	BlueWave 75MW PV Plant near Welkom Free State Province	Wetland Delineation	BlueWave Capital
2016	Harmony Solar Energy Facilities: Amendment of Pipeline and Overhead Power Line Route	Wetland Assessment (Basic Assessment)	BBEnergy

AVIFAUNAL ASSESSMENTS

Date Completed	Project Description	Type of Assessment/Study	Client
2019	Sirius Three Solar PV Facility near Upington, Northern Cape	Avifauna Assessment (Basic Assessment)	Aurora Power Solutions
2019	Sirius Four Solar PV Facility near Upington, Northern Cape	Avifauna Assessment (Basic Assessment)	Aurora Power Solutions
2019	Moeding Solar PV Facility near Vryburg, North-West Province	Avifauna Assessment (Basic Assessment)	Moeding Solar
2018	Proposed Zonnebloem Switching Station (132/22kV) and 2X Loop-in Loop-out Power Lines (132kV), Mpumalanga Province	Avifauna Assessment (Basic Assessment)	Eskom
2017	Olifantshoek 10MVA 132/11kV Substation and 31km Power Line	Avifauna Assessment (Basic Assessment)	Eskom
2016	TEWA Solar 1 Facility, east of Upington, Northern Cape Province	Wetland Assessment (Basic Assessment	Tewa Isitha Solar 1
2016	TEWA Solar 2 Facility, east of Upington, Northern Cape Province	Wetland Assessment	Tewa Isitha Solar 2

Appendix 4 Specialist Curriculum Vitae: JH Keet

Personal Details:

- Name: Dr. Jan-Hendrik Keet
- Address: Somerset West, Western Cape, 7130
- Cell: 071 451 4853
- Email: ecofloristix@gmail.com / keetjanhendrik@gmail.com
- Date of Birth: 07 November 1988
- Website: https://ecofloristix.co.za/

Expertise and Experience:

- Current: Botanical & Terrestrial Biodiversity Specialist Consultant; Founder and Principal Consultant at EcoFloristix Specialist Environmental Consulting
- Current: Freelance Academic/Technical Editor, Proof-reader, Dissertation Specialist, and Data Scientist
- Previous: Post-Doctoral Researcher — Mathematical Biosciences Hub (Department of Mathematics), Stellenbosch University
- Previous: Post-Doctoral Researcher — DST NRF Centre of Excellence for Invasion Biology (Department of Botany and Zoology), Stellenbosch University
- Specialization: Botany, Ecology, Biogeography, Invasive Plant Species, and Invasion Biology
- Years of experience: > 10 years
- Published in various, high-impact, national and international scientific journals

Skills and Competencies:

- Invasive Species Biology (PhD in Botany [Stellenbosch University] with a focus on Invasive Alien Plant Species and their environmental impacts)
- Plant Biogeography and Ecology
- Plant Identification and Taxonomy
- Vegetation Surveys and Mapping
- Biological Sciences
- Soil Microbiome Composition, Function, and Chemistry
- Geographic Information Systems (*GISB1500S, NQF level 5*)
- Research Data Management and Data Visualization
- Statistical Computing Methods (*R Statistical Computing Expert*)
- Experimental Design and Analysis

Global Scientific Influence:

- Research Interest Score >380
- Citations >460
- Scopus h-index 9
- Google Scholar h-index 10
- Google Scholar i10-index 12

Tertiary Education:

- 2015 – 2019: Stellenbosch University, Stellenbosch, South Africa. Doctor of Philosophy (Botany)

- 2013 – 2014: University of the Free State, Bloemfontein, South Africa. Magister Scientiae (Botany)
- 2012: University of the Free State, Bloemfontein, South Africa. Bachelor of Science Honours (Botany) - *cum laude*
- 2009 – 2011: University of the Free State, Bloemfontein, South Africa. Bachelor of Science (Chemistry with Physics and Biology) - *cum laude*

Employment History:

- 2015 – present: Botanical Specialist and Principal Consultant at EcoFloristix Specialist Environmental Consulting (https://www.ecofloristix.co.za/).
- 2021 – present: Freelance Academic/Technical Editor, Proof-reader, and Dissertation Specialist
- 2019 – 2021: Post-Doctoral Researcher – Centre for Invasion Biology (Department of Botany and Zoology), Stellenbosch University
- 2011: Part-time demonstrator. Department of Plant Sciences, University of the Free State, Bloemfontein, South Africa
- 2010: Part-time lab assistant. Department of Chemistry, University of the Free State, Bloemfontein, South Africa
- 2007 – 2009: Shop Manager. Christian Tees, Brandwag Centre, Bloemfontein

