- After avoidance of infrastructure and additional mitigation measures, the Watercourse habitat can be considered as medium sensitivity (refer to the separate Aquatic Assessment in Chapter 8 of the EIA Report). Refer to the Sensitivity Analysis Summary Statement below.

The sensitivity map for the entire study area is indicated in Figure 4 10 while the sensitivity map specific for Kudu Solar Facility 4 is indicated in Figure 4 11 below. For Kudu Solar Facility 4, no habitats are considered highly sensitive which must be avoided. Proposed mitigation measures could include changes to project infrastructure design to limit the amount of habitat impacted. The PV solar arrays and associated infrastructure were focused in areas identified as medium sensitivity and lower (all highly sensitive areas have been avoided), should the appropriate mitigation measures be implemented.

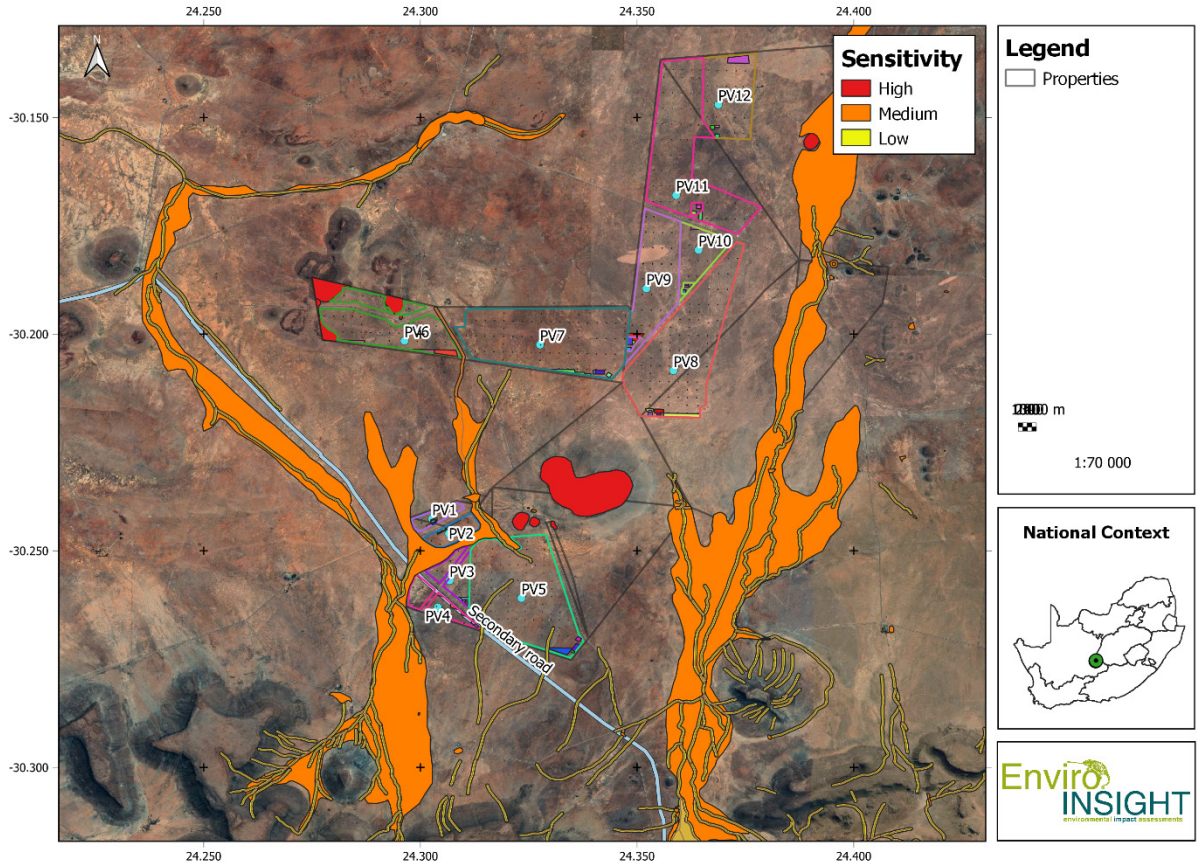
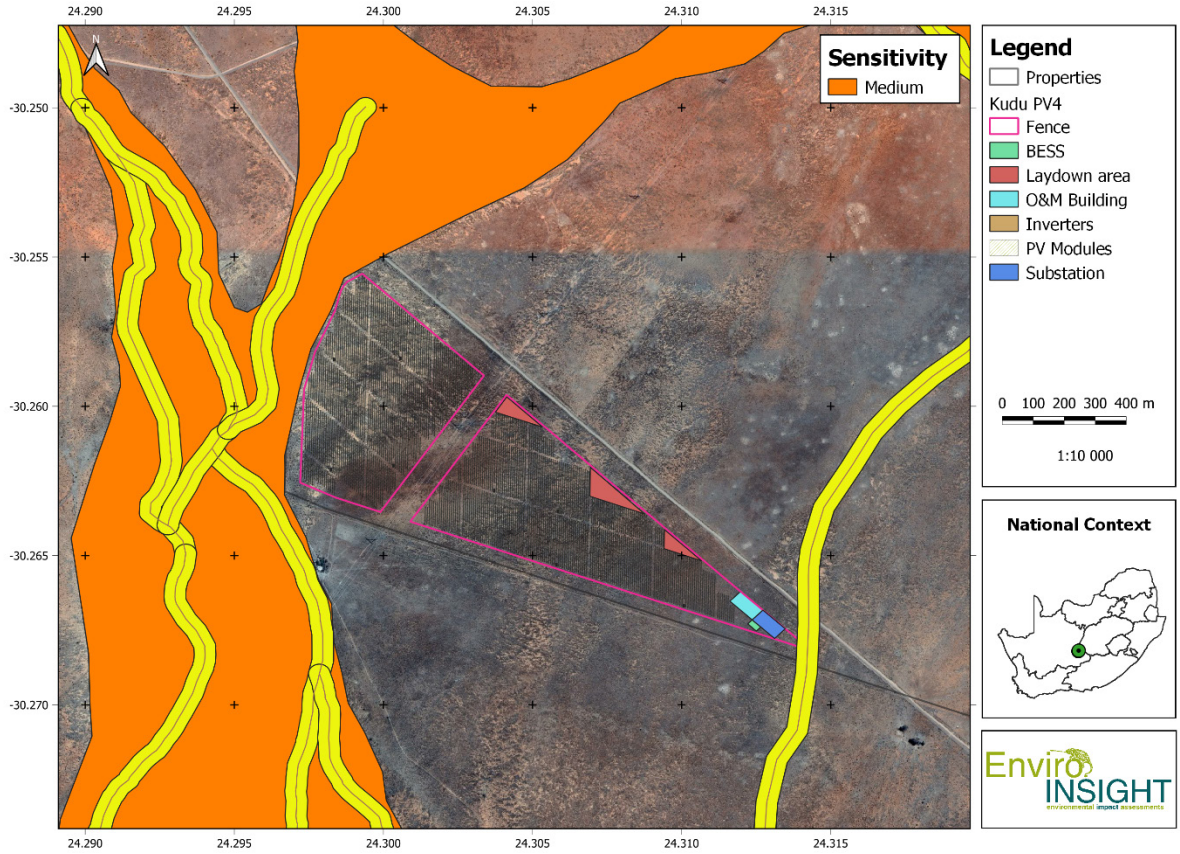


Figure 4-10: Sensitivity map for Kudu Solar Facilities 1-12.



The yellow areas indicated above are regarded as low sensitivity

Figure 4-11: Sensitivity map for Kudu Solar Facility 4.

From a mapping aesthetic perspective, the larger on-site substation complex, internal roads and access road are not displayed on the map above, however they have been considered in this assessment, along with all project components discussed in the project description. Refer to Chapter 2 of the EIA Report for additional layout maps.

4.4.2.1. Kudu Solar Facility 4 and associated infrastructure

The Watercourse habitat is identified as a medium sensitivity feature which must be buffered and mitigated as per the Aquatic Biodiversity report. The Watercourse habitat is critical for the continuation of important ecosystem services from a Terrestrial ecological point of view. The proposed mitigation measures suggested in this report as well as the aquatic biodiversity report could reduce the impact which could make it possible to develop within the proposed buffer area as suggested by the aquatic specialist.

4.4.3. Sensitivity Analysis Summary Statement

The sensitivity maps generated (Figure 4-11) is based on the SEI as follows:

- Highly sensitive features:
  - The Koppies are high sensitivity features which must be avoided by development activities. This is not relevant for PV4. Only limited development activities of low impact will be acceptable.
  - Linear infrastructure such as roads and overhead powerlines can cross the Watercourse, but it is advised to construct pylons outside the buffer areas.

  - Linear infrastructure such as roads and overhead powerlines should not cross the Koppies, and pylons should not be constructed in this habitat.
  - No sensitive plants were recorded, however several provincially protected species as well as a protected tree species were recorded. The Koppies habitat will assist in protecting many of the provincially protected species as well as a protected tree species.
- Medium sensitive areas:
  - The White Grassland habitat is considered moderately sensitive owing to its pristine nature with limited major impacts, mostly concentrated at homesteads, cattle camps and watering holes. Restoration efforts post-construction for temporary laydown areas are critical, as well as after the decommissioning of the facilities.
  - The Watercourse sensitivity is medium.
  - The larger tributary: the delineated edge of the surrounding floodplain wetland features. No buffer area was deemed to be required by the aquatic specialist considering that the floodplain is a wide transitional area between the tributary and the surrounding terrestrial areas.
  - Smaller streams and drainage features that are indicated to be of medium sensitivity: at least 35m for the watercourse or the delineated edge of wetland features to allow for the movement of water along these streams.
- Very Low sensitive areas – existing Transformed areas.

Note that the detailed layout shown in Figure 4-11 is considered acceptable from a terrestrial biodiversity, plant and animal species perspective. Changes to the detailed layouts post Environmental Authorisation (should such be granted) are deemed acceptable if the changes remain within the approved buildable areas / development footprints, and area assessed during this Scoping and EIA Process (with the avoidance of no-go sensitive areas).

5. Alternative Development Footprints

The Terrestrial Biodiversity Protocol (GN 320) states that the assessment must identify any alternative development footprints within the preferred site which would be of a low sensitivity as identified by the screening tool and verified through the site sensitivity verification. The protocol further states that a motivation must be provided if there were development footprints identified as per the latter that were identified as having a “low” terrestrial biodiversity sensitivity and were not considered appropriate.

The Plant Species Protocol (GN 1150) states that the study must identify any alternative development footprints within the preferred site which would be of “low” or “medium” sensitivity as identified by the screening tool and verified through the site sensitivity verification. The protocol further states that a motivation must be provided if there were any development footprints identified as per the latter that were identified as having “low” or “medium” terrestrial plant species sensitivity and were not considered appropriate.

At the commencement of this EIA Process, the specialists considered the entire study area, which included the Original Scoping Buildable Areas (during scoping). Following the identification of sensitivities and other considerations by the developer, Revised Scoping Buildable Areas were determined at the end of the Scoping Phase. The Original and Revised Scoping Buildable Areas served as development footprints. The aim of the EIA Phase is to identify the preferred development footprint or layout within the approved site as contemplated in the accepted Scoping Report, which in this case is the Study Area. The proposed development footprint within the preferred development site (i.e. study area) has been amended through the project assessment process to ensure that it will not be located within high sensitivity areas.

This report focuses on the development footprint for Kudu Solar Facility 4, which is considered suitable from a terrestrial biodiversity, plants and animal species perspective, as the sensitivities identified above have been taken into consideration. Development in high sensitivity areas is avoided by the layout, and only areas of medium or low sensitivity are considered for this project. There are no development footprints identified that are not considered appropriate.

In addition, the entire study area was assessed in this Scoping and EIA Process. Furthermore, as indicated in Chapter 5 of the EIA Report, no other site alternatives were considered as the site was deemed feasible based on various site suitability factors. Therefore, no other alternative development footprints of low or medium sensitivity were identified and not considered appropriate for this study.

6. Issues, Risks and Impacts

6.1 Identification of Potential Impacts/Risks

The potential impacts identified during the S&EIA are listed below:

Construction Phase

I. Potential impact 1: Fragmentation and loss of habitat and sensitive features
- The total developable area is estimated to be 3268 ha based on the based on the development footprints. Refer to the Chapter 2 of the EIA Report for the estimated area of each PV Facility. The solar arrays will be positioned approximately 3.5m above ground, and groundworks will be minimal for these areas. Vegetation cover will still remain, albeit at a lower species composition and structure.
- It is estimated that approximately 90 ha will be cleared for internal roads in total for all 12 PV projects. Refer to the Chapter 2 of the EIA Report for the estimated area to be cleared for the internal roads needed for each facility. This will result in loss of vegetation and will increase habitat fragmentation as small islands of vegetation will remain. The functionality of these vegetation patches will be reduced.
- The Watercourse habitat has high habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches.
- The Grassland habitat has good habitat connectivity with potentially functional ecological corridors with minor current negative ecological impacts.
- The Watercourse habitat will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, where species 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. Accordingly, their resilience is considered to be medium.
- The significance of the impact is considered High (before the implementation of mitigation measures) and should be avoided from the development.

II. Potential impact 2: Loss of protected species
- Several provincially protected species (refer to Table 4-2) occur on site which must either be relocated prior to construction or alternative measures made (depending on comments received from the provincial authority - refer to Table 4-2 for site specifics). A permit application is required for submission to the relevant provincial department where the proposed development will impact on these species.
- Without mitigation measures this impact is rated with a high significance, and with mitigation the significance is reduced to low.

III. Potential impact 3: Introduction and spread of alien invasive species
- Alien and invasive species are more likely to establish in disturbed areas due to construction activities.
- Currently, alien invasive species are dominant in the Watercourse habitat and where existing infrastructure are located, such as homesteads and livestock pens.
- Vehicles can also transport seeds from other areas and introduce new species previously unknown to the area.
- Without mitigation measures this impact is rated with a moderate significance, and with mitigation the significance is reduced to moderate-low.

IV. Potential impact 4: Increased erosion and soil compaction
- Erosion is likely to occur where vegetation has been cleared.
- Heavy machinery and vehicles operated during the construction phase will lead to soil compaction. Plants cannot readily establish in compacted soil, since the soil is too hard for root penetration.
- Water infiltration is less in compacted areas and the runoff is higher, which could lead to increased erosion.
- It is expected that internal routes will cross the Watercourse habitat. This may result in damage to the habitat, including changes in flow patterns, functionality and erosion.
- Erosion increases the sediment load in the watercourses, resulting in increased sedimentation downstream of the disturbance. Sedimentation may cause a blockage and alter the characteristics of the watercourse.
- Without mitigation measures this impact is rated with a moderate significance, and with mitigation the significance is reduced to low.

V. Potential impact 5: Littering and General Pollution
- The site camp and construction activities are potential sources of pollution, including hydrocarbons, construction material, domestic waste and sewage.
- Pollution may inhibit plant growth.
- It can cause soil and water pollution if not managed appropriately.
- Pollution will be localised to the site, but several pollutants may spread due to water runoff.
- Without mitigation measures this impact is rated with a moderate significance, and with mitigation the significance is reduced to low.

Operational Phase

I. Potential impact 1: Increase in alien invasive species
- After construction, alien invasive species could have established in optimal conditions.
- If not managed, these species can spread and reduce plant species diversity and could alter species composition.
- Without mitigation measures this impact is rated with a moderate significance, and with mitigation the significance is reduced to low.

II. Potential impact 2: Loss of species composition and diversity
- The shading effect from solar panels is likely to affect the species composition and diversity, and may result in some bare patches. Numerous shrubs will be removed, where only the herbaceous and grass layers remain.
- Emerging seedlings of protected species may also be affected by the shading. Protected tree species and sensitive species may therefore not regenerate in the developed area.
- Large numbers of seedlings are not expected during the project cycle for protected trees.
- Without mitigation measures this impact is rated with a moderate significance.

III. Potential impact 3: Littering and General Pollution
- The most likely type of pollutants are hydrocarbons spilled when refuelling vehicles, leakages from poorly maintained vehicles, spillage from maintaining machinery on site and littering at the site office or security gate.
- Without mitigation measures this impact is rated with a moderate significance, and with mitigation the significance is reduced to low.

Decommissioning Phase

I. Potential impact 1: Alien invasive species management
- During this phase, machinery can disturb the soil which can create optimal conditions for seeds to sprout.
- Vehicles can also transport seeds from other areas and introduce new species previously unknown to the area.
- Without mitigation measures this impact is rated with a moderate significance, and with mitigation the significance is reduced to low.

II. Potential impact 2: Loss of habitat
- Some vegetation may be destroyed during decommissioning, which may result in loss of species composition and diversity. Decommissioned areas must be rehabilitated to restore the habitats.
- Without mitigation measures this impact is rated with a low significance, and with mitigation the significance is reduced to very low.

6.2 Cumulative Impacts

Note that for cumulative impacts, other Wind and Solar projects, as well as EGI projects, within a 30 km radius are considered during the EIA Phase. The projects considered in the cumulative assessment are shown in Figure 6-1 below and Table 6-1. Note that each project has been assigned a number, and the number is shown in Table 6-1 with additional project specific information.

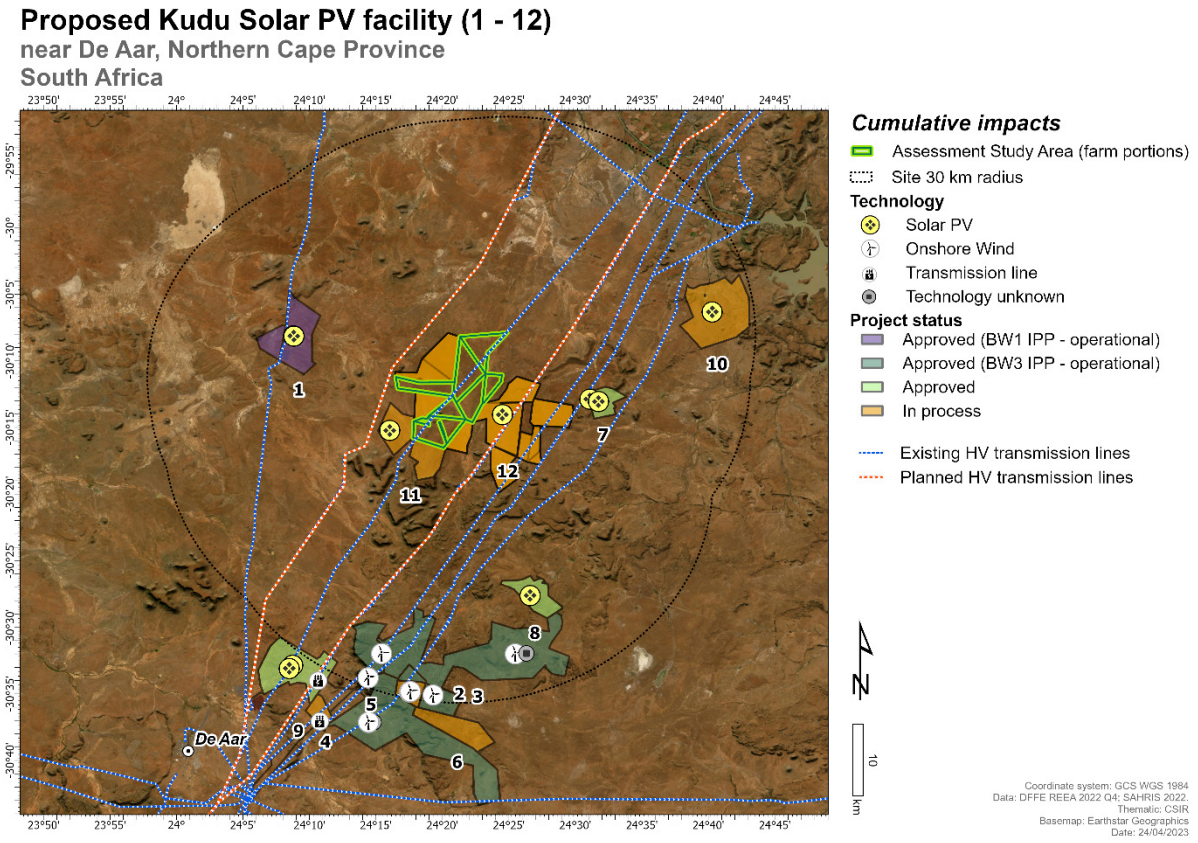


Figure 6-1: Map illustration of the proposed renewable energy projects, located within 30 km of the proposed Kudu Solar Facilities, considered in the Cumulative Impact Assessment (in addition to the Kudu Solar Facilities) (Source: DFFE REEA, Quarter 4, 2022; and SAHRIS).

Table 6-1: Proposed renewable energy projects, located within 30 km of the proposed Kudu Solar Facilities, considered in the Cumulative Impact Assessment (Source: DFFE REEA, Quarter 4, 2022; and SAHRIS).