Memberships, Certifications, and Short Courses:

- SACNASP: Professional Natural Scientist (No.: 121678)
- SAGIC Invasive Species Consultant (Cape Town, South Africa), March 2016
- GIS Intermediate (NQF level 5): Hydrological modelling and terrain analysis using digital elevation models (University of the Free State, South Africa), 2014
- Project Management (Stellenbosch University), 2023
- Good Laboratory Practice seminar presented by Merck Millipore South Africa, 2012
- Laboratory Safety seminar presented by Merck Millipore South Africa, 2012
- Golden Key International Honour Society (Membership No.: 7564025)

Selected Peer-reviewed Scientific Publications and Book Chapters:

- **Keet J-H**, Ellis AG, Hui C, Le Roux (2023) Responses of soil bacterial communities to invasive Australian *Acacia* species over large spatial scales. In: Richardson DM, Le Roux JJ, & Marchante E (Eds.) *Wattles: Australian Acacia Species Around the World*, CAB International, https://www.cabidigitallibrary.org/doi/10.1079/9781800622197.0000.
- **Keet J-H**, Datta A, Foxcroft LC, Kumschick S, Wilson JRU, Nichols GR, Richardson DM (2022) Assessing the level of compliance with alien plant regulations in a large African protected area. *Biological Invasions* 24: 3831 – 3844, https://doi.org/10.1007/s10530-022-02883-7.
- Warrington S, Ellis AG, **Keet J-H**, Le Roux JJ (2022) How does familiarity in rhizobial interactions impact the performance of invasive and native legumes? *Neobiota* 72: 129 – 156, https://neobiota.pensoft.net/article/79620/.
- **Keet J-H** & Richardson, DM (2022) A rapid survey of naturalized and invasive eucalypt species in southwestern Limpopo, South Africa. *South African Journal of Botany* 144: 339 – 346, https://doi.org/10.1016/j.sajb.2021.09.008.
- Novoa A, Foxcroft LC, **Keet J-H**, Pyšek P, Le Roux JJ (2021) The invasive cactus *Opuntia stricta* creates fertility islands in African savannas and benefits from

those created by native trees. Scientific Reports 11: 20748, https://www.nature.com/articles/s41598-021-99857-x.

- **Keet J-H**, Ellis AG, Hui C, Novoa A, Le Roux JJ (2021) Impacts of invasive Australian acacias on soil bacterial community composition, microbial enzymatic activities, and nutrient availability in fynbos soils. *Microbial Ecology* 82: 704 – 721, http://dx.doi.org/10.1007/s00248-021-01683-1.
- **Keet J-H**, Robertson MP, Richardson DM (2020) *Alnus glutinosa* (Betulaceae) in South Africa: invasive potential and management options. *South African Journal of Botany* 135: 280 – 293, https://doi.org/10.1016/j.sajb.2020.09.009.
- Wilson JRU, Datta A, Hirsch H, **Keet J-H**, Mbobo T, Nkuna KV, Nsikani MM, Pyšek P, Richardson DM, Zengeya TA, Kumschick S (2020) Is invasion science moving towards agreed standards? The influence of selected frameworks. *NeoBiota*, 62: 569 – 590, https://doi.org/10.3897/neobiota.62.53243.
- Novoa A, **Keet J-H**, Lechuga-Lago Y, Pyšek P, Le Roux JJ (2020) Urbanization and *Carpobrotus edulis* invasion alter the diversity and composition of soil bacterial communities in coastal areas. FEMS Microbiology Ecology 96(7): fiaa106, https://doi.org/10.1093/femsec/fiaa106.
- Le Roux JJ, Leishman MR, Cinantya AP, Gufu GD, Hirsch H, **Keet J-H**, Manea A, Saul W-C, Tabassum S, Warrington S, Yannelli FA, Ossola A (2020) Plant biodiversity in the face of global change. *Current Biology* 30: R371 – R392, https://doi.org/10.1016/j.cub.2020.02.066.
- Hirsch H, Allsopp MH, Canavan S, Cheek M, Geerts S, Geldenhuys CJ, Harding G, Hurley BP, Jones W, **Keet J-H**, Klein H, Ruwanza S, van Wilgen BW, Wingfield MJ, Richardson DM (2019) *Eucalyptus camaldulensis* in South Africa – past, present, future. *Transactions of the Royal Society of South Africa* 75(1): 1 – 22, https://doi.org/10.1080/0035919X.2019.1669732.
- Le Roux JJ, Hui C, Castillo ML, Iriondo, JM, **Keet J-H**, Khapugin, AA, Médail F, Rejmánek M, Theron G, Yannelli FA, Hirsch H (2019) Recent anthropogenic plant extinctions differ in biodiversity hotspots and coldspots. *Current Biology* 29(17): 2912 – 2918, https://doi.org/10.1016/j.cub.2019.07.063.
- **Keet J-H**, Ellis AG, Hui C, Le Roux JJ (2019) Strong spatial and temporal turnover of soil bacterial communities in South Africa's hyperdiverse fynbos biome. *Soil Biology and Biochemistry* 136: 107541, https://doi.org/10.1016/j.soilbio.2019.107541.
- Le Roux JJ, Ellis AG, Van Zyl L-M, Hosking ND, **Keet J-H**, Yannelli F (2018) Importance of soil legacy effects and successful mutualistic interactions during Australian acacia invasions in nutrient-poor environments. *Journal of Ecology* 106(5): 2071 – 2081, https://doi.org/10.1111/1365-2745.1296.
- **Keet J-H**, Ellis AG, Hui C, Le Roux JJ (2017) Legume–rhizobium symbiotic promiscuity and effectiveness do not affect plant invasiveness. *Annals of Botany* 119(8): 1319 – 1331, https://doi.org/10.1093/aob/mcx028.
- Le Roux JJ, **Keet J-H**, Mutiti B, Ellis AG (2017) Cultivation may not dramatically alter rhizobial community diversity or structure associated with rooibos tea (*Aspalathus linearis* Burm.f.) in South Africa. *South African Journal of Botany* 110: 87-96, https://doi.org/10.1016/j.sajb.2017.01.014.
- Le Roux JJ, Hui C, **Keet J-H**, Ellis AG (2017) Co-introduction vs ecological fitting as pathways to the establishment of effective mutualisms during biological invasions. *New Phytologist* 215(4): 1354 – 1360, https://doi.org/10.1111/nph.14593.
- Nsikani M, Novoa A, Van Wilgen B, **Keet J-H**, Gaertner M (2017) *Acacia saligna*'s soil legacy effects persist up to ten years after clearing: Implications for