CSIR NUMBER	DFFE REFERENCE	TECHNOLOGY	MW/KV	STATUS	PROJECT TITLE
1	• 12/12/20/2258 • 12/12/20/2258/1	Solar PV	75	Approved and Preferred Bidder (Operational)	• The Proposed Establishment of Photovoltaic (Solar Power) Farms in the Northern Cape Province - Kalkbult
2	• 12/12/20/2463/1 • 12/12/20/2463/1/2 • 12/12/20/2463/1/A2 • 12/12/20/2463/1/AM3 • 12/12/20/2463/1/AM4 • 12/12/20/2463/1/AM5	Onshore Wind	140	Approved and Preferred Bidder (Operational)	• Longyuan Mulilo De Aar 2 North Wind Energy Facility • Longyuan Mulilo De Aar Maanhaarberg Wind Energy Facility • The Wind Energy Facility (North and South) situated on the Plateau Near De Aar, Northern Cape Province
3	• 12/12/20/2463/2 • 12/12/20/2463/2/AM2	Onshore Wind	100	Approved and Preferred Bidder (Operational)	• Longyuan Mulilo De Aar Maanhaarberg Wind Energy Facility • The Wind Energy Facility (North and South) Situated on The Plateau Near De Aar, Northern Cape Province
4	• 14/12/16/3/3/1/1166 14/12/16/3/3/1/1166/AM3 14/12/16/3/3/1/1166/AM4	Transmission line	132	Approved	• Basic Assessment for the proposed construction of a 132 kV transmission line corridor adjacent to the existing Eskom transmission line from Longyuan Mulilo De Aar 2 North Wind Energy Facility (WEF) to the Hydra Substation in De Aar, Northern Cape
5	• 14/12/16/3/3/1/785	Transmission line	132	Approved	• Proposed construction of two 132kV transmission lines from the South & North Wind Energy Facilities on the Eastern Plateau (De Aar 2) near De Aar, Northern Cape.
6	• 14/12/16/3/3/2/278 • 14/12/16/3/3/2/278/1 • 14/12/16/3/3/2/278/2	Onshore Wind	118	Approved	• Proposed Castle Wind Energy Facility Project, located near De Aar, Northern Cape
7	• 14/12/16/3/3/2/564 • 14/12/16/3/3/2/564/AM1 • 14/12/16/3/3/2/564/AM2	Solar PV	75	To be confirmed	• Proposed Swartwater 75MW solar PV power facility in Petrusville within Renosterburg Local Municipality, Northern Cape
8	• 14/12/16/3/3/2/740	Solar PV	300	Approved	• Proposed 300MW Solar Power Plant in Phillipstown area in Renosterberg Local Municipality
9	• 14/12/16/3/3/2/744	Solar PV	0	Approved	• Proposed PV facility on farm Jakhalsfontein near De Aar
10	• 14/12/16/3/3/2/739	Solar PV	70 - 100	To be confirmed	• Proposed 70 - 100 MW Solar Power Plant in Petrusville
11	• Not issued yet (it is understood that the project is still within the pre-application stage)	Solar PV	800 (Maximum)	Pre-Application	• The Proposed Keren Energy Odyssey Solar PV Facilities (Odyssey Solar 1, Odyssey Solar 2, Odyssey Solar 3, Odyssey Solar 4, Odyssey Solar 5, Odyssey Solar 6, Odyssey Solar 7 And Odyssey Solar 8)

CSIR NUMBER	DFFE REFERENCE	TECHNOLOGY	MW/KV	STATUS	PROJECT TITLE
12	• To be confirmed	Solar PV	3050	Scoping	• The Proposed Development of the Crossroads (formally referred to as the Hydra B) Green Energy Cluster of Renewable Energy Facilities and Grid Connection Infrastructure, Pixley Ka Seme District Municipality, Northern Cape Province. The Cluster entails the development of up to 21 solar energy facilities, with the Scoping and EIA Processes consisting of three phases. Phases 1, 2 and 3 consist of 9, 6 and 6 solar facilities, respectively. The Phase 1 Scoping and EIA Processes were launched in January 2023.
Study area shown on map	• 14/12/16/3/3/2/2244 • 14/12/16/3/3/2/2245 • 14/12/16/3/3/2/2246 • 14/12/16/3/3/2/2247 • 14/12/16/3/3/2/2248 • 14/12/16/3/3/2/2249 • 14/12/16/3/3/2/2250 • 14/12/16/3/3/2/2251 • 14/12/16/3/3/2/2252 • 14/12/16/3/3/2/2253 • 14/12/16/3/3/2/2254 • 14/12/16/3/3/2/2255	Solar PV	2180	Scoping and EIA Process underway	• Proposed Development of 12 Solar Photovoltaic (PV) Facilities (Kudu Solar Facility 1 to 12) and associated infrastructure, near De Aar, Northern Cape Province
Shown on map as Existing HV Lines	• N/A	Transmission Line	220	Existing Power Line	• Hydra Roodekuil 2
Shown on map as Existing HV Lines	• N/A	Transmission Line	132	Existing Power Line	• Hydra Roodekuil 1
Shown on map as Existing HV Lines	• N/A	Transmission Line	765	Existing Power Line	• Beta Hydra 2
Shown on map as Existing HV Lines	• N/A	Transmission Line	400	Existing Power Line	• Hydra Perseus 3
Shown on map as Existing HV Lines	• N/A	Transmission Line	220	Existing Power Line	• Van Der Kloof Roodekuil 2
Shown on map as Existing HV Lines	• N/A	Transmission Line	220	Existing Power Line	• Van Der Kloof Roodekuil 1
Shown on map as Existing HV Lines	• N/A	Transmission Line	400	Existing Power Line	• Beta Hydra 1
Shown on map as Existing HV Lines	• N/A	Transmission Line	400	Existing Power Line	• Hydra Perseus 2

CSIR NUMBER	DFFE REFERENCE	TECHNOLOGY	MW/KV	STATUS	PROJECT TITLE
Shown on map as Existing HV Lines	• N/A	Transmission Line	132	Existing Power Line	• Kalkbult/Kareeboschpan 1
Shown on map as Existing HV Lines	• N/A	Transmission Line	132	Existing Power Line	• Roodekuil/Orania 1
Shown on map as Planned HV Lines	• N/A	Transmission Line	765	Planned Power Line	• Perseus to Gamma 2nd 765 kV line • Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line
Shown on map as Planned HV Lines	• N/A	Transmission Line	765	Planned Power Line	• Relocate Beta-Hydra 765kV line to form Perseus-Hydra 1st 765kV line • Cape Corridor Phase 2: Zeus - Hydra 765kV Integration
Shown on map as Planned HV Lines	• N/A	Transmission Line	765	Planned Power Line	• Perseus to Gamma 2nd 765 kV line • Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line

I. Cumulative impact 1: Habitat loss and fragmentation

- The Eastern Upper Karoo vegetation type is not considered threatened, but sensitive features still exist within these vegetation types and on the study area.
- The total developable area for all twelve PV facilities and associated infrastructure is 3268 ha, but the entire site will not be cleared of vegetation. The basal layer will still maintain the grass and herbaceous layer, but shrubs will be removed which will alter the vegetation structure and species composition. In addition, additional loss will be due to internal road network. This accounts for <1% loss of the original vegetation type extent, which is not considered significant.
- Koppies and Watercourse habitats still remain important ecological features in terms of ecosystem functioning, climate refugia, landscape corridors and harbouring endemic species. Avoiding these habitats as indicated, will reduce the total sensitive areas for development which in turn will reduce the overall cumulative impacts.

6.3 Summary of Issues identified during the Public Consultation Phase

The potential terrestrial biodiversity issues identified during the Scoping and EIA Process include:

- Destruction of sensitive fauna and flora species.
- Increase in alien and invasive species which require management.
- Fauna electrocutions with electric fences.
- Potential for Giant bull frogs to occur on site.
- The heat island effect on reptiles.
- Destruction of *Hippotragus niger* (Sable Antelope) habitat.

The issues raised are summarised below in Table 6-2.

Table 6-2: Comments Received from Stakeholders during the Public Consultation Phase.

TERRESTRIAL		
I&AP	**KEY ISSUE**	**RESPONSE**
02/02/2023 (Letter received via email) Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform: Environmental Research and Development (ERD) (Natalie Uys)	Fauna and flora permits will be needed from the department for handling/ removing/ relocating/ destroying all specially protected and protected flora and fauna. Estimated numbers for species that need to be removed must be provided for permit approval.	The need for fauna and flora permits has been addressed in this Terrestrial Biodiversity and Species Assessment. Estimated numbers of species that need to be removed will be provided during the preconstruction walkdown of the site for permit approval. A walkdown is required in order to identify and quantify the protected species that will be impacted on by the approved layout. All relevant permits will be applied for prior to construction, after EA is issued, should such authorisation be granted.
As above	*Boscia albitrunca* is protected under both the National Forest Act and under the Northern Cape Nature Conservation Act. Estimated densities must be calculated or the actual number of trees to be removed must be provided for permit purposes. Contact person for DFFE Forestry in the Northern Cape is Jacoline Mans, Jmans@dffe.gov.za.	As noted in this report, a permit for the removal of *Boscia albitrunca* from the Northern Cape DFFE under the National Forest Act will be required should the proposed development impact on any individuals. Estimated densities need to be calculated or the actual number of trees to be removed provided for permit purposes. The relevant contact person (as indicated) will be contacted as necessary. All relevant permits will be applied for prior to construction, after EA is issued, should such authorisation be granted.
As above	Please take note that *Olea europaea subsp. africana* is a protected tree under the Northern Cape Nature Conservation Act.	*Olea europaea subsp. africana* is one of the species recorded associated with the Koppies habitat. The Koppies, however, will be avoided by the proposed project, and more specifically related to Kudu Solar Facility 6 only.
As above	Alien and invasive species management must be done throughout the lifetime of the projects. Please take note that cacti species such as *Opuntia* spp cannot dumped at general waste sites without prior treatment (drying/chemical). Please liaise with Dr Thabiso Mokotjomela, 073 324 6118, mokotjomela@sanbi.org.za, on the management and disposal of cacti.	In terms of current impacts on site, impacts include the presence of alien invasive species, mainly *Prosopis* species and planted *Eucalyptus* and *Opuntia* species. In some areas, *Opuntia* has spread into the grassland. These specific recommendations regarding the management of cacti species such as *Opuntia* spp. are noted and are included in the Project Environmental Management Programme (EMPr).
As above	The availability of foundational and baseline data for the Northern Cape is limited and as a result the Screening Tool has limitations and shortcomings when assessing impacts for this area. Proper site surveys are for that reason critically important and always recommended.	The specialists involved in this assessment are aware of this and have undertaken proper site surveys as noted in the Site Sensitivity Verifications in Appendix C of this report. In terms of the Terrestrial Biodiversity and Species Assessment, a detailed survey was carried out by the specialist. The Screening Tool report is a guideline which was used along with available literature and other data for the area to inform the Site Sensitivity Verification and field survey.
As above	The initial vegetation map generated for the site reflects the limitations as mentioned before reflecting the gaps in the National Vegetation Map.	The comment is unclear and does not have a significant impact on the outcome of the assessment. Any limitations that exist within existing tools or datasets can be rectified after the site surveys, but the data collected did not change the status of the vegetation unit and no sensitive species were recorded during the survey.
As above	I.t.o. the terrestrial biodiversity please assess, mitigate and	The Animal Compliance Statement included as Appendix E to this Terrestrial Biodiversity and Species Assessment notes that Leopard

TERRESTRIAL		
I&AP	**KEY ISSUE**	**RESPONSE**
	make provision for in the EMPR the following: a) Please take note that tortoise populations are affected by the following: i. electrocutions with electric fences. ii. predations by crows – (relates to waste management).	tortoise (a generalist tortoise) is found in a variety of habitats including arid and mesic savannah, thorn scrub and grasslands. The species was recorded in the south and north of the study area, and it can be deduced that the species occurs throughout the study area. Various impact management actions have been included in the compliance statement with regards to faunal management. Littering and general pollution is also identified as a potential impact, with various mitigation measures, which are included in the EMPr. This will ensure that the construction site is managed appropriately in terms of waste, and therefore reduce the likelihood of predation by crows.
As above	I.t.o. the terrestrial biodiversity please assess, mitigate and make provision for in the EMPR the following: a) Giant bull frogs were found in De Aar area in pans after the recent rains. Most of the injuries and mortalities to this species occurs from collision with vehicles when moving between their breeding sites (pans) and their burrows. Their burrows can range from 200m to 1km from the pans and they are capable of estivating underground for 7 years. Herbicide and pesticide use should also be restricted near the sites (Yetman, undated). Please liaise with EWT in this regard.	Response from Luke Verburgt (herpetofauna specialist): The Animal Compliance Statement included as Appendix E to this Terrestrial Biodiversity and Species Assessment made use of the Frog Atlas of Southern Africa (FrogMAP, 2022), and Amphibian Species of Conservation Concern (SCC) information was obtained from Du Preez and Carruthers (2017). Various impact management actions have been included in the compliance statement with regards to faunal management, including road mortalities, such as: ▪ All vehicle speeds associated with the project should be monitored and should be limited to 40 km/h (maximum) during the construction phase. ▪ As roadkills are currently considered high for this area, a roadkill monitoring programme (inclusive of wildlife collisions record keeping) should be established. Where needed, Animex fences must be installed to direct animals to safe road crossings. Finally, mitigation should be adaptable to the onsite situation which may vary over time. The various mitigation measures have been included in the EMPr. Furthermore, neither the Screening Tool Report nor the FrogMap data indicates the presence of the species in the area. *Pyxicephalus adspersus* (Giant Bullfrog, hereafter GB) is not considered to be a species of conservation concern as it has been evaluated as Least Concern (see: http://speciesstatus.sanbi.org/assessment/last-assessment/1533/). In addition, this species has not been previously recorded on the quarter degree grid cells (3024AD, 3024AB) which are overlapped by the project study area, so it is not common in the area. However, it is still considered moderately likely that this species could occur across the project study area. Because the pans and watercourses were already delineated and excluded from development infrastructure, it is only considered necessary to provide additional mitigation for this species if it is being impacted upon by vehicles operating in the PV and construction area. This will require an Environmental Control Officer (ECO) to record all incidences of GB roadkills in a spatial database to allow evaluation of hotspots of activity and migration corridors. Should this occur, mitigation will need to be applied to these areas through the creation of “frog underpasses” in combination with drift fences allowing migration to occur while continuing the safe operation of vehicles in the project area. It is, however, good practice to ensure that the majority of construction activity takes place during the dry winter months when frogs are inactive to limit the potential for roadkill (temporal avoidance). The pans have been identified by the Aquatic specialist, and are currently buffered by 50 m. Note that only one pan occurs within the study area. The large floodplains are not buffered as the aquatic specialist noted no buffer is needed; and the smaller watercourses are buffered by 35 m (as noted in Chapter 8 of this EIA Report). A 50 m buffer around pans is considered sufficient for GBs to breed successfully. Note that the raised solar panels will still allow for foraging options and migration to and from the breeding

TERRESTRIAL		
I&AP	**KEY ISSUE**	**RESPONSE**
		pans by this species, so this habitat is not considered completely removed from utilisation by GBs. New roads developed for the proposed project that will be regularly travelled/patrolled should ideally be placed >100 m from a pan and should be regularly inspected by an ECO to assess roadkills. Note that existing roads do run within 100 m of the mapped pan. If there is increased traffic expected from the development (at least during the construction phase this is a reasonable assumption), then the relevant portion of the existing road close to the pan should be monitored for roadkills also so that mitigation can be applied if necessary. Herbicide and pesticide used as part of control measures should be approved by the ECO prior to application, taking all sensitive features into account.
As above	I.t.o. the terrestrial biodiversity please assess, mitigate and make provision for in the EMPR the following: b) The following are concerns i.t.o. of the cumulative footprint of the 12 x PV's and should be assessed: i. The heat island effect (local warming, impacts on reptiles etc.). ii. Lake effect on insects (e.g. insects have been lying eggs on panels instead of pans). iii. Insect mortalities (security lights at these sites at night attract insects). iv. Bat impacts (bats are attracted to by the security lights). Various bat species have been recorded around Vanderkloof and in De Aar.	▪ Heat island effect (local warming) impacts on reptiles etc.: This has not been studied in the SA context, and accordingly the impacts are not well known. Generally, the construction of solar farms removes most of the vegetative cover and rocky material at the surface, which would make much of the solar farm unsuitable for the survival of the original small mammal or reptile community. Given that none of these represent species of conservation concern, these habitats are not excluded from the development. Thus, the impact of the heat-island is of little significance. ▪ Lake effect on insects: Should appropriate buffers be applied to watercourses, it is less likely for aquatic insects to lay eggs on these structures. Studies have found that in general insects avoided solar cells with nonpolarizing white borders and white grates. Fragmenting panels solar-active area does lessen their attractiveness to polarotactic insects. The design of solar panels and collectors and their placement relative to aquatic habitats will likely affect populations of aquatic insects that use polarized light as a behavioural cue. Accordingly, appropriate mitigation measures have been applied to reduce the potential impacts. This is not considered a fatal flaw. ▪ Insect mortalities: The Animal Compliance Statement (included as Appendix E to this Terrestrial Biodiversity and Species Assessment) provides various proposed impact management actions. One of the impact management actions that relates to this comment is the recommendation to "reduce exterior lighting to that necessary for safe operation and implement operational strategies to reduce spill light. Use down-lighting from non-UV lights where possible, as light emitted at one wavelength has a low level of attraction to insects. This will reduce the likelihood of attracting insects and their predators. Insects generally see three colours of light, Ultraviolet (UV), blue and green. Bright white or bluish lights (mercury vapor, white incandescent and white florescent) are the most attractive to insects. Yellowish, pinkish, or orange (sodium vapor, halogen, dichroic yellow) are the least attractive to most insects. ▪ Bat impacts: Assessing bats is not a requirement for solar facilities, and there are no formal guidelines in this regard. No Species of Conservation Concern were identified by the Screening Tool or during the initial site sensitivity verification. The watercourses have been buffered accordingly by the Aquatic Specialist, which is the most important foraging habitat for bats.
20/01/2023 Letter (received via email on 20/01/2023) Department of Forestry, Fisheries and the Environment:	Need for the indication of the location/ habitat of the *Hippotragus niger* (Sable Antelope) in the final layout plan, along with a suitable buffer zone. DFFE (PV 1,2, and 3)	As indicated in the Animal Compliance Statement (Appendix E of this report), the Sable Antelope is an introduced species i.e. it does not occur naturally in the area and it was introduced to the country, therefore occurs outside its area of historical distribution, is possibly ranched or farmed or free roaming. **Importantly it does not function as part of the study area ecosystem**. It is believed that the individual sited came from an adjacent property, which has high fences. The adjacent property owner is believed to have game on their land. It is suggested that the developer come to an agreement with the adjacent landowner to consider appropriate measures for the current bordering fences to prohibit the Sable to move between the

<table>
<tr><th colspan="3">TERRESTRIAL</th></tr>
<tr><th>I&AP</th><th>KEY ISSUE</th><th>RESPONSE</th></tr>
<tr><td>Chief Directorate: Integrated Environmental Authorisations (Ms Milicent Solomons; Acting Chief Director: Integrated Environmental Authorisations; Letter signed by: Mahlatse Shubane; Enquiries: Ms Olivia Letlalo)</td><td></td><td>two properties. Once this is achieved, there are no further mitigation measures required.

As further indicated in the Animal Compliance Statement, even though animals were sighted at specific locations, they can occur across the study area (or site) as they move around to feed. Accordingly, the animals mentioned in the Animal Compliance Statement should not be associated with a specific PV facility and the possible impacts and proposed mitigation measures will be applicable for all PV facilities. However, the only exclusion can be that of the Sable Antelope, which is unlikely to venture of further away from the adjacent property. Based on this, it is not vital to show the habitat in which it was found in the layout plan. Furthermore, based on the above, a buffer zone is not required.</td></tr>
<tr><td>As above</td><td>Query as to why a full animal assessment is not required as part of the impact analysis and SEI evaluation. DFFE (PV 1,2, and 3)</td><td>The Species Environmental Assessment Guideline (2022[8]), which must be used as per the requirements of the Terrestrial Animal Species Protocol (GN 1150), states the following (direct extract, Page 89) in relation to the Sable:

<table><tr><th>Species or species groups</th><th>Description</th><th>Recommendation</th></tr><tr><td>Large carnivores</td><td>Introduced, outside area of historical distribution, ranched or farmed, not functioning as part of PAOI ecosystem. May persist in artificially inflated numbers due to feeding supplementation and/ or intensive practices and will not exhibit usual home range/ecological behaviour. Species that have been introduced into areas outside of historical distribution and have fully integrated into the natural PAOI ecosystem are considered 'feral' or 'alien'.</td><td>Highly unlikely to be relevant. Specialist advised to exclude presence of species as part of the impact analysis and SEI evaluation. If species are to remain within the PAOI post development, rare or high-value species should form part of the security management plan.</td></tr></table>
Based on the reasons above (i.e. it is an introduced species, likely to occur on the adjacent property and the need for an agreement between the developer and the adjacent landowner to consider appropriate measures for the bordering fences to restrict the Sable from entering the PV Facility; and based on recommendation of the Species Environmental Assessment Guideline), it is not necessary to include the presence of this species as part of the impact analysis and Site Ecological Importance (SEI) evaluation, and accordingly a full animal assessment is not required.</td></tr>
</table>

Comments related to terrestrial biodiversity, plant and animal species impacts associated with the proposed project were raised by Interested and Affected Parties during the review period of the Draft EIA Report. Some of the comments raised by the DFFE are similar to those submitted and considered during the Scoping Phase, and therefore similar responses apply. Comments were raised on the applicability of geographical areas in Listing Notice 3 in terms of the proposed project; the indigenous vegetation types affected; clarity on the sensitivity of grassland and watercourse habitats; and queries on the Sable Antelope (specific comment from the DFFE in terms of Kudu Solar Facility 1 to 3). Responses have been provided in Appendix H.7 of the Final EIA Report.

[8] 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 3.1. 2022.

7. Impact Assessment

7.1 Potential Impacts during the Construction Phase

The potential impacts identified during the construction phase are discussed below.

Potential impact: Fragmentation and loss of habitat and sensitive features.

Refer to Section 6 of this chapter for a description of this potential impact, which is rated as negative with a site specific spatial extent, long term duration, low reversibility and moderate irreplaceability, as well as a severe consequence and very likely probability, rendering the pre-mitigation significance as High. With mitigation, the impact is rated as moderate significance. The potential mitigation measures are discussed in the table below.

Potential impact: Loss of protected species.

Refer to Section 6 of this chapter for a description of this potential impact, which is rated as negative with a site specific spatial extent, long term duration, irreversible reversibility and high irreplaceability, as well as a severe consequence and very likely probability, rendering the pre-mitigation significance as High. With mitigation, the impact is rated as low significance. The potential mitigation measures are discussed in the table below.

Potential impact: Introduction and spread of alien invasive species.

Refer to Section 6 of this chapter for a description of this potential impact, which is rated as negative with a local spatial extent, medium term duration, moderate reversibility and low irreplaceability, as well as a substantial consequence and likely probability, rendering the pre-mitigation significance as Moderate. With mitigation, the impact is rated as moderate-low significance. The potential mitigation measures are discussed in the table below.

Potential impact: Increased erosion and soil compaction.

Refer to Section 6 of this chapter for a description of this potential impact, which is rated as negative with a site-specific spatial extent, medium term duration, moderate reversibility and moderate irreplaceability, as well as a substantial consequence and likely probability, rendering the pre-mitigation significance as Moderate. With mitigation, the impact is rated as low significance. The potential mitigation measures are discussed in the table below.

Potential impact Littering and General Pollution.

Refer to Section 6 of this chapter for a description of this potential impact, which is rated as negative with a local spatial extent, short to medium term duration, moderate reversibility and low irreplaceability, as well as a substantial consequence and likely probability, rendering the pre-mitigation significance as Moderate. With mitigation, the impact is rated as low significance. The potential mitigation measures are discussed in the table below.

Table 7-1: Potential Impacts during the Construction Phase.