ecological restoration. *Austral Ecology* 42(8): 880 – 889, https://doi.org/10.1111/aec.12515.
- **Keet J-H**, Cindi D, Du Preez PJ (2016) Assessing the invasiveness of *Berberis aristata* and *B. julianae* (Berberidaceae) in South Africa: management options and legal recommendations. *South African Journal of Botany* 105: 288 – 298, https://doi.org/10.1016/j.sajb.2016.04.012.

Selected Conferences:

- 46th South African Association of Botanists conference (Qwa-Qwa, South Africa), January 2020, ***Alnus glutinosa* (L.) Gaertn. [Black Alder]: *an emerging invader in South Africa***
- International Association for Food Protection (IAFP; Louisville, Kentucky, USA), July 2019.
- Ecological Society of America Conference, (New Orleans, Louisiana, USA), August 2018 **Invasive legumes dramatically impact soil bacterial community structures but not function**
- Legumes for Life Workshop (Stellenbosch, South Africa), May 2018 **Legume-rhizobium symbiotic promiscuity and effectiveness do not affect plant invasiveness**
- Fynbos Forum Conference (Swellendam, South Africa), July 2017 **Assessing the impacts of invasive legumes on soil conditions and microbial community composition in a biodiversity hotspot**
- 43rd South African Association of Botanists Conference (Cape Town, South Africa), January 2017, **Legume-rhizobium symbiotic promiscuity and effectiveness do not affect plant invasiveness** *Best PhD presentation*
- 43rd Annual Research Symposium on the Management of Biological Invasions Conference (Worscester, South Africa), May 2016, **Legume-rhizobium symbiotic promiscuity does not determine plant invasiveness**
- Evolutionary dynamics of tree invasions: drivers, dimensions, and implications for management (Stellenbosch, South Africa), November 2015
- Neobiota: 8th International Conference on Biological Invasions (Antalya, Turkey), November 2014, **Assessing the threat and potential for management of Berberis spp. (Berberidaceae) in South Africa**
- 42nd Annual Symposium on the Management of Invasive Alien Plants (Karridene Beach Hotel, Durban, South Africa)
- XXth Association for the Taxonomic Study of the Flora of Tropical Africa International Conference (Stellenbosch, South Africa), January 2014
- 41st Annual Symposium on the Management of Invasive Alien Plants (Cape St. Francis, South Africa), May 2013

Brief Summary of EIAs and other surveys:

- Botanical Study and Assessment for a Housing Development, 2023. Proposed development of the development of Erf 397, Suiderstrand, Western Cape. Report prepared for RMS Environmental.
- Botanical Study and Assessment for a Mining Permit Application, 2023. Proposed development of a dolerite mine near Beaufort West, Western Cape. Report prepared for Greenmined Environmental (Pty) Ltd.