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Habitat loss and fragmentation	*Status*	*Negative*	*High*	• *No development should take place within High sensitivity areas or buffer zones. Accordingly, the Koppies habitat (where relevant) should be avoided. The Watercourse habitats of medium sensitivity should be avoided, as recommended by the Aquatic specialist in Chapter 8 of this EIA Report.* • *No construction related activities, such as the site camp, storage of materials, temporary roads or ablution facilities may be located in the high sensitivity areas.*	*Moderate*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Very Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Moderate*				
Loss of protected species	*Status*	*Negative*	*High*	*Where the approved layout designs impact on individuals, permit applications are required for either the relocation or destruction of provincially protected species (Northern Cape Nature Conservation Act No.9 of 2009) and for protected trees in terms of the National Forests Act No. 84 of 1998.*	*Low*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Very Likely*				
	Reversibility	*Irreversible*				
	Irreplaceability	*High*				
Increased alien invasive species	*Status*	*Negative*	*Moderate*	*Implement an alien and invasive species control and monitoring plan in terms of NEMBA. Alien invasive species establishment and spreading should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with such plants.*	*Moderate to Low*	*Medium*
	Spatial Extent	*Local*				
	Duration	*Medium term*				
	Consequence	*Substantial*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low irreplaceability*				
Increased erosion and soil compaction	*Status*	*Negative*	*Moderate*	• *Utilise existing access routes as far as possible.* • *Confine the movement of vehicles to the access routes to and from the site and to the construction areas.* • *Do not drive in the natural veld.* • *Rehabilitate new vehicle tracks and areas where the soil has been compacted as soon as possible.* • *Monitor the entire site for signs of erosion throughout the construction phase of the project.* • *Refer to the Aquatic Biodiversity Specialist Assessment Report for mitigation measures relevant to watercourse crossings and development close to watercourses.*	*Low*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Medium term*				
	Consequence	*Substantial*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Moderate*				

Impact	***Impact Criteria***		***Significance and Ranking (Pre-Mitigation)***	***Potential mitigation measures***	***Significance and Ranking (Post-Mitigation)***	***Confidence Level***
Littering and general pollution	*Status*	*Negative*	*Moderate*	• *The site camp must not be located in high sensitivity areas and their buffer zones.* • *Dangerous goods may not be stored within 100 m of a watercourse.* • *Hydrocarbon fuels must be stored in a secure, bunded area.* • *Sufficient waste disposal bins must be available on site and clearly marked. Skip bins may be required during the construction phase which must be emptied on a regular basis by an approved/licenced waste disposal contractor. Proof of disposal to be kept on file.* • *Ablution facilities must be located outside sensitive areas and their buffer zones.* • *Portable ablution facilities must be regularly cleaned and maintained in good working condition.* • *Any spillage from ablution facilities must be cleaned up immediately and disposed of in an appropriate manner.* • *Vehicles must be in good working condition, with no oil, water, or fuel leaks. Vehicles must be regularly inspected, and any problems corrected.* • *Refuelling may only take place in an appropriate, bunded area. Refuelling may not take place in sensitive areas.* • *Hydrocarbon spills must be contained and cleaned up immediately. Spill kits must be available on site in case of accidental spillage.*	*Low*	*Medium*
	Spatial Extent	*Local*				
	Duration	*Short to Medium term*				
	Consequence	*Substantial*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

7.2 Potential Impacts during the Operational Phase

The potential impacts identified during the operational phase are discussed below.

Potential impact: Loss of species composition and diversity.

Refer to Section 6 of this chapter for a description of this potential impact, which is rated as negative with a site-specific spatial extent, medium term duration, moderate reversibility and moderate irreplaceability, as well as a substantial consequence and likely probability, rendering the pre-mitigation significance as Moderate. With mitigation, the impact is rated as moderate significance. The potential mitigation measures are discussed in the table below.

Potential impact: Increase in alien invasive species.

Refer to Section 6 of this chapter for a description of this potential impact, which is rated as negative with a local spatial extent, medium term duration, moderate reversibility and low irreplaceability, as well as a substantial consequence and likely probability, rendering the pre-mitigation significance as Moderate. With mitigation, the impact is rated as low significance. The potential mitigation measures are discussed in the table below.

Potential impact Littering and General Pollution.

Refer to Section 6 of this chapter for a description of this potential impact, which is rated as negative with a local spatial extent, short to medium term duration, moderate reversibility and low irreplaceability, as well as a substantial consequence and likely probability, rendering the pre-mitigation significance as Moderate. With mitigation, the impact is rated as low significance. The potential mitigation measures are discussed in the table below.

Table 7-2: Potential Impacts during the Operational Phase.

Impact	***Impact Criteria***		***Significance and Ranking (Pre-Mitigation)***	***Potential mitigation measures***	***Significance and Ranking (Post-Mitigation)***	***Confidence Level***
OPERATIONAL PHASE						
Loss of species composition and diversity	*Status*	*Negative*	*Moderate*	• *The loss of species composition and diversity cannot be mitigated due to a permanent structure which will change microclimatic conditions for the life of the facility operation.* • *Implement appropriate rehabilitation measures to restore each habitat to a natural state that is representative of the respective vegetation type after construction.*	*Moderate*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Medium term*				
	Consequence	*Substantial*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Moderate*				
Increased alien invasive species	*Status*	*Negative*	*Moderate*	*Follow an alien and invasive species control and monitoring plan in terms of NEMBA by implementing appropriate control methods.*	*Low*	*Medium*
	Spatial Extent	*Local*				
	Duration	*Medium term*				
	Consequence	*Substantial*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				
Littering and general pollution	*Status*	*Negative*	*Moderate*	• *Vehicles must be in good working condition, with no oil, water or fuel leaks.* • *Vehicles must be regularly inspected, and any problems corrected.* • *Refuelling may only take place in an appropriate, designated bunded area.*	*Low*	*Medium*
	Spatial Extent	*Local*				
	Duration	*Short to Medium term*				
	Consequence	*Substantial*				
	Probability	*Likely*				

Impact	***Impact Criteria***		***Significance and Ranking (Pre-Mitigation)***	***Potential mitigation measures***	***Significance and Ranking (Post-Mitigation)***	***Confidence Level***
	Reversibility	*Moderate*		• *Any spillages must be reported immediately and dealt with appropriately.* • *Spill kits must be available on site in case of accidental spillage.* • *Sufficient waste disposal bins must be available on site and clearly marked.*		
	Irreplaceability	*Low*				

7.3 Potential Impacts during the Decommissioning Phase

The potential impacts identified during the decommissioning phase are discussed below.

Potential impact: Loss of habitat.

Refer to Section 6 of this chapter for a description of this potential impact, which is rated as negative with a site specific spatial extent, short term duration, low reversibility and moderate irreplaceability, as well as a moderate consequence and likely probability, rendering the pre-mitigation significance as Low. With mitigation, the impact is rated as Very Low significance. The potential mitigation measures are discussed in the table below.

Potential impact: Increase in alien invasive species.

Refer to Section 6 of this chapter for a description of this potential impact, which is rated as negative with a local spatial extent, medium term duration, moderate reversibility and low irreplaceability, as well as a substantial consequence and likely probability, rendering the pre-mitigation significance as Moderate. With mitigation, the impact is rated as low significance. The potential mitigation measures are discussed in the table below.

Table 7-3: Potential Impacts during the Decommissioning Phase.

Impact	***Impact Criteria***		***Significance and Ranking (Pre-Mitigation)***	***Potential mitigation measures***	***Significance and Ranking (Post-Mitigation)***	***Confidence Level***
DECOMMISSIONING PHASE						
Loss of habitat	*Status*	*Negative*	*Low*	*The loss of vegetation is unavoidable within the approved layout development footprint, but sensitive areas must be avoided. Implement appropriate rehabilitation measures to restore each habitat to a natural state that is representative of the respective vegetation type after decommissioning.*	*Very Low*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Moderate*				
Increased alien invasive species	*Status*	*Negative*	*Moderate*	*Follow an alien and invasive species control and monitoring plan in terms of NEMBA by implementing appropriate control methods.*	*Low*	*Medium*
	Spatial Extent	*Local*				
	Duration	*Medium term*				
	Consequence	*Substantial*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				
	Irreplaceability	*Low*				

7.4 Cumulative Impacts

The potential cumulative impacts identified during the construction phase are discussed below.

Potential impact: Loss of habitat.

Refer to Section 6 of this chapter for a description of this potential impact, which is rated as negative with a local spatial extent, permanent duration, low reversibility and moderate irreplaceability, as well as a substantial consequence and very likely probability, rendering the pre-mitigation significance as moderate. With mitigation, the impact is rated as Moderate significance. The potential mitigation measures are discussed in the table below.

Table 7-4: Cumulative Impacts.

Impact	***Impact Criteria***		***Significance and Ranking (Pre-Mitigation)***	***Potential mitigation measures***	***Significance and Ranking (Post-Mitigation)***	***Confidence Level***
CONSTRUCTION PHASE						
Loss of habitat / vegetation	*Status*	*Negative*	*Moderate*	*Transformation is considered low for this vegetation type but increased renewable developments could change this.*	*Moderate*	*Medium*
	Spatial Extent	*Local*				
	Duration	*Permanent*				
	Consequence	*Substantial*				
	Probability	*Very Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Moderate*				

7.5 Battery Energy Storage System

A Lithium-Ion BESS and Vanadium Redox Flow (VRF) BESS were both considered for the proposed project. For Redox Flow BESS, various chemical compositions are likely, such as Vanadium. Refer to Chapter 15 of this EIA Report for a High-Level Safety, Health and Environment Risk Assessment, which provides high level information on the safety, health and environmental risks of the BESS technologies.

With Lithium-Ion BESS, the most significant hazard with battery units is the possibility of thermal runaway and the generation of toxic and flammable gases. The flammable gases generated may ignite leading to a fire which accelerates the runaway process and may spread the fire to other infrastructure and possibly set the grassland ablaze which could cause a run-a-way fire and cause damage in the area if not controlled. As highlighted in Chapter 15, thermal runaway could happen at any point during transport to the facility, during construction or operation at the facility or during decommissioning and safe making for disposal. In terms of a worst conceivable case container fires, the significant impact zone is likely to be limited to within 10m of the container and mild impacts to 20m. Several preventative and mitigative measures have been proposed in Chapter 15 of the EIA Report in order to prevent potential fires.

No BESS is located in a sensitive area, but all are located within the grassland. Accordingly, the necessary measures need to be put in place to limit potential fires, including considering a fire break[9], if possible, around each Kudu PV facility (this is a worst-case scenario). However, as a containerised approach including the usual good practice of separation between containers which will be applied for this project, the impacts are likely restricted to events to one container at a time, the main risks being close to the containers i.e., to transport drivers, employees at the facilities and first responders to incidents.

[9] A natural or constructed barrier used to stop or check fires that may occur.

For Redox Flow BESS, the most significant hazard with VRF battery units is the possibility of spills of corrosive and environmentally toxic electrolyte. Several preventative and mitigative measures have been proposed in Chapter 15 in order to contain potential spillage.

The type of BESS technology will have no influence on terrestrial biodiversity, therefore both are considered viable options. There are no fatal flaws associated with the proposed Kudu 4 SEF battery installation for either technology types.

7.6 No-Go Alternative

The no-go alternative is the option of not undertaking the proposed activity or any of its alternatives, implying a continuation of the current situation / status quo.

The no-go alternative means the project does not get developed and no transformation or disturbance of topsoil and vegetation takes place, and no removal of provincially protected species are required. The baseline conditions signify the two grasslands, the Northern Upper Karoo and the Eastern Upper Karoo, remain as is with all current impacts still present, including livestock pens, waterpoints, windpumps, alien invasive species, fences and existing overhead powerlines. Furthermore, impacts on ecosystem functions including biodiversity protection, water regulation, quantity and quality, protection of medicinal plants, and climate refugia habitats will not be impacted on, and will continue as normal.

Should the development not proceed, the landowners will continue to utilise the grassland (baseline - dominant land use) for grazing purposes and creates an opportunity for the land to be used for other means, should the landowner, for example, wish to do other developments on site. Any development considered for this site, should result in a net benefit to society and should avoid undesirable negative impacts.

It must be noted however, that not approving this project does not exclude other renewable energy projects from being developed in this area. Accordingly, since this area is not considered an exclusion zone for development, multiple applications for renewable energy has and is being submitted to the competent authority for approval. Therefore, the no-go alternative cannot be looked in isolation and must take into account the regional land use and other developments to determine the ‘sense of place’ and whether this development will significantly impact on the baseline conditions in a regional context.

8. Impact Assessment Summary

The summary assessment for terrestrial biodiversity for the Kudu Solar Facility is provided in Table 8-1. All the impacts assessed can be reduced through avoidance and mitigation measures. There are no residual impacts anticipated and accordingly the project can proceed, but only if sensitive areas are avoided, and the proposed mitigation measures are implemented. Some impacts such as habitat loss and ecological functioning cannot be avoided, but the overall impact for this vegetation type is medium to low significance post mitigation.

Table 8-1: Terrestrial Biodiversity - Overall Impact Significance (Post Mitigation)

Phase	**Overall Impact Significance**
Construction	Moderate
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Moderate
Cumulative - Operational	Low
Cumulative - Decommissioning	Low

9. Legislative and Permit Requirements

The following legislation and guidelines are applicable to the proposed development:

- Northern Cape Nature Conservation Act (No. 9 of 2009)
- National Forests Act (No. 84 of 1998, as amended)
- 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 NEMA (1998), published on 20 March 2020, in Government Gazette 43110, GN No. 320, with regards to Terrestrial Biodiversity.
- 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 NEMA (1998), published on 30 October 2020, in Government Gazette 43855, GN 1150 with regards to Terrestrial Animal and Plant Species.
- 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 3.1.2022.
- Alien and Invasive Species lists in terms of sections 66(1), 67(1), 70(1)(a), 71(3) and 71A of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

The following permits are required where the development impacts directly on these species:

- Relocation permits for provincially protected species (Refer to Table 4-2) from the Northern Cape Department Agriculture, Environmental Affairs, Rural Development and Land Reform under the Northern Cape Nature Conservation Act (No.9 of 2009)

10. Environmental Management Programme Inputs

Management Plan for the Design / Pre-construction Phase

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Impact and loss of fauna as a result of operational activities	To reduce the loss of and impact on fauna	• Provide critter paths through the fence line to allow species access to site and in order to escape. • Ensure that the live electrical fence wire is not placed at ground level.	• Identify where fauna may be affecting operations of site (burrows etc.). Consider redress if necessary. • Include paths through the fence line, where appropriate. Generally, this should be done towards natural areas and away from construction sites and busy roads.	• Once-off	Project Developer, Engineers
Destruction / clearance of indigenous and protected vegetation	Ensure compliance with relevant Provincial and National legislation in respect of habitat and species permits.	Ensure the necessary permits or licenses are identified and applied for as applicable for removal of indigenous vegetation, especially for protected species. Provincially protected species must be avoided during the construction activities where it will be impacted on by construction activities. Alternatively, permits for the rescue i.e. removal and translocation or destruction, where relevant, of any of these protected species must be applied for and granted by the provincial authority. Await response and provision of permit (as required) from the relevant Authorities prior to the removal of the indigenous species (if required). Once these permits are obtained, search and rescue must be undertaken for the relevant indigenous species prior to the commencement of construction activities.	• Review the findings of the Specialist Assessments and consider legislative requirements in respect of loss of indigenous and protected vegetation. • Review the approved site plan with the ECO and appoint a suitable terrestrial ecologist to undertake a walk-through of the final approved site layout prior to construction. • Contact the relevant Provincial and National Environmental Authorities to discuss and confirm if any protected species need to be relocated or rescued and undertake the required permit application processes. • Appoint a suitable specialist and/or contractor to undertake plant search and rescue for the plants earmarked for removal and/or relocation as per the approved permits.	• Once-off	Project Developer and ECO/Specialist / Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Impact on ecological succession and animal re-colonisation	Allow for ecological succession and animal re-colonisation.	Apply appropriate space between consecutive PV panels to allow for sunlight to reach the basal vegetation and monitor ecological succession and animal re-colonisation.	Implement appropriate spacing between consecutive PV panels and verify that this is undertaken by reviewing the approved designs.	Once-off	Project Developer
Loss of natural vegetation in and outside development footprint area and veld degradation.	Reduced loss of natural vegetation and veld degradation within the development footprint and the surrounding area.	Ensure that the footprint required for the proposed project activities is kept at a minimum	Verify that the proposed project area is determined and outlined prior to the commencement of the construction phase by undertaking visual inspections.	Once-off	Project Developer, ECO

Management Plan for the Construction Phase (Including pre- and post-construction activities)

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Loss of natural vegetation in and outside development footprint area and veld degradation.	Reduced loss of natural vegetation and veld degradation within the development footprint and the surrounding area.	• Sensitive habitats and areas outside of the project development area should be clearly demarcated as no go areas during the construction phase to avoid accidental impacts. • Workers should not be allowed outside the demarcated construction areas or camps or beyond the boundaries of the solar PV facility itself, i.e. they will not be allowed to wander across the undeveloped parts of each site. No development or activities should take place in the high sensitivity areas. • No development should take place within High sensitivity areas or buffer zones.	• Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. • ECO must monitor activities and record and report non-compliance. • Strict control and proper education of staff to prevent misconduct. If ECO is absent, there should be a designated Environmental Officer (EO) present to deal with any urgent issues.	Daily	ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		Accordingly, the Koppies habitat (where relevant) should be avoided. • No construction related activities, such as the site camp, storage of materials, temporary roads or ablution facilities may be located in the high sensitivity areas. • Minimise loss of natural vegetation. • Only clear areas designated for development.			
		• The proposed project footprint must be demarcated to reduce unnecessary disturbance beyond the proposed project area	Carry out visual inspections to ensure strict control over the behaviour of staff in order to restrict activities to within demarcated areas.	Weekly	ECO
		• Unnecessary impacts on surrounding natural vegetation must be avoided during construction. No construction vehicles should be allowed to drive around the veld. All construction vehicles should strictly remain on properly demarcated roads.	• Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. • Include periodical site inspection in environmental performance reporting that specifically records occurrence or not of off-road vehicle tracks in specific areas.	Daily	ECO and Contractor
		• Undertake re-vegetation and rehabilitation of disturbed areas as soon as possible after construction. Stockpile the shallow topsoil layer separately from the subsoil layers. Reinstate the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly re-colonise the bare soil areas. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site during the pre-construction phase.	• Undertake audits following the construction phase and report any non-compliance.	Daily	ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		• The collection, hunting or harvesting of any plants (or 'veldkos'), fuel wood or animals at the site during construction should be strictly forbidden and the staff should be educated to prevent this from happening. • Indigenous vegetation must not be removed or damaged.	• Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. • Carry out Environmental Awareness Training. • Conduct audits of the signed attendance registers. • Issue fines where relevant as per specifications in their contracts. • Ensure that environmental awareness programmes are implemented.	• Once-off training and ensure that all new staff is inducted. • Weekly during construction phase.	ECO and Contractor
		Fires should only be allowed within fire-safe demarcated areas. Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on site for the duration of the construction phase.	• Strict control over the behaviour of construction workers, restricting activities to within demarcated areas. • Ensure fire safety requirements are well. understood and respected by workers (by providing basic fire safety training).	Daily	ECO and Contractor
Loss of provincially protected species and their habitats	Minimise impacts on protected species.	• A plant rescue operation must be initiated to confirm that no SSC are located within the development footprint. • Should any of the listed / protected species need to be removed, the requisite provincial and/or national permits must be obtained prior to the removal of the species.	• Project Developer must ensure that a suitable terrestrial ecologist is appointed to undertake a final walk-through of the final approved site prior to commencement of construction to identify SCC requiring Search and Rescue or avoidance. • Monitor activities and record and report non-compliance. • Apply for relevant permits with relevant authorities.	• Once-off prior to the commencement of construction • Daily monitoring required	Project Developer, Specialist and ECO

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Disturbance of terrestrial fauna and flora on site due to construction workers and activities, including the impact of littering and pollution	To advise construction staff of the requirements in respect of management of flora and fauna on site during the construction phase.	• Establish a recording method in order to monitor the construction activities, including species presence within site, mortalities and observations.	• Establish database of species, observations, conditions, impacts etc. • Construction personnel should advise on the findings and presence of fauna on site.	Daily to weekly	ECO
As above	Minimise the disturbance to flora and fauna in the surrounding area as a result of littering and pollution. Reduce the amount of littering and pollution within and around the construction site	• The site camp must not be located in high sensitivity areas and their buffer zones. • Ablution facilities must be located outside sensitive areas and their buffer zones. • Dangerous goods may not be stored within 100 m of a watercourse.	• Monitor the placement of the site camp, ablution facilities and dangerous goods via visual inspections, and record and report any non-compliance.	Once-off prior to construction and as required during the construction phase.	ECO
As above	As above	• Sufficient waste disposal bins must be available on site and clearly marked. Skip bins may be required during the construction phase which must be emptied on a regular basis by an approved/licenced waste disposal contractor. Proof of disposal to be kept on file.	• Monitor general waste generation by construction staff and collection, as well as the provision of bins and/or skips via audits throughout the construction phase. • Monitor the handling of general waste on site via site audits and record non-compliance and incidents. • Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	Daily or Weekly	ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
As above	As above	• Portable ablution facilities must be regularly cleaned and maintained in good working condition. • Any spillage from ablution facilities must be cleaned up immediately and disposed of in an appropriate manner.	• Conduct visual inspections to verify that portable ablution facilities are cleaned and maintained regularly, and report any non-compliance. • Monitor if spillages have taken place and if so, are removed immediately and correctly. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	• Daily During spills	ECO
As above	As above	• Hydrocarbon fuels must be stored in a secure, bunded area. • Vehicles must be in good working condition, with no oil, water, or fuel leaks. Vehicles must be regularly inspected, and any problems corrected. • Refuelling may only take place in an appropriate, bunded area. Refuelling may not take place in sensitive areas. • Hydrocarbon spills must be contained and cleaned up immediately. Spill kits must be available on site in case of accidental spillage.	• Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents. • Undertake visual inspections to ensure that vehicles are in good working condition with no leaks, and that they are regularly serviced. Record non-compliance and incidents • Monitor the refuelling process and its location and record the occurrence of any spillages. • Monitor if spillages have taken place and if they are removed correctly.	Weekly	ECO and Contractor
Increased erosion and soil compaction	Reduced erosion and soil compaction caused by construction activities	• Utilise existing access routes as far as possible. • Confine the movement of vehicles to the access routes to and from the site and to the construction areas. • Do not drive in the natural veld.	• Construction access roads must be demarcated clearly. Undertake site inspections to verify. • Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. • Include periodic site inspection in environmental performance	Weekly	ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			reporting that specifically records occurrence or not of off-road vehicle tracks in specific areas.		
As above	As above	• Rehabilitate new vehicle tracks and areas where the soil has been compacted as soon as possible. • Monitor the entire site for signs of erosion.	• Ensure that this is taken into consideration during the construction and record any non-compliance. • Undertake regular monitoring for erosion to ensure is reduced and rectified as soon as possible.	Weekly	Contractor and ECO
As above	As above	• Refer to the Aquatic Biodiversity Specialist Assessment Report for mitigation measures relevant to watercourse crossings and development close to watercourses.	• Ensure that this is taken into consideration during the construction and record any non-compliance.	Monthly	ECO and Contractor
Faunal road mortality as a result of increased vehicles travelling to and within the site.	Minimise loss of fauna as a result of road mortalities.	• To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with suitable material, where appropriate, and the site camp must be kept clean on a daily basis.	• Monitor the activities via visual inspections, and record and report any non-compliance.	Daily	ECO and Contractor
As above	As above	• All vehicle speeds associated with the project should be monitored and should be limited to 40 km/h (maximum) during the construction phase. • Conduct inspections of the fence line to address any animals that may be affected by the fence, i.e. stuck or casualties.	• Carry out Environmental Awareness Training. • Conduct audits of the signed attendance registers. • Conduct weekly inspections of the fence line to address any animals that may be affected by the fence.	• Once-off training and ensure that all new staff are inducted. • Monthly. • Weekly record keeping. A register of all faunal sightings indicating date of siting;	Project Developer, ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
				species affected; position of species (specific or indicative) and other observations should be established.	
Impact and loss of fauna as a result of the fence line and exclusion of fauna from site resulting in ecological change within the site	To reduce incidental mortality and injury of fauna within the construction area.	• Conduct inspections of the fence line to address any animals that may be affected by the fence, i.e. stuck or casualties.	• Conduct weekly inspections of the fence line to address any animals that may be affected by the fence.	Weekly record keeping. A register of all faunal sightings indicating date of siting; species affected; position of species (specific or indicative) and other observations should be established.	Project Developer and ECO
Increased alien invasive species	Avoid establishment and reduce the spread of alien invasive plants due to the project activities.	• Implement an ongoing monitoring programme for alien invasive vegetation for the construction phase to detect and quantify any alien invasive species that may become established within the construction site.	• Ongoing monitoring should be undertaken according to an approved method statement that makes use of alien clearing methods as provided by the Working for Water Programme and outlined on Resources | Department of Environmental Affairs (https://www.dffe.gov.za/projectsprogrammes/wfw/resources#mannuals).	Ongoing. Monitoring and control measures should take place at least biannually (every six months).	ECO and Contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			• Herbicide and pesticide used as part of control measures should be approved by the ECO prior to application, taking all sensitive features into account.		
Loss of vegetation by increased degradation and reduced ecosystem services	Rehabilitation post-construction by replacing topsoil and re-seeding. Refer to vegetation type for list of dominant species.	• Re-vegetation of disturbed surfaces must occur immediately after construction activities are completed. Allow natural vegetation recruitment from the topsoil unless the vegetation cover is insufficient. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction or by using a commercial seed mix indigenous to the area.	• Compare vegetation establishment on rehabilitated areas to surroundings natural vegetation. • Rehabilitate the following areas: - Road verges after road construction is completed. - transformed portions of the site not developed. - Areas where pockets of alien invasive species have been removed. • A list of indigenous plants used during rehabilitation must be approved by the ECO prior to commencement of rehabilitation activities.	As recommended by the specialist / ECO	Appointed Botanist and ECO