- In collaboration with Nkurenkuru Ecology and Biodiversity, 2022. Full Botanical Assessment for the proposed development of wind energy facilities south of Bethal, Mpumalanga Province.
- In collaboration with Nkurenkuru Ecology and Biodiversity, 2021. Application (Expansion of mining footprint), and Final Basic Assessment and Environmental Management Plan for the proposed sand mine expansion on Portion 4 of the Farm Zandberg Fontein 97, Western Cape Province.
- In collaboration with Nkurenkuru Ecology and Biodiversity, 2021. Proposed development of wind energy facilities on the farms Brussels, Driepoort (664-1 and 664-2), Kameelfontein, Lisbon, Nazareth, and Zwartkrans, near Vryburg, Northwest Province.
- In collaboration with Nkurenkuru Ecology and Biodiversity, 2021. Botanical Study and Assessment: Proposed development of wind energy facilities on the farm Kluitjieskraal, Loeriesfontein, Northern Cape Province.
- In collaboration with Nkurenkuru Ecology and Biodiversity, 2021. Botanical Study and Assessment: Proposed development of an access road to the authorised Sutherland 1 and Rietrug wind energy facilities near Sutherland.
- Specialist Botanical Assessment Report: Assessment of Damage and Rehabilitation Costs for Unauthorised Driving of a 4x4 Vehicle in the Big Bay Open Space System, Cape Town. Prepared for Hannes, Pretorius, Bock & Bryant Attorneys.
- In collaboration with Nkurenkuru Ecology and Biodiversity, 2019. Mining Permit, Final Basic Assessment & Environmental Management Plan for the proposed mining of Sillimanite, Aggregate and Stone Gravel on the Farm Koenabib 43, Northern Cape Province. Botanical Study and Assessment Report. Unpublished report prepared by Nkurenkuru Ecology and Biodiversity for GreenMined Environmental. Version 1.0, 30 January 2020
- In collaboration with Nkurenkuru Ecology and Biodiversity, 2019. Mining Permit, Final Basic Assessment & Environmental Management Plan for the proposed mining of Sillimanite on the Farm Wortel 42, Northern Cape Province. Botanical Study and Assessment Report. Unpublished report prepared by Nkurenkuru Ecology and Biodiversity for GreenMined Environmental. Version 1.0, 30 January 2020
- Specialist Invasive Alien Plant Species Report: Prepared for: Mpact Corrugated, Kuils River (Western Cape), July 2019
- Proposed Township development, Country view, Gauteng: Biodiversity Impact Assessment (Flora) – Specialist Report prepared for Zone Land Solutions (PTY) Ltd, July 2015
- Colenso Anthracite Coal Mining and Power Station Project: Biodiversity Impact Assessment (Flora) – Specialist Report prepared for Zone Land Solutions (PTY) Ltd, July 2015

forestry, fisheries
& the environment

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Forestry, Fisheries and the Environment
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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE
The Proposed Boshoek Solar 1 Energy Facility and Associated Infrastructure near Boshoek, North West Province.

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)*', where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Terrestrial Ecological Study (Biodiversity, Plant Species and Animal Species) and Impact Assessment
Specialist Company Name	Nkurenkuru Ecology and Biodiversity (Pty) Ltd.
Specialist Name	Gerhard Botha
Specialist Identity Number	8604115136088
Specialist Qualifications:	BSc Zoology & BSc (Hons) Botany
Professional affiliation/registration:	SACNASP Pr Sci Nat 400502/14 Ecological and Botany
Physical address:	2 Jock Meiring Street, Park West, Bloemfontein, 9324
Postal address:	PO Box 12500, Brandhof, 9324
Postal address	9324
Telephone	-
Cell phone	084 207 3454
E-mail	gabotha11@gmail.com

2. DECLARATION BY THE SPECIALIST

I, Gerhard Botha declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- 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 Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Botha

Signature of the Specialist

Nkurenkuru Ecology and Biodiversity (Pty) Ltd

Name of Company:

28 Aug 2024

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Gerhard Botha_________, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Nkurenkuru Ecology and Biodiversity (Pty) Ltd

Name of Company

28 Aug 2024

Date

Signature of the Commissioner of Oaths

28 Jul 2024

Date

ROSS SUTTNER
Commissioner Of Oaths (RSA)
Chartered Accountant (SA)
Registration Number 20039986
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7 West Quay Road, Waterfront
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Tel: +27 82 502 2021