Management Plan for the Operational Phase

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Vegetation management on site and loss of species composition and diversity	Manage vegetation throughout the site to avoid conflict with operations of the proposed PV facility and reduce ecological degradation.	• Monitor rehabilitation efforts post-construction phase.	• Compare vegetation establishment on rehabilitated areas to surroundings natural vegetation	At the end of the growing season and then as recommended by the specialist	Appointed Botanist and ECO
Impact and loss of fauna as a result of operational activities	To reduce the loss of and impact on fauna	• Avoidance of damage to infrastructure by faunal activity as well as impact on fauna as a result of the site infrastructure. • Identify impact of burrowing and other faunal activities on the fence line and operations activities. • Undertake the management of faunal intrusion through the fence, including possible mortalities. • Conduct inspections of the fence line to address any animals that may be affected by the fence. • Promote and support faunal presence and activities within the proposed PV facility, where possible.	• Identify where fauna may be affecting operations of site (burrows etc.). Consider redress if necessary. • Conduct regular (daily) inspections of the fence line to address any animals that may be affected by the fence. • Monitor the activities via visual inspections, and record and report any non-compliance. • Induction / toolbox talks should be promoted where general awareness is created to prevent faunal disturbance.	• Daily to weekly record keeping. • A register of all faunal sightings indicating date of siting; species affected; position of species (specific or indicative) and other observations should be established.	ECO and Operations and Maintenance Contractor
Impact and loss of fauna as a result of the fence line and exclusion of fauna from site resulting in ecological change within the site.	To reduce the impact and loss of fauna from site as a result of their exclusion from the area due to fencing	• Conduct inspections of the fence line to address any animals that may be affected by the fence, i.e. stuck or casualties.	• Conduct weekly inspections of the fence line to address any animals that may be affected by the fence.	Weekly record keeping. A register of all faunal sightings indicating date of siting; species affected; position of species (specific or indicative) and	Project Developer and ECO

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
				other observations should be established.	
Impact of electrical light pollution (ELP) around the site	The avoidance of electrical light pollution through prudent positioning of external lighting.	• The operational personnel and staff should be made aware of the presence of fauna within the proposed project area. • Driving is not allowed at night, where possible.	• Carry out Environmental Awareness Training. • Conduct audits of the signed attendance registers.	• Once-off training and ensure that all new staff are inducted. • Monthly	ECO and Operations and Maintenance Contractor
Faunal and avifaunal road mortality as a result of increased vehicles travelling to and within the site.	Minimise loss of fauna as a result of road mortalities.	• To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with suitable material, where appropriate, and the offices must be kept clean on a daily basis.	• Monitor the activities via visual inspections, and record and report any non-compliance.	Daily	ECO and Operations and Maintenance Contractor
Increased alien invasive species	Avoid establishment and reduce the spread of alien invasive plants due to the project activities.	• Implement an ongoing monitoring programme for alien invasive vegetation for the operational phase to detect and quantify any alien invasive species that may become established within the operational site.	• Ongoing monitoring should be undertaken according to an approved method statement that makes use of alien clearing methods as provided by the Working for Water Programme and outlined on Resources | Department of Environmental Affairs (https://www.dffe.gov.za/projectsprogrammes/wfw/resources#mannuals). • Herbicide and pesticide used as part of control measures should be approved by the ECO prior to application, taking	Ongoing. Monitoring and control measures should take place at least biannually (every six months) for the first 3 years of the project and should be adjusted as required based on the first 3 years results / success rate.	ECO and Project Developer

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			all sensitive features into account.		
Disturbance of terrestrial fauna and flora on site due to operational workers and activities, including the impact of littering and pollution	Minimise the disturbance to flora and fauna in the surrounding area as a result of littering and pollution. Reduce the amount of littering and pollution within and around the operational site	• Sufficient waste disposal bins must be available on site and clearly marked.	• Monitor general waste generation by operational staff and collection, as well as the provision of bins and/or skips via audits throughout the operational phase.	Daily or Weekly	ECO
As above	As above	• Vehicles must be in good working condition, with no oil, water, or fuel leaks. • Vehicles must be regularly inspected, and any problems corrected. • Refuelling may only take place in an appropriate, designated bunded area. • Any spillages must be reported immediately and dealt with appropriately. • Spill kits must be available on site in case of accidental spillage.	• Undertake visual inspections to ensure that vehicles are in good working condition with no leaks, and that they are regularly serviced. Record non-compliance and incidents • Monitor the refuelling process and its location and record the occurrence of any spillages. • Monitor if spillages have taken place and if they are removed correctly.	Weekly	ECO

Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Rehabilitation of flora on site	Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to construction.	• The loss of vegetation is unavoidable within the approved layout development footprint, but sensitive areas must be avoided. • Implement appropriate rehabilitation measures to restore each habitat to a natural state after decommissioning. • The effort must benefit the potential faunal species that may find refuge on the site. • All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction. • Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas.	• Monitor the placement of decommissioning activities via visual inspections, and record and report any non-compliance. • Final external audit of area to confirm that area is rehabilitated to an acceptable level.	Once-off	Project Developer with advice from specialist
Increased alien invasive species	Avoid establishment and reduce the spread of alien invasive plants due to the project activities.	• Implement an ongoing monitoring programme for alien invasive vegetation for the decommissioning phase to detect and quantify any alien invasive species that may become established within the decommissioning site.	• After all infrastructure is removed, a final site inspection should be done and all remaining plants must be cleared. • Herbicide and pesticide used as part of control measures should be approved by the ECO prior to application, taking all sensitive features into account.	Once-off	ECO and Project Developer

11. Final Specialist Statement and Authorisation Recommendation

11.1 Statement and Reasoned Opinion

The proposed development is not located in a threatened vegetation type or ecosystem and is located in an ESA mainly due to presence of sensitive birds. There are no high sensitivity features on site, and no plant SCC were recorded. However, three provincially protected species occur on Kudu Solar Facility 4 and requires permits for relocation from the provincial authority.

The development of Kudu Solar Facility 4 can proceed should all no-go sensitive areas be avoided, and the recommended mitigation measures are implemented.

11.2 EA Condition Recommendations

- Vegetation clearing must be limited to the development footprint.
- Walk down of the approved site prior to construction activities to record all provincially protected species that will be impacted on by the development.
- Submit the necessary permit application with the provincial authority prior to construction for the relocation of provincially protected species. Copies of the permits must be kept on site by the ECO.
- Implement appropriate rehabilitation measures to restore each habitat to a natural state that is representative of the respective vegetation type after construction and decommissioning.
- Topsoil from excavations must be salvaged and reapplied during rehabilitation.
- No alien and invasive plant species may be used for rehabilitation purposes; only indigenous species of the area / vegetation type may be used.
- Cleared alien vegetation may not be dumped on adjacent natural vegetation during clearing but must be temporarily stored in a demarcated area and disposed of at a legal facility.
- Removal of alien and invasive species, monitoring and follow-up procedures must be implemented as indicated in the report and based on best practice guidelines.
- Electric fencing must not have any strands within 30cm of the ground which still remain as an effective security barrier while allowing smaller mammals and reptiles to pass through.
- Carry out Environmental Awareness Training throughout the construction period and conduct audits of signed attendance registers to ensure compliance with the EMPr and EA conditions.

12. References

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NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT. 2004 (Act NO 10 of 2004): Publication of lists of critically endangered, endangered, vulnerable and protected species.

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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 3.1. 2022.

Van Wyk, B.-E. and Smith, G. (2003). Guide to aloes of South Africa. (2nd ed.). Briza Publications, Pretoria.

Victor, J.E. (2009). *Tridentea virescens* (N.E.Br.) L.C.Leach. National Assessment: Red List of South African Plants version 2020.1.

Appendices

Appendix A: Specialist Expertise

Personal details

Full Name Corné Niemandt

DOB May 1989

Nationality RSA

Email corne@enviro-insight.co.za

Project relevance

Corné is an ecologist who mainly operates as a botanist since 2012. Corné has worked on renewable energy projects, particularly in the Northern - and Western Cape provinces. Relevant recent projects include the Botterblom WEF (Loeriesfontein), Aggeneys WEF, Bloemsmond Solar Facilities (Keimoes), Bergrivier WEF (Gouda), and Pofadder WEF. Corné has a good understanding of the Nama Karoo system and associated vegetation types and has successfully identified species of conservation concern in question for the relevant projects, making him suitable for this work. Corné has also submitted permit application with the competent authorities before, and has written search and rescue plans for SCC before.

Memberships & Certificates

- SACNASP Registered Professional Natural Scientist in the field of Ecological Science - Registration Number: 116598
- South African Association of Botanists (2018-current)
- International Association for Impact Assessment South Africa (2018-current)
- IAIAsa Gauteng Branch Committee member (2021-2023)
- GDARD EAP Forum Committee member (2020-2022)
- SAEON Graduate Student Network Membership (2013-2019)
- Invitation from Golden Key International Honour Society (2010)

Employment

Corné has operated mainly as a terrestrial biodiversity specialist and has compiled more than 40 terrestrial biodiversity and plant species assessments, and several rehabilitation and alien invasive species management plans.

2017 - present	Environmental Assessment Practitioner, Environmental Control Officer (ECO) and Ecological Specialist at Enviro-Insight CC. Responsible for writing BA and EIA reports, conducting ecological assessments, writing ECO reports, GIS mapping, and project management.
2016 - 2017	Ecologist and Consultant at Bokamoso Landscape Architects and Environmental Consultants CC Responsible for conducting ecological assessments as part of the EIA process and compile EIAs, BAs and WULAs.

2015	Freelance (7 weeks) for Ecotone Freshwater Consultants CC
2012 - 2015	Tutor for first year Botany modules, University of Pretoria. Responsible for assisting students during practicals and managing demonstartors.
2014 - 2015	Organiser of journal club for the Ecology unit, Department of Plant Science, University of Pretoria.
2014	Guest lecturer for botany honours module BOT 788: Vegetation classification, Department of Plant Science, University of Pretoria.
2014	Mentoring third year student part of mentorship programme, Department Plant Science.
2013	Invasive plant species survey for M2 Environmental Connections.
2012	WULA and Aquatic Assistant at MENCO
2012	Fieldwork at Richard Bay Minerals part of coastal dune rehabilitation programme

Education

Completed Degrees and Institution

2015	M.Sc. Plant Science, University of Pretoria, Pretoria, South Africa
2012	B.Sc. (Hons) Zoology, University of Pretoria, Pretoria, South Africa
2011	B.Sc. Ecology, University of Pretoria, Pretoria, South Africa
2007	Merensky High School, Tzaneen, Limpopo Province, South Africa

Publications & Contributions

Niemandt, C. and Greve, M. 2016. Fragmentation metric proxies provide insights into historical biodiversity loss in critically endangered grassland. Agriculture, Ecosystems and Environment 235, 172–181. doi.org/10.1016/j.agee.2016.10.018

Niemandt, C., Kovacs, K.M., Lydersen, C., Dyer, B.M., Isaksen, K., Hofmeyr, G.J.G., & de Bruyn, P.J.N. 2015. Chinstrap and macaroni penguin diet and demography at Nyrøysa, Bouvetøya, Southern Ocean. Antarctic Science. doi:10.1017/S0954102015000504

Courses attended

- Introduction to Environmental Impact Assessment and Auditing (Department of Geography, Geoinformatics and Meteorology).
- Basic Wetland Workshop (Gauteng wetland forum, DWS, GDARD, ARC).
- R for basic statistics (Department Plant Science, University of Pretoria).
- Basic statistics (Department Plant Science, University of Pretoria).
- General Linear Modelling (Department Plant Science, University of Pretoria).
- Georeferencing course (SANBI).
- Spatial Analysis with ArcGIS (ESRI, South Africa).

Conferences and Workshops

Attended

- IAIAsa Gauteng Branch Event. Incorporating Biodiversity and Wetland Offsets into the EIA process, Midrand, 24 July 2019.
- IAIAsa Gauteng Branch Event. Integration of Climate Change Assessments in EIA's, Midrand, 15 May 2019.
- IAIAsa Gauteng Branch Event. SAHRA Heritage Workshop, Midrand, 26 February 2019.
- IAIAsa 2018 Energy symposium, Midrand, 17 August 2018.
- IAIA18. 38th Annual Conference of the International Association for Impact Assessment. Durban, South Africa, 16-19 May 2018.
- Section 21 (c) and (i) water use authorisation training. Department of Water and Sanitation, Sub-Directorate In-stream Water Use, February 2018
- IAIA Webinar: Accessing and interpreting biodiversity information for high-level biodiversity screening. 10 April 2018.

Contributions

- Spatial changes in vegetation cover over time in a highly threatened vegetation complex, Limpopo Province. 41st SAAB Annual Conference, Tshipise (University of Venda), January 2015.
- Anthropogenic impacts on a highly threatened vegetation complex, Limpopo province. XXth AETFAT Congress, Stellenbosch, January 2014.
- Anthropogenic impacts on a highly threatened vegetation complex, Limpopo province. Biodiversity Southern Africa Conference, Cape Town, December 2013.
- Land use change and the effects of habitat fragmentation on a highly threatened vegetation complex, Limpopo province. GSN SAEON Indibano Conference, Cape Town, August 2013.
- Spatial changes in vegetation cover over time in a highly threatened vegetation complex, Limpopo Province. 41st SAAB Annual Conference, Tshipise (University of Venda), January 2015.

Software Skills

Appendix B: Specialist Statement of Independence

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

Scoping and Environmental Impact Assessment Processes for the Proposed Development of 12 Solar Photovoltaic (PV) Facilities and associated infrastructure (i.e. Kudu Solar Facility 1 - 12), near De Aar, Northern Cape

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:	Enviro-Insight CC			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	Corné Niemandt			
Specialist Qualifications:	MSc Plant Science, University of Pretoria BSc (Honours) in Zoology, University of Pretoria BSc Ecology, University of Pretoria			
Professional affiliation/registration:	SACNASP (116598) International Association for Impact Assessment South Africa (2018-2023) The Botanical Society of South Africa (2022-2023) South African Association of Botanists (2018-2022)			
Physical address:	Unit 8, Oppidraai Office Park 862 Wapadrand Road, Wapadrand, Pretoria			
Postal address:	Unit 8, Oppidraai Office Park 862 Wapadrand Road, Wapadrand, Pretoria			
Postal code:	0050	Cell:	073 405 5708	
Telephone:	012 807 0637	Fax:		
E-mail:	corne@enviro-insight.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Corné Niemandt**, 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

Enviro-Insight CC

Name of Company:

04/07/2023

Date

Details of Specialist, Declaration and Undertaking Under Oath

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Corné Niemandt**, 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

Enviro-Insight CC

Name of Company

04/07/2023

Date

Signature of the Commissioner of Oaths

04 / 07 / 2023

JACQUES GEORGE BASCH
Commissioner of Oaths
Chartered Accountant (SA)
Ex Officio
862 WAPADRAND ROAD
WAPADRAND 0081 PRETORIA

Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 3 of 3

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

Scoping and Environmental Impact Assessment Processes for the Proposed Development of 12 Solar Photovoltaic (PV) Facilities and associated infrastructure (i.e. Kudu Solar Facility 1 - 12), near De Aar, Northern Cape

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:	Enviro-Insight CC			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	Samuel David Laurence			
Specialist Qualifications:	BSc (Honours) Wildlife Management, University of Pretoria			
Professional affiliation/registration:	SACNASP (400450/13) Private Security Regulatory Authority (PSIRA), Johannesburg, South Africa Birds and Renewable Energy Specialist Group (BARESG)			
Physical address:	Unit 8, Oppidraai Office Park 862 Wapadrand Road, Wapadrand, Pretoria			
Postal address:	Unit 8, Oppidraai Office Park 862 Wapadrand Road, Wapadrand, Pretoria			
Postal code:	0050	Cell:	072 437 1742	
Telephone:	012 807 0637	Fax:		
E-mail:	sam@enviro-insight.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Samuel David Laurence**, 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

Enviro-Insight CC

Name of Company:

07/07/2023

Date

Details of Specialist, Declaration and Undertaking Under Oath

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Samuel David Laurence**, 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

Enviro-Insight CC

Name of Company

07/07/2023

Date

Signature of the Commissioner of Oaths

07 July 2023

Date

KERRY AUGUST
Commissioner of Oaths
Master HR Professional (MHRP)
Member Number: 53544596
25 Bordeaux Close
Stellenbosch
7600

Details of Specialist, Declaration and Undertaking Under Oath

Appendix C: Site Sensitivity Verification

Prior to commencing with the specialist assessment in accordance with the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014 (as amended) and the environmental theme protocols (March 2020, October 2020), a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

Date of Site Visit	21 -22 February 2022
Specialist Name	Corné Niemandt
Professional Registration Number	116598
Specialist Affiliation / Company	Enviro-Insight CC

The following section provides information on what was done as part of the site sensitivity verification process.

Screening Report and Literature review

Terrestrial Biodiversity
The Very High sensitivity category was scrutinised by assessing the relevant sources of information, such as the Northern Cape CBA Map (2016). Accordingly, the reason for being listed as an Ecological Support Area (ESA) was assessed prior to the site visit to ensure that the relevant sensitive features were included in the survey.

Sensitive Plant Species
The screening report highlighted the area as Medium sensitivity due to suspected habitat for SCC based on occurrence records for these species collected prior to 2002 and/or is based on habitat suitability modelling. The presence or likely presence of the SCC identified by the screening tool, must be confirmed. Where SCC are found on site or have been **confirmed to be likely present**, a Terrestrial Plant Species Specialist Assessment must be submitted in accordance with the requirements specified for “very high” and “high” sensitivity in the Terrestrial Plant Species protocol of GN1150. Similarly, where no SCC are found on site during the investigation or if the presence is confirmed to be unlikely, a Terrestrial Plant Species Compliance Statement must be submitted.

The relevant sensitive species indicated in the screening report was assessed in terms of suitable habitat, location and flowering period prior to the site visit. Relevant sources include:

- iNaturalist (https://www.inaturalist.org/)
- GBIF (https://www.gbif.org/)
- SANBI Red List of South African plants version 2021 (http://redlist.sanbi.org/index.php)
- Plants of southern Africa: Botanical Database of Southern Africa (BODATSA) (http://posa.sanbi.org/sanbi/Explore)

The most recent aerial imagery from Google Earth was used in order to identify the different habitats for each site. This information was then ground-truthed during the survey.

Based on this initial work, the specialist expected that a full Terrestrial Biodiversity Impact Assessment and Terrestrial Plant Species Specialist Assessment was required.

Site visit

A site visit was undertaken from 21-22 February 2022 to confirm the site sensitivity based on the screening report outcome. The specialist considered this only a formality as suitable habitat was present on site for the SCC (*T. virescens*), and ESA had to be assessed. Based on the initial findings, a full assessment was carried out for both the Terrestrial Biodiversity and Terrestrial Plant Species themes in order to comply with the protocols.

The site visit confirmed the Very High[10](VH) Terrestrial Biodiversity theme owing to the nature of semi-natural grassland (grazing has a moderate to low impact) and natural koppies on site (Figure C1-1). The ESA has important ecosystem functions and promotes ecological processes required for a healthy system. The Besemkaree Koppies Shrubland specifically is included as important vegetation types for maintaining ecological process and combating climate change. Furthermore, they act as important corridors in the landscape and could be vital for combating climate change in the future. It is the specialists opinion that the Terrestrial Biodiversity theme can be considered Medium sensitivity, once the Koppies and relevant aquatic features have been avoided. It does not represent a fatal flaw to the project.

For the Plant Species theme, the identified suitable habitat for *Tridentea virescens* had to be further assessed, and accordingly the medium sensitivity rating was upgraded to comply with a Terrestrial Plant Species Specialist Assessment. *Tridentea virescens* has been recorded previously near to De Aar and could possibly occur on site.

Figure C1-1: The land is in a semi-natural state as grazing activities are the main impact currently.

[10] This theme only distinguishes between Low and Very High (VH) sensitivity. ESA in our opinion cannot be VH as it is not irreplaceable areas, and depending on what ecological features it is based on, can be regarded as Medium or High.

Appendix D: Impact Assessment Methodology

The impact assessment includes:

- *the nature, status, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

Terminology used in impact assessment can overlap. To avoid ambiguity, please note the following clarifications (that are based on NEMA and the EIA Regulations):

- *The term environment is understood to have a broad interpretation that includes both the natural (biophysical) environment and the socio-economic environment. The term socio-ecological system is also used to describe the natural and socio-economic environment and the interactions amongst these components.*
- *Significance = Consequence x Probability, which means that significance is equivalent to risk.*
- *The impact can have a positive or negative status. The significance of a negative impact may be called a risk, and the significance of a positive impact may be called an opportunity.*

The following principles are to underpin the application of this methodology:

- *Transparent and repeatable process - specialists are to describe the thresholds and limits they apply in their assessment, wherever possible.*
- *Adapt parameters to context (where justified) – the methodology proposes some thresholds (e.g. for spatial extent, in Step 3 below), however, if the nature of the impact requires a different definition of the categories of spatial extent, then this can be provided and described.*
- *Combination of a quantitative and qualitative assessment – where possible, specialists are to provide quantitative assessments (e.g. areas of habitat affected, decibels of noise, number of jobs), however, it is recognised that not all impacts can be quantified, and then qualitative assessments are to be provided.*

As per the DFFE Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *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. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *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. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the aspects described below.

- ***Step 1**: **Nature** of impact/risk - The type of effect that a proposed activity will have on the environment.*

- ***Step 2**: **Status** - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- ***Step 3**: **Qualitatively** determine the **consequence** of the impact/risk by identifying the **a) SPATIAL EXTENT; b) DURATION; c) REVERSIBILITY; AND d) IRREPLACEABILITY**.*

    - ***A) Spatial extent** – The size of the area that will be affected by the impact/risk:*
        - *Site specific;*
        - *Local (<10 km from site);*
        - *Regional (<100 km of site);*
        - *National; or*
        - *International (e.g. Greenhouse Gas emissions or migrant birds).*

    - ***B) Duration** – The timeframe during which the impact/risk will be experienced:*
        - *Very short term (instantaneous);*
        - *Short term (less than 1 year);*
        - *Medium term (1 to 10 years);*
        - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
        - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

    - ***C) Reversibility** of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
        - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
        - *Moderate reversibility of impacts;*
        - *Low reversibility of impacts; or*
        - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

    - ***D) Irreplaceability** of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
        - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
        - *Moderate irreplaceability of resources;*
        - *Low irreplaceability of resources; or*
        - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

*Some of the criteria are quantitative (e.g. spatial extent and duration) and some may be described in a quantitative or qualitative manner (e.g. reversibility and irreplaceability). The specialist then combines these criteria in a qualitative manner to determine the **consequence**.*

The consequence terms ranging from slight to extreme must be calibrated per Specialist Study so that there is transparency and consistency in the way a risk/impact is measured. For example, from a biodiversity and ecology perspective, the consequence ratings could be defined according to a

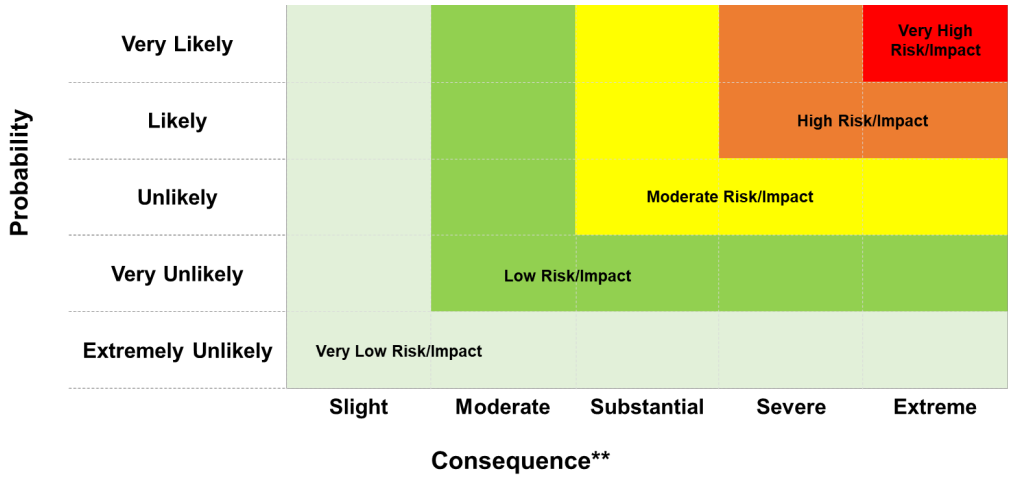
reduction in population or occupied area in relation to Species of Conservation Concern (SCC) status, ranging from slight consequence for defined areas of Least Concern, to extreme consequence for defined areas that are Critically Endangered. For example, from a social perspective, a slight consequence could refer to small and manageable impacts, or impacts on small sections of the community; a moderate consequence could refer to impacts which affect the bulk of the local population negatively or may produce a net negative impact on the community; and an extreme consequence could refer to impacts which could result in social or political violence or institutional collapse.

- ***Consequence*** *– The anticipated consequence of the risk/impact is generally defined as follows:*
    - *Extreme (extreme alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they temporarily or permanently cease);*
    - *Substantial (substantial alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they temporarily or permanently cease;*
    - *Moderate (notable alteration of natural or socio-economic systems, patterns or processes, i.e. where the natural or socio-economic environment continues to function but in a modified manner; or*
    - *Slight (negligible and transient alteration of natural or socio-economic systems, patterns or processes, i.e. where natural systems/environmental or socio-economic functions, patterns, or processes are not affected in a measurable manner, or if affected, that effect is transient and the system recovers).*

- ***Step 4****: Rate the* ***probability*** *of the impact/risk using the criteria below:*

    - ***Probability*** *– The probability of the impact/risk occurring:*
        - *Extremely unlikely (little to no chance of occurring);*
        - *Very unlikely (<30% chance of occurring);*
        - *Unlikely (30-50% chance of occurring)*
        - *Likely (51 – 90% chance of occurring); or*
        - *Very Likely (>90% chance of occurring regardless of prevention measures).*

- ***Step 5****: Use both the* ***consequence*** *and* ***probability*** *to determine the* ***significance*** *of the identified impact/risk (qualitatively as shown in Figure 1). Significance definitions and rankings are provided below:*



[Qualitatively determined based on Spatial Extent, Duration, Reversibility and Irreplaceability]

Figure 1. Guide to assessing risk/impact significance as a result of consequence and probability.

- ***Significance*** *– Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

The specialists must provide a written supporting motivation of the assessment ratings provided.

- ***Step 6****: Determine the* ***Confidence Level*** *– The degree of confidence in predictions based on available information and specialist knowledge:*
    - *Low;*
    - *Medium; or*
    - *High.*

Appendix E: Animal Compliance Statement

ANIMAL COMPLIANCE STATEMENT

Scoping and Environmental Impact Assessment (EIA) Processes for the Proposed Development of 12 Solar Photovoltaic (PV) Facilities (Kudu Solar Facilities 1-12) and associated infrastructure, near De Aar, Northern Cape province

MAY 2022

by

Samuel Laurence

Pr.Sci.Nat. Zoological and Ecological Science

Corné Niemandt

Pr.Sci.Nat. Ecological Science

Specialist details

Specialists	Contact details	SACNASP registration	Experience
Samuel David Laurence	sam@enviro-insight.co.za	Zoological and Ecological Sciences - 400450/13	15
Corné Niemandt	corne@enviro-insight.co.za	Ecological Science - 116598	7

Statement of independence

We, Samuel David Laurence and Corné Niemandt, as the appointed terrestrial animal specialists, hereby declare/affirm the correctness of the information provided in this compliance statement, and that we:

- meet the general requirements to be independent and have no business, financial, personal or other interest in the proposed development and that no circumstances have occurred that may have compromised my objectivity; and
- are aware that a false declaration is an offence in terms of regulation 48 of the EIA Regulations (2014).

Samuel Laurence

Corné Niemandt

23 May 2022

Date

Site Inspection Details

A site visit was undertaken by an ecologist (Mr Corné Niemandt) to confirm the low sensitivity for terrestrial animal species (excluding avifauna), and to confirm that the proposed development will have no significant impact on Species of Conservation Concern (SCC). The desktop analysis including database search and literature review was done by Mr Sam Laurence.

Date	21-22 February 2022
Duration	Two days (±16 hours)
Season	Wet season
Season Relevance	Conditions were optimal due to good rains.

Methodology

Desktop Study

Relevant databases, field guides and texts were consulted for the literature study which included the following:

- The online Virtual Museum (VM) facility of the Animal Demography Unit (ADU) of the University of Cape Town (http://vmus.adu.org.za) was queried for the presence of mammal (MammalMAP, 2022), reptile (ReptileMAP, 2022) and amphibian (FrogMAP, 2022) SCC within the quarter degree grid cell (QDGC) in which the proposed development resides;
- Mammal SCC information was obtained from Child *et al.,* (2016);
- Reptile SCC information was obtained from Bates *et al.,* (2014); and
- Amphibian SCC information was obtained from Du Preez and Carruthers (2017).

Species nomenclature follows the aforementioned references throughout this document except for herpetofauna where nomenclature for reptiles follows ReptileMAP (2022) as new distribution data and taxonomic changes have already occurred since publication of Bates *et al.,* (2014). Similarly, the Frog Atlas of Southern Africa (FrogMAP, 2022) provides information on the geographic distributions of amphibians and keeps up to date with the latest taxonomic changes. The use of these online facilities is justified as it not only includes the latest verified publicly contributed data but also a complete record of the museum material in South Africa. The applicability of the information obtained from the literature sources was evaluated for the study area and the subsequent recommendations are to be used by the Applicant to drive the development process in accordance with the relevant legislation.

Field survey

- The specialist investigated the study area on foot and by vehicle for two days.
- All twelve[11] PV facilities were investigated for animal signs and sightings.
- Since no SCC (excluding avifauna) were flagged by the screening report or desktop assessment, the survey was brief.

[11] The total number of PV projects decreased to 12 following the specialist site work, as well as other considerations such as discussions with landowners and the capacity limits of Bidding Window 6, as described in the main report.

- For each PV site the habitat was characterised, photographs were taken and the likelihood of any SCC being present were assessed.
- All fauna observed during the site survey were photographed (where possible).

Assumptions and limitations

- It is assumed that all third-party information used (e.g. GIS data and satellite imagery) is correct at the time of generating this report.
- The survey was restricted to a single season (early dry season), but it is not considered necessary to perform an additional survey due to the absence of SCC.
- The Avifauna assessment is not part of this report and is dealt with under the relevant theme and presented in a separate report. Where relevant from a Terrestrial Biodiversity perspective, short descriptions are included. For instance, to describe the functionality of a habitat.

Results

Sampling

Random walk transects were done, covering all major habitats on site within each of the twelve[12] PV facilities. At each sample site the habitat was characterised, photographs were taken and the likelihood of any SCC being present was assessed. The below table indicates species recorded on site.

[12] Refer to the footnote above regarding the number of PV projects.

Table 1: Recorded species and site description.

Description	Habitat[13]	Photo
Hippotragus niger niger Sable Antelope Vulnerable Provincially Protected	Sable Antelope are grazers of perennial grasses and are found mainly in medium to tall grasslands. However, these intact grasslands are highly threatened in South Africa and only 10% are well protected. It is important to note that the species has been introduced to the country, therefore occurring outside its area of historical distribution, is possibly ranched or farmed or free roaming, but importantly does not function as part of the study area ecosystem. It is possible that this individual came from the surrounding farm next to PV1 (furthest corner to the south), evident from the high fences. It is suggested that the developer come to an agreement with the adjacent landowner to consider appropriate measures for the current bordering fences to prohibit the Sable to move between the two properties. A Sable within a solar facility will not be ideal and could cause damage to infrastructure. The species is protected and may not be killed or injured. However, it is not necessary to include the presence of this species as part of the impact analysis and SEI evaluation, and accordingly a full animal assessment is not required.	
Stigmochelys pardalis Leopard tortoise Least Concern Provincially Protected	This is a generalist tortoise that is found in a variety of habitats including arid and mesic savannah, thorn scrub and grasslands. Tortoises are important seed dispersers as they eat large quantities of plants and their faeces or scats are full of undamaged seeds. The species was recorded in the south at PV5, PV6, and PV7, as well as in the north at PV11 and PV12. It can be deduced that the species occur throughout the study area.	

[13] Even though animals were sighted at specific locations, they can occur across the study area as they move around to feed. Accordingly, the mentioned animals should not be associated with a specific PV facility and the possible impacts and proposed mitigation measures will be applicable for all PV facilities. Perhaps the only exclusion can be that of the Sable, which is unlikely to venture of further away from the adjacent property.

Description	Habitat[13]	Photo
Xerus inauris Cape Ground Squirrel Least Concern Provincially Protected	They have a preference for open terrain with little bush cover and a substrate suitable for burrowing, occurring on open calcareous ground on the fringes of dry pans, watercourses and floodplains, on open overgrazed ground, and in open grassland or karroid areas, providing the substrate is suitable.	
Raphicerus campestris Steenbok Least Concern Provincially Protected	The species prefers open grassland (tall grass), avoiding craggy or mountainous terrain. Recorded in PV5.	

Description	Habitat[13]	Photo
Hystrix africaeaustralis Porcupine Least Concern Provincially Protected	Cape porcupines inhabit shrublands and grasslands, rural gardens and arable lands. Their day-time shelter is thought to include rock crevices, caves and abandoned burrows or other types of holes, which they have excavated or modified to their own requirements. Cape porcupines are crucial members of a healthy ecosystem due to their positive influence on the landscapes through biotic (foraging) and abiotic (soil turnover) impacts.	
Genetta genetta Small-spotted genet Least Concern Provincially Protected	Prefers more arid and more open areas; also arid shrubveld and dry riverine forest. This roadkill was recorded at the south at PV5, PV6 and the grid connection.	

Description	Habitat[13]	Photo
Antidorcas marsupialis Springbok Least Concern Provincially Protected	The species occurs in open, dry shrubby veld, grass plains or dry riverbeds. It is not confined to a specific property. Arrangement will have to be made with the landowners so that the species does not occur within a property where the PV arrays are placed	
Lepus saxatilis Scrub hare Least Concern Provincially Protected	Prefers thickets with patches of grasslands. The species is primarily found in savanna woodland and scrub areas, but can occur in grasslands occasionally (but avoid open grass plains). It occurs throughout the study area.	
Phacochoerus africanus Common warthog Least Concern Provincially Protected	Prefers savannah with open areas around pans and waterholes. Species was recorded at PV8 and east of PV8 in tall grassland with shrubs, close to the watercourse.	**No image available**
Otocyon megalotis Bat eared fox Least Concern	Several bird species benefit from this species during winter, as they consume termites which are dug up. They also influence vegetation structure by digging.	**No image available**

Description	Habitat[13]	Photo
Provincially Protected		
Bitis arietans Puff Adder Least Concern	Occurs in a wide variety of habitats, but is more abundant where bushy cover occurs. It was recorded in the northern section of the study area, at PV 11 and 12.	**No image available**
Ictonyx striatus *Striped polecat* Least Concern Provincially Protected	Highly adaptable species which exhibit a wide habitat tolerance, as they are found in open grassland, savannah woodland, thornbush, rocky habitats, agricultural areas, forest, and even desert (usually along drainage lines, provided there is some scrub cover). The species was recorded along the roads while driving to sites in the northern section of the study area.	**No image available**
Naja nivea Cape cobra Least Concern	Inhabits arid karoo, open fynbos and grassland habitats throughout its range. Within its range it is a habitat generalist which adapts well to urban environments. Species was recorded crossing the road at the southern boundary of the study area.	**No image available**

Proposed impact management actions

- Vegetation clearing close to the watercourse should be minimised and where necessary, appropriate storm water management should be put in place to limit erosion potential of exposed soil, such as placing sedimentation trapping to prevent exposed soils from spilling into the watercourse (if necessary).
- The watercourse and its buffer areas should be demarcated and fenced off prior to construction to exclude the watercourse from development activities.
- Buffer zones are allocated to sensitive or important habitat features to alleviate the effect of habitat loss, habitat fragmentation, disturbances, increased isolation and edge effects.
- All vehicle speeds associated with the project should be monitored and should be limited to 40 km/h (maximum) during the construction phase.
- As roadkills are currently considered high for this area, a roadkill monitoring programme (inclusive of wildlife collisions record keeping) should be established. Where needed, Animex fences must be installed to direct animals to safe road crossings. Finally, mitigation should be adaptable to the onsite situation which may vary over time.
- Reduce direct mortalities by allowing for fauna to cross the roads. Where applicable, this can be achieved by constructing fauna underpasses under the roads (large culverts or large open-ended concrete pipes laid into the raised roads). These underpasses should be used in conjunction with "fauna barriers" which prevent the most susceptible small fauna from crossing the roads on the surface by directing them towards the underpasses where they can cross under the roads safely. It is important to note that utilization of underpasses is strongly dependent on animal body size (larger culverts are more successful) and the surrounding habitat.
- All staff operating motor vehicles must undergo an environmental induction training course that includes instruction on the need to comply with speed limits, to respect all forms of wildlife (especially reptiles and amphibians) and, wherever possible, prevent accidental road kills of fauna. Drivers not complying with speed limits should be subject to penalties.
- Excavated trenches must be left open for as short a time as possible to avoid acting as dispersal barriers or traps.
- All open excavated trenches must have escape points with an angle of less than 45° to allow for trapped animals to escape.
- Equipment with low noise emissions must be used to not disrupt ecological life cycles (breeding, migration, feeding) of animals. Do not unnecessarily disturb faunal species, especially during the breeding season and juveniles.
- Reduce exterior lighting to that necessary for safe operation and implement operational strategies to reduce spill light. Use down-lighting from non-UV lights[14] where possible, as light emitted at one wavelength has a low level of attraction to insects. This will reduce the likelihood of attracting insects and their predators.
- All staff should be subjected to an induction training program where appropriate conservation principles, safety procedures, snake bite avoidance and first aid treatment are taught. Several staff members should complete a snake handling course to safely remove snakes from construction areas.

[14] Insects generally see 3 colours of light, Ultraviolet (UV), blue and green. Bright white or bluish lights (mercury vapor, white incandescent and white florescent) are the most attractive to insects. Yellowish, pinkish, or orange (sodium vapor, halogen, dichroic yellow) are the least attractive to most insects.

Conclusion

This compliance statement is applicable to the study area as described in the Scoping Report. The study area is in a natural or semi-natural state (due to presence of alien invasive species), and accordingly it is of a medium to low sensitivity for terrestrial animal species.

One animal SCC was recorded, namely Sable Antelope, however, since this is an introduced species and it is believed that the species are from the adjacent property a full animal assessment is not required. The species could still be included as part of the construction and operational management plan, as the species moves between the two properties.

Almost all fauna species recorded on the property are provincially protected, including species under Schedule 1 and 2 of the Northern Cape Nature Conservation Act (No. 9 of 2009). Should it be necessary to capture and relocate any of these animals prior or during construction, or during the operational phase of the project, a permit application with the provincial authority is required. No species may be killed or injured during any phase of the project.

The above management actions should be included in the Environmental Management Programme to reduce fatalities and minimise impacts on animals that do occur on the study area.

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CHAPTER 8:

Aquatic Biodiversity and Species Assessment

CSIR
Touching lives through innovation

AQUATIC BIODIVERSITY AND SPECIES SPECIALIST REPORT: Scoping and Environmental Impact Assessment (EIA) Processes for the Proposed Development of the Kudu Solar Photovoltaic Facility 4 and associated infrastructure, near De Aar, Northern Cape Province

Report prepared for:	*Report prepared by:*
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The aquatic features within the study area comprise ephemeral unnamed tributaries of the Orange River. The larger watercourses flow along the eastern and western extents of the study area, flowing in a northerly direction to join the Orange River downstream of Van der Kloof Dam. Associated with these larger watercourses are wide floodplains. Smaller watercourses and drainage features drain into the larger river corridors. The watercourses and associated wetlands and floodplains are in a largely natural to moderately modified ecological condition due to the low level of impact in the area. It is recommended that the larger watercourses, floodplains and wetlands within the site are not allowed to degrade further from their current ecological condition of largely natural to moderately modified.

The catchments of the tributaries of the Orange River in which the proposed project is not located within any FEPA river sub-catchments. The only Freshwater Ecosystem Priority Areas (FEPA) Wetland within the study area is a largely artificial wetland associated with a farm dam or erosion control structure and is thus not considered of high aquatic biodiversity conservation significance. There is also a natural depression wetland that is within the valley floor of the river system to the west of the study area that is mapped as a FEPA Wetland. Both wetlands are located outside of the proposed activities and are unlikely to be impacted by the proposed project. The artificial wetland is more than 100 m from the proposed activities, while the natural wetland is more than 3 km from any of the proposed activities. The National FEPA Wetlands, as well as the wider river floodplains associated with the unnamed tributaries of the Orange River located in the eastern and western portions of the wider study area, have been included in the National Wetland Map version 5. The wider floodplain areas have been excluded from the proposed development area for the project.

In the 2016 Northern Cape CBA mapping, the entire area within and surrounding the study area is mapped as Ecological Support Areas. In addition, wetland habitats included in the National FEPA Wetland mapping and smaller wetlands that are located largely within the river floodplain areas have been mapped as aquatic CBAs. None of these mapped wetlands occurs within the project areas, with the closest mapped wetland being the artificial FEPA wetland that is more than 100 m from the proposed development area. The aquatic CBAs are thus unlikely to be impacted by the proposed project activities.

The deemed sensitivity for the larger unnamed tributaries of the Orange River and their floodplains is medium while the smaller feeder streams, drainage lines and dams are deemed to be low. The recommended buffer area between the aquatic features and the project components to ensure these aquatic ecosystems are not impacted by the proposed activities is as follows:

- *The larger tributary: the delineated edge of the surrounding floodplain wetland features. No buffer area is deemed to be required considering that the floodplain is a wide transitional area between the tributary and the surrounding terrestrial areas; and*
- *Smaller streams and drainage features that are indicated to be of medium sensitivity: at least 35 m for the watercourse or the delineated edge of wetland features to allow for the movement of water along these streams.*
- *In addition, with regards to the BESS, it should preferably not be placed within 100 m of major rivers, watercourses and wetlands.*

With mitigation, the potential freshwater impacts of the proposed PV Facility for the construction, operation and decommissioning phases are likely to be very low. One can also expect that the cumulative impact of the proposed project would not be significant provided mitigation measures are implemented.

Based on the findings of this specialist assessment, there is no reason from a freshwater perspective, why the proposed activity (with the implementation of the above-mentioned mitigation measures) should not be authorized. The proposed development footprint within the preferred development site (i.e. study area) has been amended through the project assessment process to ensure that it will be within aquatic ecosystem areas of "low" sensitivity as identified by the national web-based environmental screening tool and verified through the initial Site Sensitivity Verification and is thus considered appropriate areas for development.

The risk assessment determined that the proposed development of the PV poses a low risk of impacting aquatic habitat, water flow and water quality. The water use activities associated with the proposed project could potentially be authorised through the general authorisations for Section 21(c) and (i) water uses. The GA for groundwater use in Quaternary Catchments D33B and D62F, where the proposed project study area is located, is limited to 45 m^3/ha/a for the property extent where the abstraction is proposed. Should more than this be required for the proposed project, an integrated water use licence application would be required for the associated project. Various assessments of the current groundwater use and sustainability of the proposed groundwater use would need to be undertaken in support of such an application. The disposal of sewage from the developed site is likely to be stored in conservancy tanks for removal and treatment at the nearby wastewater treatment works of the local authority. This low volume would be within the GA for Section 21 (g) water use activities.

Recommended mitigation measures:

Construction phase:

- *Implement recommended development setbacks to minimise works within aquatic ecosystems (i.e. recommended buffer of at least 35 m for the smaller drainage features; and setback from the wider floodplain adjacent to the larger rivers)*
- *Clearing of indigenous vegetation should not take place within the aquatic features and the recommended buffers.*
- *Rehabilitate disturbed aquatic habitats by revegetating them with suitable local indigenous vegetation.*
- *Water use for construction should be minimised as much as possible. The water should be obtained from an existing water allocation or other viable water sources for construction purposes.*
- *The road crossing structures should be designed to not impede flow in watercourses - low water crossing is preferred. Use existing crossings, as best as possible and where allowable.*
- *The existing road infrastructure, particularly within the floodplain, should be utilised as far as possible to access new infrastructure to minimise the overall disturbance. It is recommended that any new linear type of infrastructure crossings over watercourses be placed where there are existing structures or road crossings within the watercourse corridors, where possible.*
- *Avoid disturbing aquatic habitats.*
- *Construction materials brought onto the site should be free of alien plant seeds. Sources of alien seed should be prevented from being brought onto the site with imported materials.*
- *Rehabilitate disturbed aquatic habitats once construction works are complete.*
- *Undertake monitoring for the growth of alien vegetation during the construction and post-construction phases.*
- *Any work within aquatic features should be undertaken in the dry season where possible.*

- *Sediment traps should be used where necessary.*
- *Construction sites and laydown areas should be located within the assessed buildable areas/development footprints.*
- *Good housekeeping and site management measures must be implemented at the laydown areas and the construction site as per the project Environmental Management Programme (EMPr) and monitored by the appointed Environmental Control Officer (ECO).*

Operation phase:

- *The medium-sensitivity aquatic habitats should be avoided in the layout design, with only low-sensitivity habitats being disturbed during construction.*
- *Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants.*
- *Should any disturbance of aquatic habitats occur that is not associated with an improvement of the ecological condition, the habitat should be rehabilitated immediately following the disturbance activity by returning the habitat to the condition prior to that disturbance.*
- *Develop a stormwater management plan for the proposed development that addresses the stormwater runoff from the developed areas.*
- *Stormwater run-off infrastructure must be designed to mitigate both the flow and water quality impacts of any stormwater leaving the developed areas. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate shaping of the road with berms or channels and swales adjacent to hardened surfaces where necessary. Should any erosion features develop, they should be stabilised immediately.*
- *A sustainable water supply should be sought.*
- *Sewage generated within the site should be discharged to a conservancy tank that is properly serviced and regularly evacuated to nearby wastewater treatment works.*

Decommissioning phase:

- *Minimise works within aquatic ecosystems. If the project layout avoided these areas, the decommissioning works would also be able to avoid aquatic habitats as delineated. Note that all aquatic areas recommended for avoidance have been avoided in the EIA phase layout identification.*
- *Rehabilitate and revegetate disturbed areas, where required.*
- *Mitigation and follow-up monitoring of residual impacts (alien vegetation growth and erosion) may be required.*
- *The road network should be returned to that resembling pre-construction, with all additional roads removed where possible.*
- *Decommissioning activities within aquatic features should be undertaken in the dry season where possible.*
- *Sediment traps should be used where necessary.*
- *Laydown areas should be placed within the approved PV footprint and layout.*
- *Good housekeeping measures should be implemented as per the project EMPr and monitored by the appointed ECO. This should specifically address on-site stormwater management and prevention of pollution during decommissioning. Any stormwater that does arise within the decommissioning site must be handled appropriately to trap sediments and pollutants.*

CONTENTS

FIGURES

TABLES

ABBREVIATIONS

BA	Basic Assessment
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
DWA(F)	Department of Water Affairs (and Forestry)
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EI&ES	Ecological Importance and Ecological Sensitivity
EMPr	Environmental Management Program
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Area
GA	General Authorisation
GG	Government Gazette
GIS	Global Information System
GN	Government Notice
ha	hectare
HI	Habitat Integrity
IPP	Independent Power Producer
IUCN	International Union for Conservation of Nature
kW	kilowatt
MMP	Maintenance Management Plan
MW	megawatt
NCBSP	Northern Cape Biodiversity Sector Plan
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Area
NWA	National Water Act
ONA	Other Natural Areas
PA	Protected Area
PES	Present Ecological Status
REC	Recommended Ecological Condition
SANBI	South African National Biodiversity Institute
SEA	Strategic Environmental Assessment
SCC	Species of Conservation Concern
WMA	Water Management Area
WUL	Water Use License
WULA	Water Use License Application

GLOSSARY

Definitions	
Aquifer	A geological formation that has structures or textures that hold water or permit appreciable water movement through them.
Catchment	The area from which any rainfall will drain into the watercourse or watercourses or part of a watercourse, through a surface flow to a common point or common points
Critical Biodiversity Areas	Areas that are required to meet biodiversity targets for species, ecosystems or ecological processes and infrastructure.
Drainage feature	A minor channel down which surface water naturally concentrates and flows that are poorly defined and usually does not contain any distinctive riparian and aquatic vegetation or habitat.
Ecological Importance and Sensitivity	The rating of any given wetland or river reaches that provides an indication of the ecological importance of the aquatic system using criteria such as conservation needy habitat or species, protected ecosystems or unique habitat observed. The sensitivity is then derived by assessing the resilience the habitat exhibits under stress as a result of changes in flow or water quality.
Ecological Support Areas	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of Protected Areas or Critical Biodiversity Areas and are often vital for delivering ecosystem services.
Other Natural Areas	Areas that have not been identified as a priority in the biodiversity spatial plans but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Although they have not been prioritised for meeting biodiversity targets, they are still an important part of the natural ecosystem.
Pans or Depression wetlands	A basin-shaped area with a closed elevation contour that allows for the accumulation of surface water. It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.
Perennial / Non-perennial rivers	Perennial rivers are those rivers that exhibit a continuous flow of water throughout the year except during extreme drought conditions. Non-perennial rivers are those rivers that have no flow for at least a part of the year. These rivers are seasonal.
Present Ecological State	The current ecological condition of a watercourse as measured against the deviation from the natural or pre-impacted condition of the system
Protected Areas	Areas that are formally protected by law and recognised in terms of the National Environmental Management: Protected Areas Act. This includes gazetted private Nature Reserves and Protected Environments concluded via a stewardship programme.
Riparian habitat	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 composition and physical structure distinct from those of adjacent land areas
River FEPA	Rivers currently in a good condition (A or B ecological category) that have been identified to achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species. They should remain in a good condition to contribute to the biodiversity goals of the country.
Watercourse	(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 of DWS may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks;
Water management area	An area established as a management unit in the national water resource strategy within which a catchment management agency will conduct the protection, use, development, conservation, management and control of water resources

Wetland	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 typically adapted to life in saturated soil.
Wetland FEPA	Wetlands currently in good condition (A or B ecological category) that have been identified to achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species. They should remain in good condition to contribute to the biodiversity goals of the country.

8. AQUATIC BIODIVERSITY AND SPECIES SPECIALIST ASSESSMENT

This chapter includes the Aquatic Biodiversity and Species Specialist Assessment that was prepared by Ms Antonia Belcher as part of the Scoping and Environmental Impact Assessment (EIA) Process for the proposed development of the Kudu Solar Facility 4 and associated infrastructure, near De-Aar, Northern Cape Province (Figure 1).

1 Introduction

1.1 Scope, Purpose and Objectives of this Specialist Report

The Kudu project will entail the proposed development of Solar PV Facilities, as well as associated infrastructure and Electrical Grid Infrastructure (EGI). Each solar PV facility will have a range of associated infrastructure, including, but not limited to, an on-site substation complex, battery energy storage systems (BESS) and is proposed to connect to an existing 400 kV power line via dedicated 132 kV power lines. During the scoping phase, the specialists considered the entire study area, with the development of up to 14 Solar PV Facilities. However, following the identification of sensitivities, discussions with landowners and other considerations such as the capacities of the Bidding Window 6, the proposed projects were re-clustered and a total of up to 12 Solar PV Facilities are being proposed.

Separate specialist reports have been provided for each PV project. This report is focused on **Kudu Solar Facility 4** only (hereafter referred to as the "Kudu Solar Facility" or "proposed project").

This report provides information in terms of the aquatic constraints within the project area and the associated aquatic ecosystem impacts for the proposed activities, and it complies with the Aquatic Biodiversity Protocol published in Government Notice (GN) 320 in March 2020. A table showing such compliance is captured in Appendix E of this chapter.

1.2 Details of Specialist

This specialist assessment has been undertaken by Toni Belcher. She is registered with the South African Council for Natural and Scientific Professions (SACNASP), with Registration Number 400040/10 in the fields of Ecological Science and Environmental Science. A curriculum vitae is included in Appendix A of this specialist assessment. In addition, a signed specialist statement of independence is included in Appendix B of this specialist assessment. Dana Grobler has reviewed the report. He is registered with SACNASP (Registration Number 002272) in the following fields of practice Environmental Science, Water Resources Science and Aquatic Science.

1.3 Terms of Reference

The Terms of Reference for this specialist report are as follows:

- Comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320. This specifically includes the Aquatic Biodiversity Protocol that applies to all activities requiring EA. This protocol replaces the requirements of Appendix 6 of the 2014 National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) EIA Regulations (as amended).
- The specialist must undertake a site visit in order to identify the level of sensitivity assigned to the project area on the Screening Tool and to verify and confirm this sensitivity and land use and either compile an

Aquatic Biodiversity and Species Specialist Report or Compliance Statement, as documented in the Assessment Protocols published on 20 March 2020, in Government Gazette 43110, GN 320.

- Provide a Site Sensitivity Verification Report based on the requirements documented in the Assessment Protocols published on 20 March 2020, in Government Gazette 43110, GN 320.
- Provide inputs to the Draft and Final Scoping Reports to include a description of the affected environment and environmental sensitivities, key legislation, key issues to be addressed during the EIA Phase, a high-level assessment of impacts, and confirmation of the scope of work for the EIA Phase.
- Provide an Aquatic Biodiversity and Species Specialist Report or Compliance Statement based on the requirements documented in the Assessment Protocols published on 20 March 2020, in Government Gazette 43110, GN 320.
- The Specialist Assessment and/or Compliance Statement must also be in adherence to any additional relevant legislation and guidelines that may be deemed necessary.
- Determination, description and mapping of the baseline environmental condition and sensitivity of the study area. Specify setbacks or buffers, and provide clear reasons for these recommendations. Also, map the extent of disturbance and transformation of the site. This environmental screening will inform each project layout. The initial screening process is required to further refine the focus areas and identify developable areas.
- Provide review input on the preferred infrastructure layout following the sensitivity analysis and layout identification.
- Describe the aquatic ecology features of the project area, with a focus on features that are potentially impacted by the proposed project. The description should include the major habitat forms within the study site, giving due consideration to aquatic ecology (flora), aquatic ecology (fauna), and freshwater ecosystems/wetlands.
- Consider seasonal changes and long-term trends, such as due to climate change.
- Identify any species of conservation concern or protected species on site.
- The assessment is to be based on existing information, national and provincial databases and professional experience and fieldwork conducted by the specialist, as considered necessary and in accordance with relevant legislated requirements. The assessment must also consider the maps generated by the National Screening Tool.
- Identify and assess the potential direct, indirect and cumulative impacts of the proposed development on aquatic biodiversity and species. Impact significance must be rated both without and with mitigation and must cover the construction, operational and decommissioning phases of the project.
- Identify and delineate wetlands that may occur on the site using the relevant protocols established.
- Compile a Risk Matrix (Appendix A to GN R509 of 2016) and determine if a Water Use License (WUL) is required and, if so, determine the requirements thereof.
- Identify any additional protocols, and legal and permit requirements that are relevant to the project and the implications thereof.
- Provide recommendations with regard to potential monitoring programmes.
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts. Also, identify best practice management actions, monitoring requirements, and rehabilitation guidelines for all identified impacts, which be included in the Environmental Management Programme (EMPr). An EMPr has been compiled for all project infrastructure at the PV facility, and a Generic EMPr has also been compiled for the on-site substation complex.

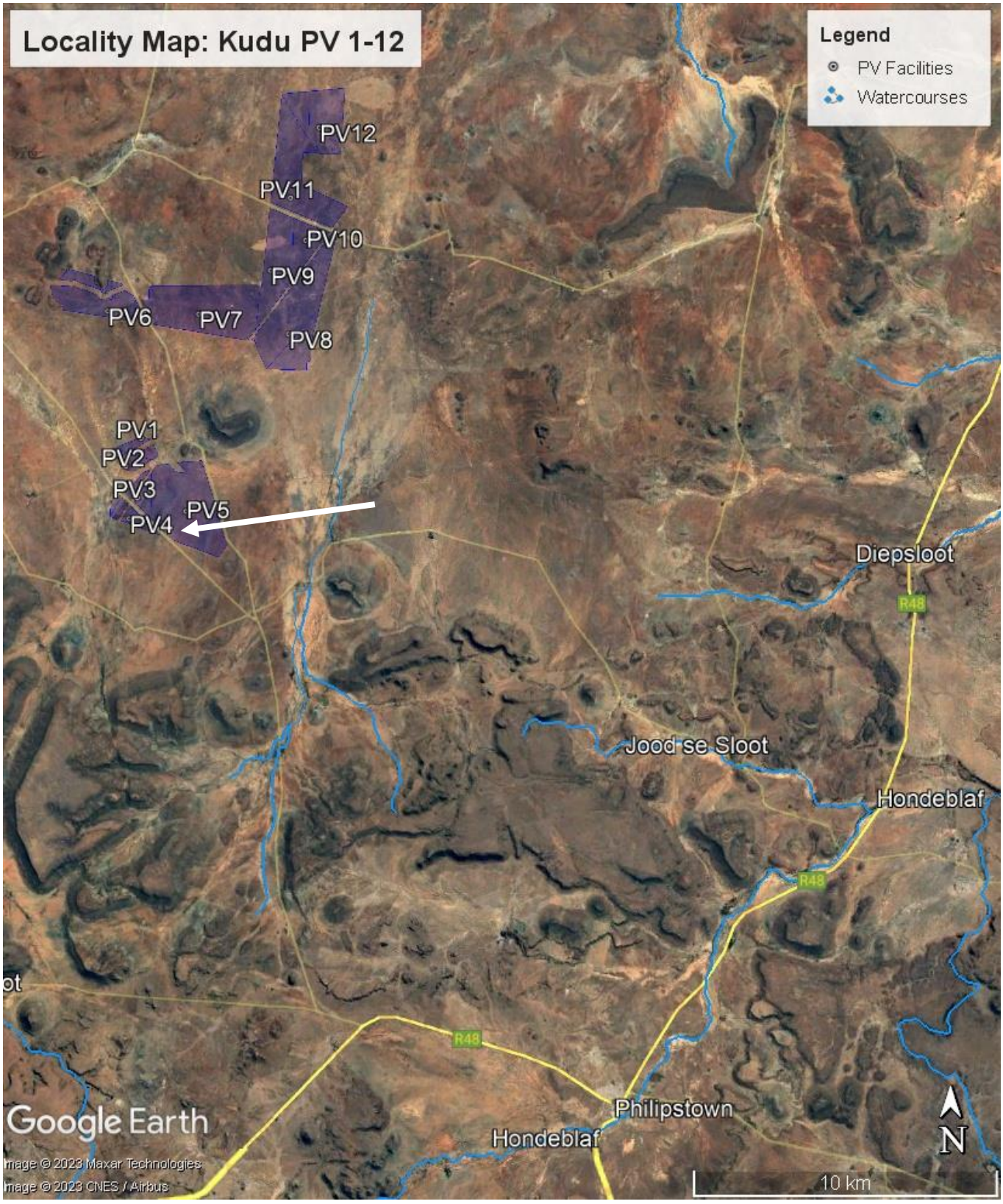


Figure 1. Locality map for the proposed project. This report deals with Kudu Solar Facility 4 (PV 4).

2 Approach and Methodology

Input into this report was informed by a combination of desktop assessments of existing freshwater ecosystem information for the study area and surrounding catchments, as well as by a more detailed assessment of the freshwater features on the various farm portions that comprise the study area.

The study area was visited on 4 March 2022 to verify the aquatic features occurring on the site. No additional site visits are deemed necessary. The field visit comprised delineation, characterisation and integrity assessments of the aquatic habitats within the study area. Mapping of the freshwater features was undertaken using a GPS Tracker and mapped in PlanetGIS and Google Earth Professional.

The following techniques and methodologies were utilised to undertake the assessments:

1. The guideline document, "A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas" document, as published by the former Department of Water Affairs and Forestry (DWAF) (currently operating as the Department of Water and Sanitation (DWS)) (2005), was followed for the delineation of the wetland areas. According to the delineation procedure, the wetlands were delineated by considering the following wetland indicators: terrain unit indicator, soil form indicator, soil wetness indicator and vegetation indicator.

2. The wetlands were subsequently classified according to their hydro-geomorphic determinants based on a classification system devised by Kotze *et al*. (2009) and the South African National Biodiversity Institute (SANBI) (2009). Notes were made on the levels of degradation in the wetlands based on field experience and a general understanding of the types of systems present.

3. A Present Ecological State (PES) assessment was conducted for each hydro-geomorphic wetland unit identified and delineated within the study area.

4. The functional wetland assessment technique, WET-EcoServices, developed by Kotze *et al.* (2009), was used to indicate the ecological benefits and services provided by delineated wetland habitats. This technique consists of assessing a combination of desktop and infield criteria to identify the importance and level of functioning of the wetland units within the landscape.

5. The present ecological condition of the watercourses was determined using national River Health Programme methodologies as described in this report.

6. The ecological importance and ecological sensitivity (EI&ES) assessment of the wetlands and watercourses was conducted according to the guidelines as developed by DWAF (1999); and

7. Recommendations are made concerning the adoption of buffer zones within the study area, based on the wetlands' functioning and site characteristics.

2.1 Information Sources

A summary of the main information sources used in this assessment is provided in Table 1 below:

Table 1. Information Sources for the Aquatic Biodiversity Assessment

Data / Information	Source	Date	Type	Description
Satellite imagery	Google Earth	May 2002 to November 2021	Spatial	Recent history of aerial imagery for the site
Northern Cape Biodiversity Sector Plan (NCBSP)	Northern Cape Department of Economic Development, Environmental Affairs and Tourism (now Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARDLR))	2016	Report & Spatial	Spatial conservation planning units and associated management recommendations for the Northern Cape province
National Biodiversity Assessment	South African National Biodiversity Institute (SANBI)	2018	Report and Spatial	Latest assessment of South African biodiversity and ecosystems, including wetlands and rivers.
National Vegetation Map	SANBI	2018	Report and Spatial	Latest national vegetation type mapping
South African Atlas of Climatology and Agrohydrology	R.E. Schulze	2012	Spatial	Climate data
Aquifer classification and Groundwater Resource Assessment information	Department of Water and Sanitation (DWS)	2005, 2012 and 2013	Spatial	Mapping of aquifer class, type, yields, susceptibility and Vulnerability as well as depths, recharge and quality
National Soil types	Environmental Potential Atlas (ENPAT)		Spatial	Mapping of soil types
National Freshwater Ecosystem Priority Areas (FEPA)	Council for Scientific and Industrial Research (CSIR)	2011	Report and spatial	Mapping of areas of aquatic ecosystem conservation importance
National River Present Ecological Status, Ecological Importance and Ecological Sensitivity	Former Department of Water Affairs (DWA) now operating as the DWS	2012	Spreadsheets and spatial	River reach assessments of ecological importance, sensitivity and condition
National Wetland Map 5	CSIR and SANBI – South African National Biodiversity Assessment 2018	2018	Spatial	Mapping of wetland habitats

2.2 Assumptions, Knowledge Gaps and Limitations

Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. The methodologies and techniques used in this assessment have been developed nationally and are typically of a rapid nature, as is required for this aquatic biodiversity impact assessment.

Very limited aquatic features occur within the study area and surrounding area. No baseline long-term monitoring was undertaken as part of this assessment. There is also very little existing information available for the aquatic features within the study area. Data was utilised for adjacent aquatic ecosystems where available. The nature of the proposed activities, however, also allows them to be placed some distance from any significant mapped aquatic features such that the likely impacts would be of a very low significance. It is usually the associated infrastructure that has the potential to have a greater impact on the aquatic features. The impacts of roads and powerlines on the aquatic features are, however, well understood and can be effectively mitigated to ensure the impacts remain of low significance. The preferred mitigation measure is to limit the disturbance to aquatic features as far as possible by avoiding and minimising the number of crossings and providing adequate buffer areas. This will also ensure that the cumulative impacts will remain of low significance.

The level of aquatic assessment undertaken was considered to be adequate for this study. No further fieldwork will be required. The ground-truthing of aquatic features was undertaken during autumn, during the rainfall period and when the use of vegetation as an indicator was possible. As it was not possible to cover the entire study area in a high level of detail, extrapolation of the areas ground-truthed to those not covered was done using the latest available aerial imagery for the site and is deemed to be sufficient for this assessment.

2.3 Consultation Processes Undertaken

No consultation was deemed to be required with landowners or neighbouring landowners during the course of preparing this specialist report. The standard public participation process was held as part of the scoping phase of the study and the comments received from that process have been responded to and considered in terms of this assessment and the constraints mapping. Comments raised during the EIA Phase have been considered accordingly, where relevant.

3 Description of Project Aspects Relevant to Aquatic Biodiversity

In terms of the potential aquatic ecosystem impacts of the proposed development, it is typically the footprint of the development and its associated infrastructure, placed in or adjacent to aquatic features, that may alter the aquatic habitat, have water quality impacts or modify the runoff in the aquatic ecosystems within the area. The proposed project is shown in Figure 2.

Figure 2. Proposed project elements under consideration in this specialist assessment. Note that the full extent of the land portions (shown in yellow) serves as the study area. This report is focused on Kudu Solar Facility 4 (PV4).

The proposed project is envisaged to consist of the following components:

- Solar PV Facilities: PV Panel Structures comprise single-axis tracking structures, dual-axis tracking, or fixed tilt mounting. Mono- or bifacial solar modules are also proposed.
- On-site substation complex (extending approximately 8 ha) per PV Facility that may include: On-site Independent Power Producer (IPP) or Facility Substation (+-1 ha), a BESS (+-1 ha), and a switching station and collector station (+-2ha).
- Temporary Laydown Area: up to 7 ha.

- New internal service roads will need to be established, and these would either comprise farm (compacted dirt/gravel) roads or be paved.
- Main site access: Up to 8 m during construction and operation. Existing roads will be used as far as practically achievable. These roads may need to be widened and upgraded.
- Internal underground lines of up to 33 kV (22 kV or 33 kV). In some instances, the internal lines may need to be routed above ground.
- Auxiliary buildings to be developed include but are not limited to an Operation and Maintenance building, site office, staff lockers, bathrooms, warehouses, etc. with a combined footprint of up to 0.5 ha (i.e., 5000 m^2).

Water use requirements for the proposed project comprise approximately 9 000 m^3 per year for a ± 18-month construction period and approximately 1 000 m^3 per year for an approximate 20-year operational lifespan of the solar energy facility. Water is to be sourced either from the local authority, a third-party supplier or from groundwater on site.

4 Baseline Environmental Description

4.1 Study Area Definition

The **study area** for the proposed Kudu Solar Facilities 1 to 12 is the full extent of the eight affected farm properties on which the proposed PV Facilities will be constructed. The full extent of these properties has been assessed in this study in order to identify environmental sensitivities and no-go areas. The total study area for all the Kudu Solar Facilities 1 to 12 is approximately 8 150 hectares (ha).

At the commencement of this Scoping and EIA Process, the **Original Scoping Buildable Areas** which fall within the study area were identified by the Project Developer following the completion of high-level environmental screening based on the Screening Tool.

Following the identification of sensitivities during the Scoping Phase, the Project Developer considered such sensitivities and formulated the **Revised Scoping Buildable Areas.** The **Revised Scoping Buildable Areas** were used to inform the design of the layout, and further assessed during this EIA Phase of the project in order to identify the preferred development footprint of the proposed project on the approved site as contemplated in the accepted Scoping Report. The **development footprint** is where the actual development will be located, i.e. the footprint containing the PV solar arrays and associated infrastructure.

The terms site and study area are used synonymously in this report.

4.2 General Description

The study area in which the PV facilities under consideration are to be constructed is located in the Pixley ka Seme District Municipality. The site is approximately 50 km northeast of De Aar. Smaller towns of Philipstown, Petrusville and Van der Kloof occur within a 40 km radius of the site. The surrounding area comprises largely farmed areas that are mostly used for livestock grazing.

The majority of the landscape consists of flat to slightly undulating plains with shallow valleys and small hilltops that are drained by non-perennial (ephemeral), northward-flowing tributaries of the Orange River. General drainage within the study area is from south to north. The elevation of the study area ranges from approximately 1250 to 1350 m.a.s.l. Table 2 provides an overview and summary of the water resource information for the study area.

Table 2: Key water resources information for the proposed project development area

Descriptor	Name/details	Notes
Water Management Area (WMA)	Mostly in the Upper Orange WMA with less than 10% in the Lower Orange WMA	
Catchment Area	Unnamed ephemeral tributaries of the middle reach of the Orange River	
Quaternary Catchment	D33B (Upper Orange) and D62F (Lower Orange)	
Present Ecological State	Not assessed as ephemeral systems that do not contain much aquatic habitat but rather exist as drainage features within the landscape	DWS (2012) assessment for nearby watercourses
Ecological Importance (EI) and Ecological Sensitivity (ES)	EI (D33B): Low; (D62F): High ES (D33B): Very low; (D62F) Moderate	
Location of the centre of the study area	30°13'03" S	Latitude
	24° 20'34"E	Longitude

4.2.1 Geology and Soils

Shales of the Volksrust Formation, Ecca Group as well as Dwyka Group sedimentary rock underly the wider area with intrusions of Karoo Dolerite sills and sheets. Superficial deposits of calcrete, surface limestone, and hardpan cover large areas. Soils tend to be variable, comprising shallow to deep, red-yellow, freely drained soils or shallow Glenrosa and Mispah forms.

4.2.2 Climate, Hydrology and Geohydrology

For the study area, the summers are hot; the winters are short, cold, and windy; and it is dry and mostly clear year-round. Average temperatures vary from 9 ^{o}C in June/July to 23 ^{o}C in January. The wet season occurs from mid-November to mid-April, with March tending to be the wettest month (45 mm on average) and July the driest month (2 mm on average). The mean annual rainfall for the area is 287 mm. The site is not in a Strategic Water Source Area for surface or groundwater.

Due to the climatic conditions of the area, the watercourses and the wetland areas that occur in the area are ephemeral (non-perennial), only containing water for short periods, immediately following local rainfall events. A dominant feature of the larger rivers is the alluvial floodplains that are characterised by multiple channels that are interchangeably used during higher flow events. These sandy floodplains tend to have mostly bare beds, with vegetation occurring in clumps along the bed and more densely along the banks. The ephemeral watercourses are highly dependent on groundwater discharge.

A minor fractured aquifer occurs within the area. The water table typically occurs at depths of about 9.5 m below ground level, and the yield of the aquifer is less than 2 litres a second. Both groundwater quality tends to be fresh with natural electrical conductivity concentrations of less than 300 mS/m. The estimated groundwater recharge in the area is 12.2 mm/a. The aquifer is of low susceptibility and vulnerability.

4.2.3 Vegetation

The study area lies near the eastern edge of the Nama Karoo biome and is mapped according to the national vegetation types (Mucina and Rutherford, 2006, updated in 2009, 2012 and 2018) as being of the vegetation type Northern Upper Karoo which is considered to be least threatened. The vegetation cover is generally

dominated by sparse dwarf karroid scrub and tufted grass with bare patches of sand in between. Portions of the area are in a disturbed condition, most likely as a result of livestock grazing.

Along the larger watercourse, the common reed *Phragmites australis* and *Juncus* spp. Dominate with some discernible riparian vegetation comprising larger shrubs such as *Searsia pyroides* along the banks. The smaller ephemeral streams have no visible aquatic vegetation.

4.2.4 Aquatic Habitats and Biota

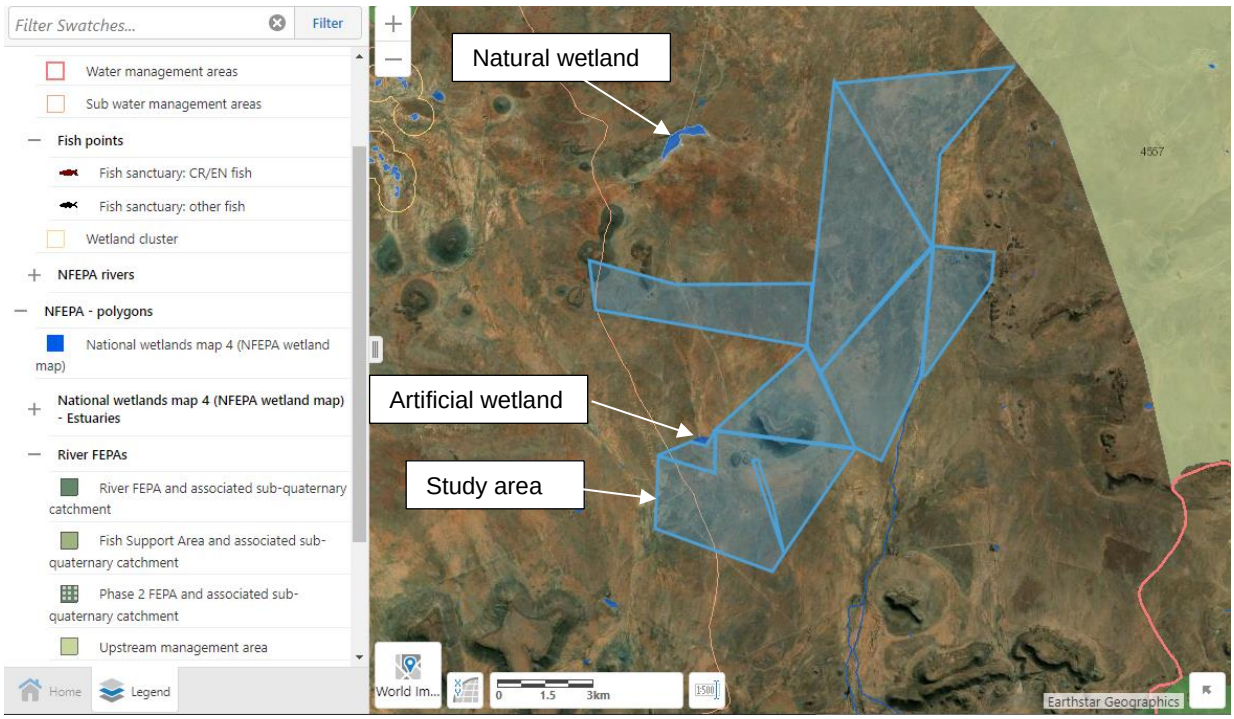
The aquatic features within the study area comprise ephemeral unnamed tributaries of the Orange River. The larger watercourses flow along the eastern and western extents of the study area, flowing in a northerly direction to join the Orange River downstream of Van der Kloof Dam. Associated with these larger watercourses are wide floodplains. Smaller watercourses and drainage features drain into the larger river corridors.

The ephemeral streams and floodplains provide aquatic habitat to a diverse array of faunal species that are adapted to the brief periods of inundation to carry out much of their life phases. Amphibians such as the Poynton's River Frog (*Amietia poyntoni),* Tandy's sand frog (*Tomopterna tandyi*), African bullfrog, (*Pyxicephalus adspersus*), Pygmy Toad (*Poyntonophrynus vertebralis*) and Karoo Toad, *Vandijkophrynus gariepensis* use the inundated pools for breeding. Other biota that use the temporary wet habitats comprise migratory birds and many invertebrates such as water fleas (*Daphnia* spp.) and tadpole shrimps (*Triops* spp.*)*. Connectivity between aquatic ecosystems and the surrounding terrestrial landscape is essential for supporting the fauna of these ecosystems.

4.2.5 Aquatic Biodiversity Sensitivity and Conservation Importance

The catchments of the tributaries of the Orange River in which the proposed project is located are not within any National Freshwater Ecosystem Priority Area (FEPA) river sub-catchments (Figure 3, top). The only FEPA Wetland within the study area is a largely artificial wetland associated with a farm dam or erosion control structure and is thus not considered of high aquatic biodiversity conservation significance. There is also a natural depression wetland that is within the valley floor of the river system to the west of the study area that is mapped as a FEPA Wetland. Both wetlands are located outside of the proposed activities and are unlikely to be impacted by the proposed project. The artificial wetland is more than 100 m from the proposed activities, while the natural wetland is more than 3 km from any of the proposed activities.

The National FEPA Wetlands, as well as the wider river floodplains associated with the unnamed tributaries of the Orange River located in the eastern and western portions of the wider study area, have been included in the National Wetland Map version 5 (Figure 3, bottom). The wider floodplain areas have been excluded from the proposed development area for the project.



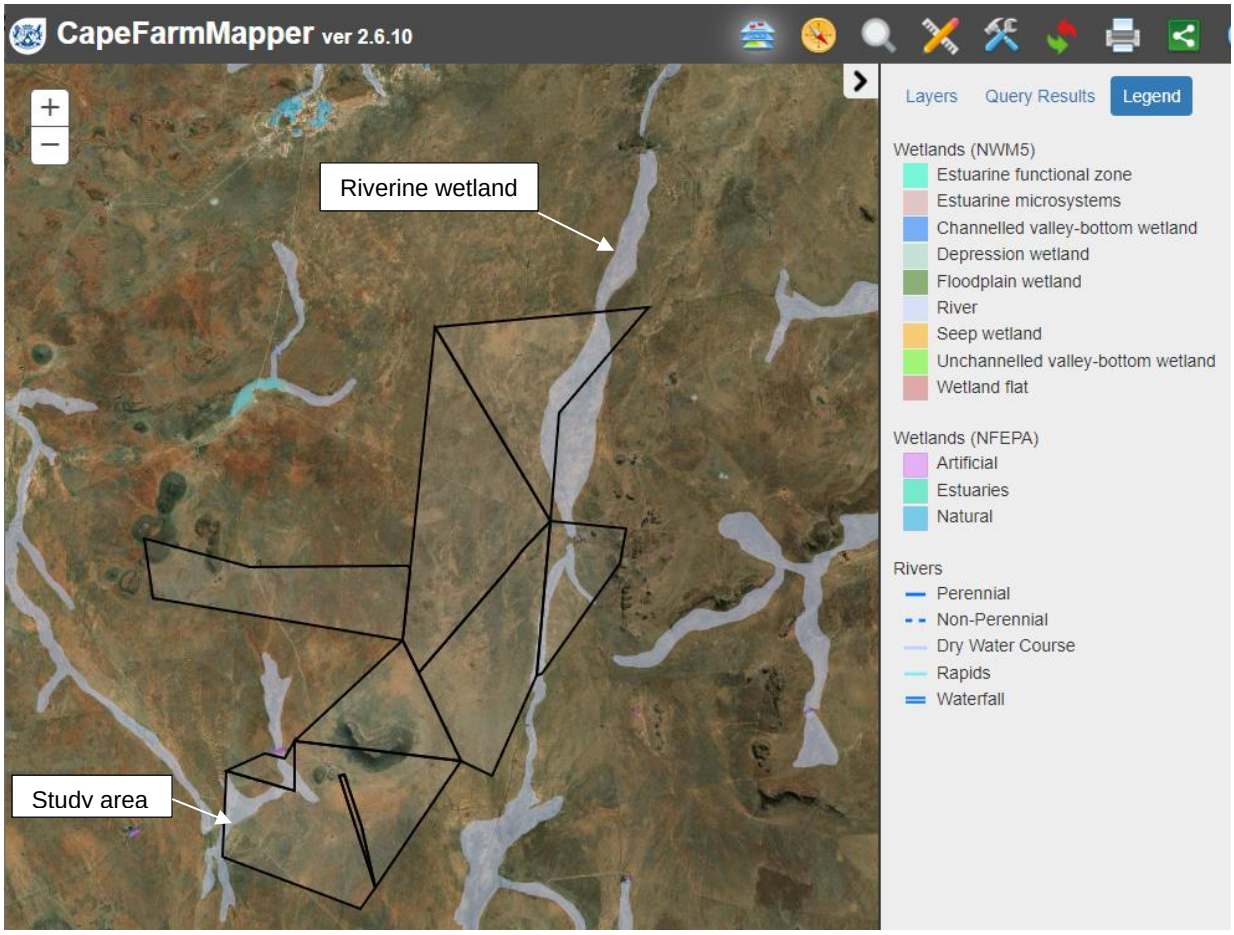


Figure 3. National Wetland Map 5 and FEPA Wetlands within the wider study area (CSIR 2019 and 2011 respectively, obtained from CapeFarmMapper, May 2022)

In the 2016 Northern Cape Critical Biodiversity Areas (CBAs) mapping (Figure 4), the entire area within and surrounding the study area is mapped as Ecological Support Areas. In addition, wetland habitats included in the National FEPA Wetland mapping and smaller wetlands that are located largely within the river floodplain areas have been mapped as aquatic CBAs. None of these mapped wetlands occurs within the project areas, with the closest mapped wetland being the artificial FEPA wetland that is more than 100 m from the proposed development area. The aquatic CBAs are thus unlikely to be impacted by the proposed project activities.

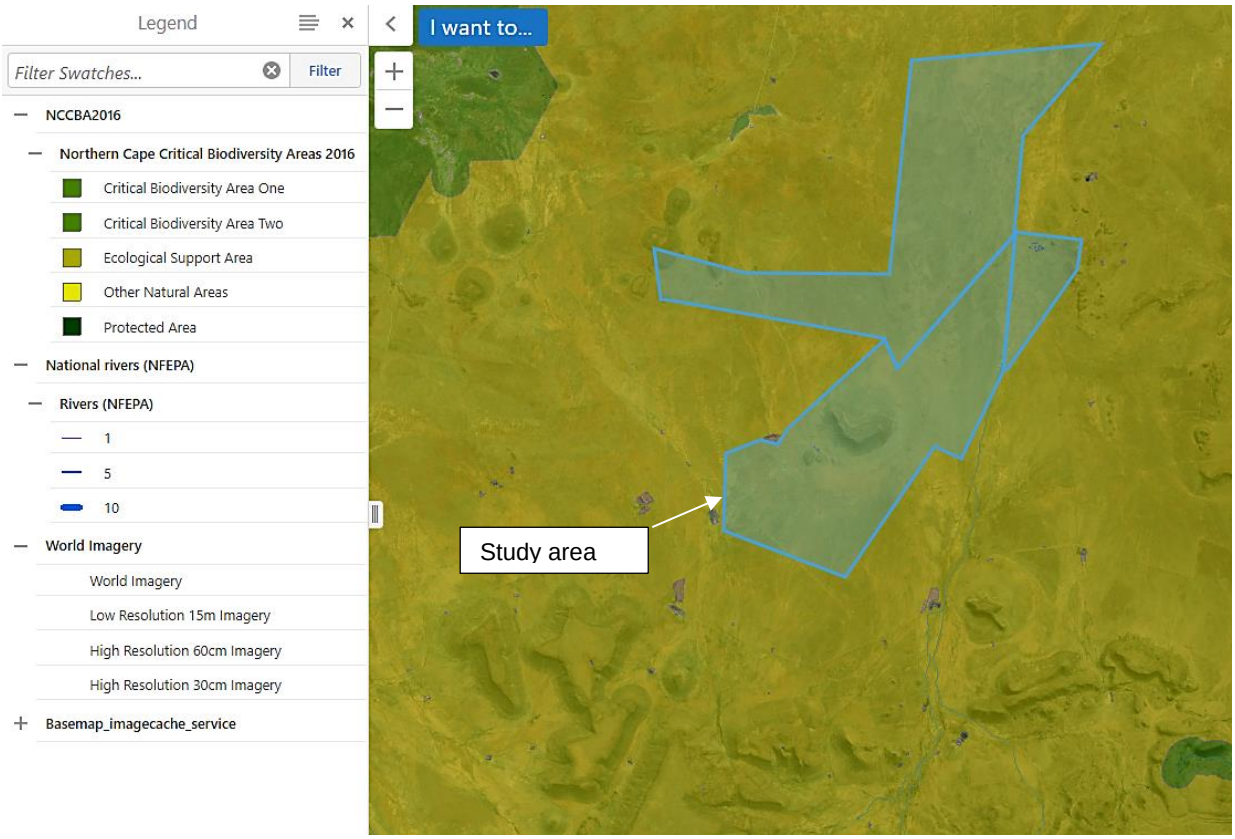


Figure 4. 2016 Northern Cape Critical Biodiversity Areas map for the study area (obtained from SANBI Biodiversity GIS in May 2022)

4.2.6 Aquatic Ecological Integrity

The rivers in the study area comprise unnamed tributaries of the Orange River System that joins the river downstream of Van der Kloof Dam. The larger watercourses all mostly drain in a northerly direction. The rivers can all be characterised as foothill and lowland rivers within the Nama Karoo Ecoregion. The watercourses and associated wetlands and floodplains are in a largely natural to moderate condition due to the low level of impact in the area. It is recommended that the larger watercourses, floodplains and wetlands within the site are not allowed to degrade further from their current ecological condition of largely natural to moderately modified.

The larger watercourse channels tend to be shallow and wide, often with an associated floodplain. The substrate comprises a mix of gravel and alluvium. Wetland areas tend to comprise depressions on the valley floor that occur as a perched feature on calcrete layers. The vegetation for the larger watercourses usually comprises indigenous grasses (*Eragrostis* and *Stipagrostis* species and *Themeda triandra*) with distinct

riparian vegetation comprising larger shrubs such as *Searsia pyroides* and *Melianthus comosus* (Figure 5). The smaller ephemeral streams and drainage features within the study area do not have a distinct channel or vegetation. Wetland areas contain *Phragmites australis* in the larger features, while the smaller features contain some wetland indicator species such as *Schoenoplectus* spp. (Figure 6).

Impacts on the watercourses in the study area are associated with agricultural encroachment, livestock grazing and infrastructure (road and powerline) construction and maintenance. The ephemeral aquatic ecosystems are particularly vulnerable to changes in hydrology as they are specifically adapted to the sporadic flow conditions that naturally occur. Contaminants and sediment are not regularly flushed from these streams.

Figure 5. View of the larger tributary to the east of the proposed project area

Figure 6. Small wetland habitats that occur in the north-western extent of the study area

4.3 Project Specific Environmental Description

The aquatic features within the study area are described below.

Kudu Solar Facility 4 and its associated infrastructure is located on the western extent of Remaining Extent of Portion 3 of the Farm Bas Berg No. 88. A wider floodplain of an unnamed tributary of the Orange River crosses the site from the south-west to the north of the site. This floodplain wetland of the unnamed tributary is not included in the FEPA Wetland (only an artificial wetland associated with an instream dam immediately to the north of the site) or CBA mapping but is included in the National Wetland Map 5 (NWM5). It is recommended that the proposed project activities be located outside of the floodplain area (shown in Figure 7). The floodplain area is lower-lying than the rest of the site, and the vegetation is indicative of periodic inundation and a seasonal increase in soil wetness.

The above aquatic constraint and recommendations have been taken into consideration in the proposed layout and development footprint. The development footprint and detailed layout are acceptable and are shown in Figure 10. Changes to the detailed layouts are deemed acceptable if the changes remain within the approved buildable areas/development footprints with the aquatic no-go sensitive areas avoided.

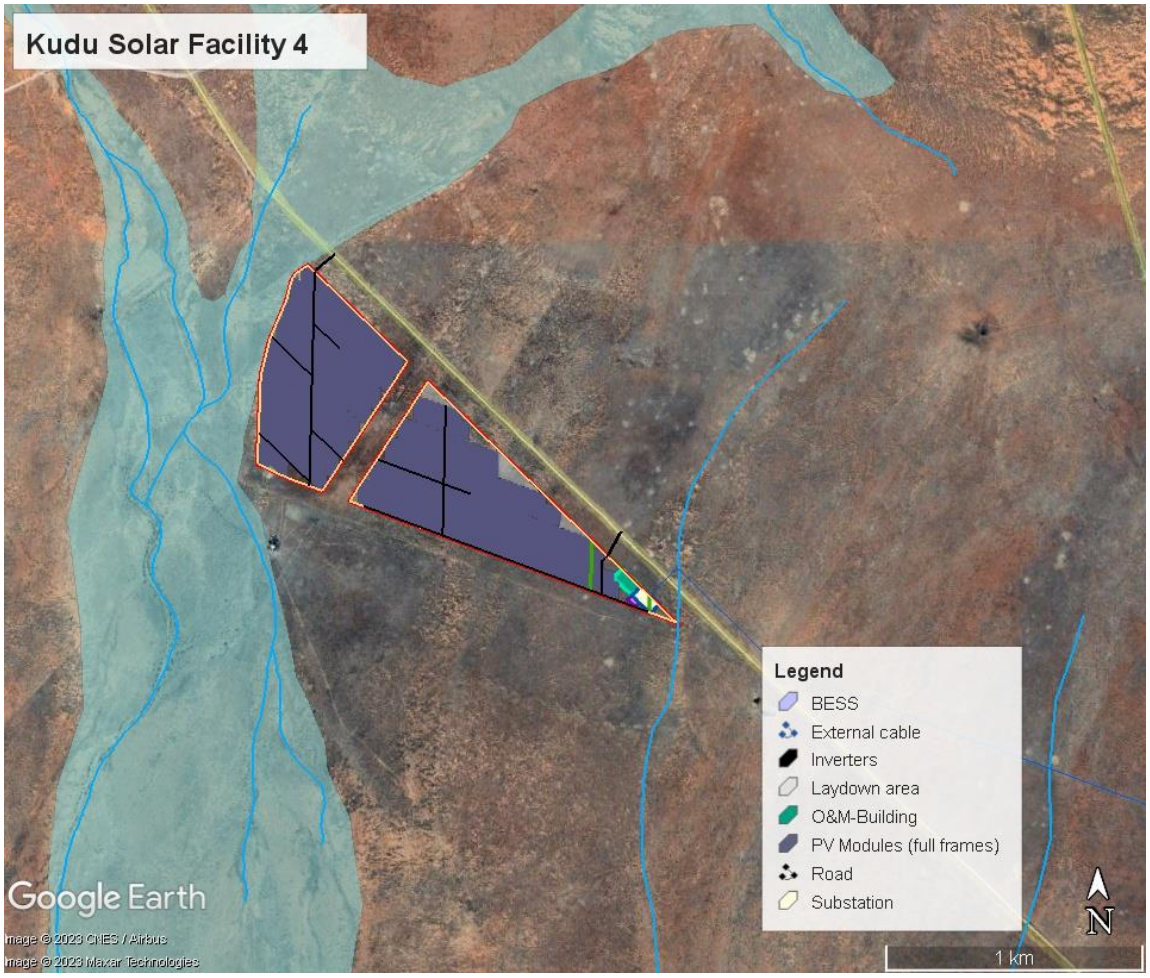


Figure 7. Development Footprint for Kudu Solar Facility 4 (red polygon shows the outer fence line), shown together with the mapped aquatic features (light blue areas and lines). The green outlined area is the on-site substation complex, which has also been assessed in this study. The external cable shown above is the subject of separate assessments (i.e. EGI Projects 13 to 26).

4.4 Identification of Environmental Sensitivities

4.4.1 Sensitivities Identified by the National Web-Based Environmental Screening Tool (Screening Tool)

The Screening Tool has indicated that the wider area surrounding the study area is generally of low Aquatic Biodiversity Combined Sensitivity (Figure 8). The very high sensitivity mapped within the study site is linked to the mapped wetlands in the National Wetland Map version 5 (the wider river floodplains associated with the unnamed tributaries of the Orange River located in the eastern and western portions of the wider study area), as mentioned in Section 4.2.5 and shown in Figure 3. The proposed project components should avoid the areas indicated as being of very high sensitivity such that they are only located in areas of low sensitivity.

The Aquatic Biodiversity Combined Sensitivity follows in the sub-sections.

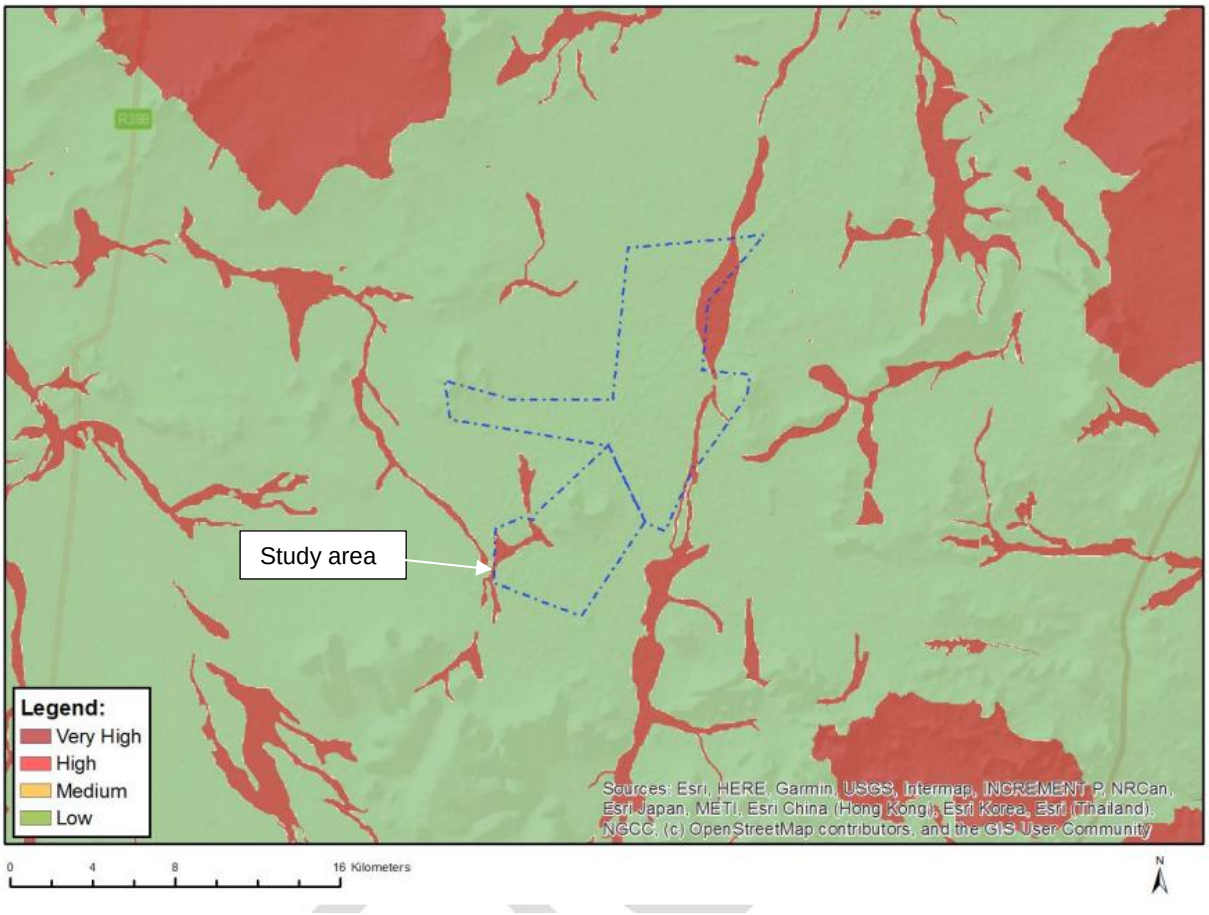


Figure 8. DFFE Screening Tool map of the study area and surrounding area for the mapped Aquatic Biodiversity Combined Sensitivity.

The wider floodplain of an unnamed tributary of the Orange River that crosses the site of Kudu Solar Facility 4 and its associated infrastructure and is included in the NWM5, has been mapped as very high Aquatic Biodiversity Combined Sensitivity in the Screening Tool. The remainder of the site is located within areas mapped as being of low Aquatic Biodiversity Combined Sensitivity in the Screening Tool. It is recommended that the proposed project activities be located outside of the floodplain area such that they only take place within the areas of the site mapped as being of low sensitivity. Note that all aquatic areas recommended for avoidance have been avoided in the EIA phase layout identification.

4.4.2 Specialist Sensitivity Analysis and Verification

The aquatic constraints of the wider study area, in terms of their aquatic ecosystem sensitivities, are shown below in Figure 9 and in more detail in Figure 10. The larger watercourses and associated floodplains, as well as wetland areas within the study area, are deemed to be of **medium aquatic ecological sensitivity**. The smaller watercourses and drainage lines that should not pose an aquatic ecosystem constraint to the proposed are considered to be of **low aquatic ecological sensitivity**.

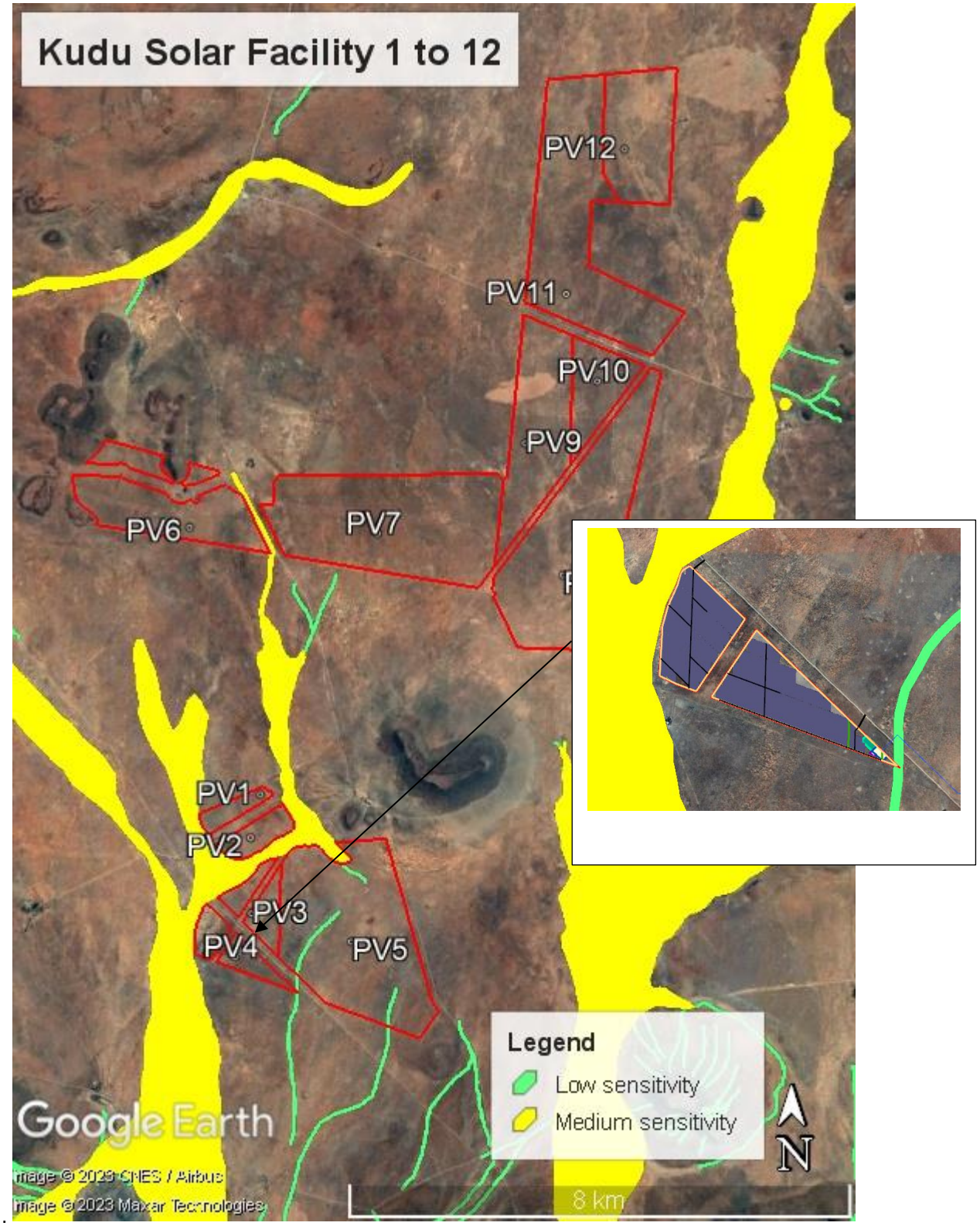


Figure 9. Google Earth image showing the mapped aquatic sensitivities for the proposed projects. This report is focused on Kudu Solar Facility 4 shown in the insert which can be seen in greater detail in Figure 10.

Based on the present ecological condition (largely natural to moderately modified) and ecological importance and sensitivity, as well as the recommended ecological condition of the watercourses (largely natural to moderately modified), buffers have been recommended to protect these ecosystems. The recommended buffer area between the aquatic features and the project components to ensure these aquatic ecosystems are not impacted by the proposed activities is as follows:

- The larger tributary: the delineated edge of the surrounding floodplain wetland features (assigned as medium sensitivity). No buffer area is deemed to be required considering that the floodplain is a wide transitional area between the tributary and the surrounding terrestrial areas; and
- Smaller streams and drainage features that are indicated to be of medium sensitivity: at least 35 m for the watercourse or the delineated edge of wetland features to allow for the movement of water along these streams.
- The Battery Energy Storage System (BESS) should preferably not be placed within 100 m of major rivers, watercourses and wetlands.
- Pans: One pan was found within the study area on Remaining Extent of the farm Wolve Kuilen No. 42. A 50 m buffer around this pan has been recommended. It does not intersect with the development footprint.

Note that the features that have been allocated a low sensitivity (dams and minor drainage features) do not need to be avoided by the proposed development. These aquatic features are primarily of an artificial nature or do not contain any significant aquatic ecosystem habitat and functionality.

The aquatic ecosystem sensitivity (medium for the unnamed tributaries of the Orange River and their floodplains and low for the smaller feeder streams, drainage lines and dams) with aquatic constraints as discussed in the previous section is shown and discussed in more detail below.

The wider floodplain of an unnamed tributary of the Orange River that crosses the study area in the vicinity of Kudu Solar Facility 4 is considered to be of medium aquatic ecosystem sensitivity. The proposed project activities will be located outside of this floodplain area in the Proposed Development Footprint for Kudu Solar Facility 4. Some access roads do cross water courses for the entire project, which would be acceptable provided the recommended mitigation is implemented. For road crossings, the sensitivities are not regarded as no-go. The external powerline will need to cross aquatic features but can be adequately mitigated to have a very low to negligible aquatic ecosystem impact (note that this will be subjected to a separate assessment, as part of Projects 13 to 26).

Therefore, the development footprint of Kudu Solar Facility 4 is deemed to be low sensitivity from an aquatic biodiversity perspective. However, there are medium and low sensitivity areas within the wider study area (preferred site).

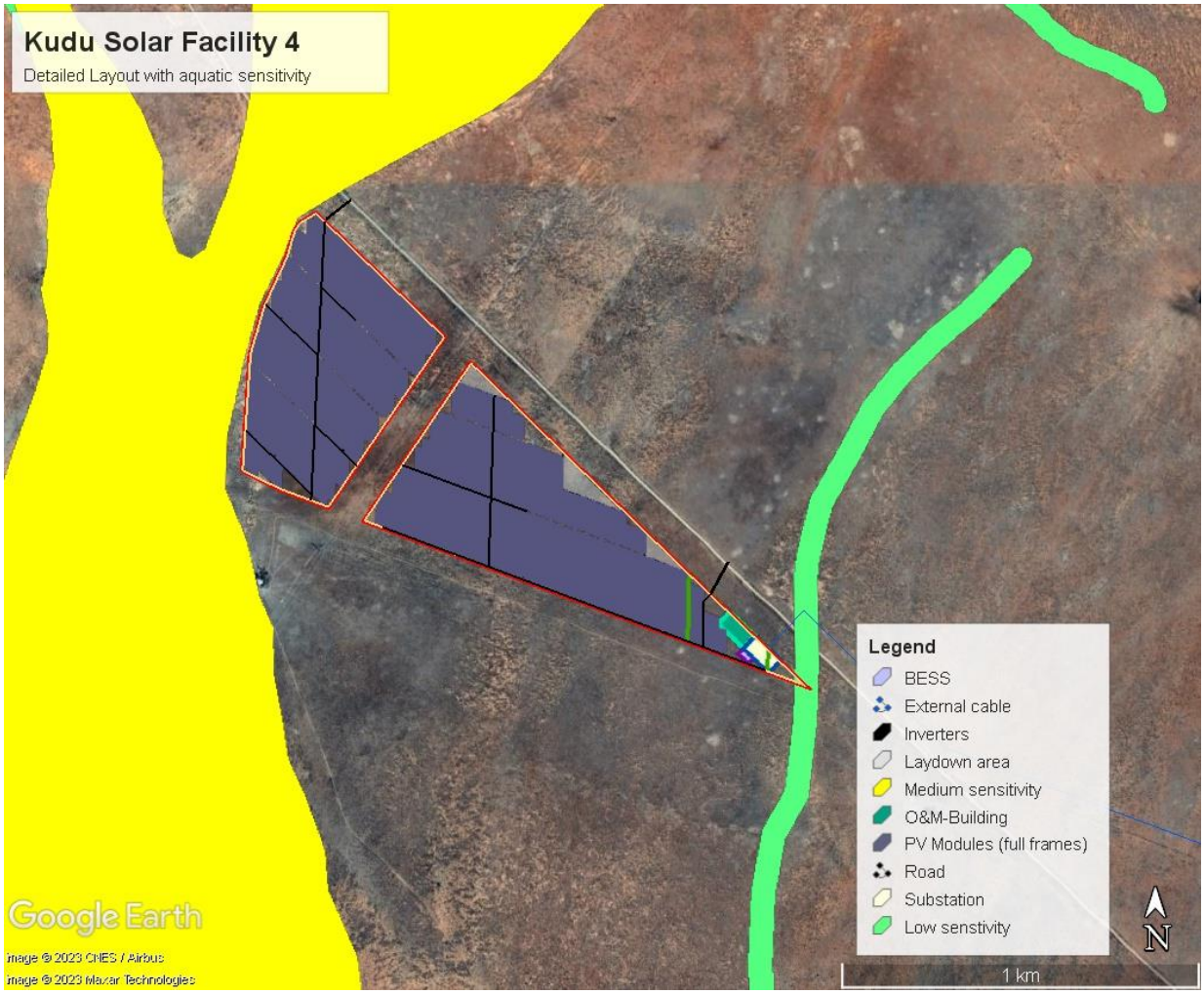


Figure 10. Proposed Development Footprint for Kudu Solar Facility 4 shown together with the sensitivities of the mapped aquatic features. The green outlined area is the on-site substation complex, which has also been assessed in this study. The external cable shown above is the subject of separate assessments (i.e. EGI Projects 13 to 26).

4.4.3 Sensitivity Analysis Summary Statement

The deemed sensitivity for the larger unnamed tributaries of the Orange River and their floodplains is medium while the smaller feeder streams, drainage lines and dams are deemed to be low. The site sensitivity verification report is included in Appendix C.

5 Alternative Development Footprints

The Aquatic Biodiversity Protocol (GN 320) states that the assessment must identify alternative development footprints within the preferred site which would be of a low sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate. The protocol further states that motivation must be provided if there were any development footprints identified as per the latter that were identified as having “low” aquatic biodiversity sensitivity and that was not considered appropriate. The proposed development footprint within the preferred development site (i.e. study area) has been amended through the project assessment process to ensure that it will be within aquatic ecosystem

areas of “low” sensitivity as identified by the screening tool and verified through the initial Site Sensitivity Verification and is thus considered appropriate areas for development. There are no development footprints identified that are not considered appropriate.

Furthermore, as indicated in Chapter 5 of the EIA Report, no other site alternatives were considered as the site was deemed feasible based on various site suitability factors. Therefore, no other alternative development footprints of low sensitivity were identified and not considered appropriate for this study.

6 Issues, Risks and Impacts

6.1 Identification of Potential Impacts/Risks

The issues, risks and impacts discussed in this section would apply to those sites where aquatic features were delineated and have been discussed in the previous sections of this report.

There are medium and low sensitivity areas within the wider study area (preferred site), and the development footprint avoids these. Therefore, based on this and from a best environmental practice perspective, it is considered important to still discuss and rate the potential impacts in the next section.

Most of the potential aquatic ecosystem impacts of the proposed activities are likely to take place during the construction phase. These potential impacts and the associated issues identified include:

- The direct disturbance of aquatic habitats within the watercourses with the associated impacts on sensitive aquatic biota. Construction activities within watercourses could result in the disturbance or destruction of sensitive habitats and any listed and or protected plant or animal species. If the construction activities are outside of any aquatic habitats and the recommended buffers, they would be unlikely to modify aquatic habitats and impact biota to such an extent that the present or future desired state of the watercourses would be compromised. No Resource Quality Objectives exist for the watercourses concerned; however, the proposed activities are unlikely to prevent these objectives from being met.

- The direct removal of indigenous riparian and instream vegetation will indirectly reduce the ecological integrity and functionality of the watercourses. Construction works, in particular, could result in the direct loss of riparian vegetation that provides ecosystem services within the site. This would occur especially when new access roads are required or road upgrades will widen any current road crossings. The impact would only be very localised at the proposed road crossings and would not impact the wider river reaches of the watercourses. With rehabilitation, this impact could be reduced to a negligible level.

- Demand for water for construction could indirectly place stress on the existing available water resources. During construction, more water is required than during the operation phase to suppress dust and use in concrete batching. This water would be required for a 1–2-year period while construction works are ongoing. Water could be sourced from 1) the Local Municipality (most likely either trucked in or otherwise made available for collection at the Water Treatment Plant via a metered standpipe); 2) a third-party water supplier which may include private services company; 3) existing boreholes on site (based on the findings of the Geohydrological Assessment and relevant registration or licence requirements); or 4) new boreholes drilled on site, which will be subject to complete and separate geohydrological testing and applicable licencing. Given the limited water availability in the area, it is advised that water be obtained off-site for construction. However, the groundwater specialist on the EIA team has indicated that sufficient

groundwater exists for associated water use. Refer to the Geohydrology Assessment in Chapter 16 of this EIA Report.

- Indirect alien vegetation infestation within the aquatic features due to disturbance. The current presence of alien vegetation on the site is limited. Sources of alien seed should be prevented from being brought onto the site with imported materials. Monitoring during construction and post-construction for the growth of alien vegetation can mitigate this potential impact.

- Indirect increased sedimentation and risks of contamination of surface water runoff during construction. During construction, the earthworks near watercourses will expose and mobilise soil as well as construction materials and chemicals that may indirectly end up in the water resources. Any spills during transport or while works are conducted in proximity to a watercourse also have the potential to indirectly affect the surrounding biota. Given the low rainfall in the area, if work is undertaken during the drier periods of the year, this impact would be unlikely.

During the operational phase, potential impacts would include:

- The direct ongoing disturbance of aquatic features and associated vegetation along access roads or adjacent to infrastructure that needs to be maintained. As for the disturbance of aquatic features described under construction impacts, the direct disturbance of aquatic habitat is unlikely if the activities are located outside the mapped aquatic features and the recommended buffers.

- Modified runoff characteristics from hardened surfaces have the indirect potential to result in the erosion of watercourses. Limited hardening of surfaces will take place as a result of the proposed projects that may concentrate and convey runoff with its associated erosion.

- Any structures within the watercourses associated with the proposed project must not indirectly impede flow in the watercourses. Given the episodic flow in the watercourses, the structures at the road crossings should consist of low water crossings that will not impede water or sediment movement.

- Water supply (and possibly sanitation services) may be required for the operation phase. The various water supply options are indicated above. The water could potentially be provided from groundwater without any aquatic ecosystem impacts as the groundwater specialist has indicated there is sufficient groundwater available for use in the project. Refer to the Geohydrology Assessment in Chapter 16 of this EIA Report. However, new boreholes should not be sited within or immediately adjacent to watercourses where they would potentially be indirectly impacting the subsurface flow in the watercourses. The baseflow in the watercourse is important in maintaining aquatic vegetation and some aquatic biota. The larger flows in the watercourses are unlikely to be impacted by the proposed project.

During the decommissioning phase, potential impacts would include:

- The direct disturbance of aquatic habitats within the watercourses with the associated impacts on sensitive aquatic biota. Decommissioning activities within watercourses could result in the disturbance or destruction of sensitive habitats and any listed and or protected plant or animal species and indirectly reduce the ecological integrity and functionality of the watercourses. The impact would only be very localised at the road crossings and would not impact the wider river reaches of the watercourses. With rehabilitation, this impact could be reduced to a negligible level.

- Indirect alien vegetation infestation within the aquatic features due to disturbance. The current presence of alien vegetation on the site is limited. Sources of alien seed should be prevented from being brought onto the site with imported materials. Monitoring the post-decommissioning phase for the growth of alien vegetation can mitigate this potential impact.

- Indirect increased sedimentation and risks of contamination of surface water runoff during decommissioning. Works near watercourses will expose and mobilise soil as well as materials and chemicals that may indirectly end up in the water resources. Any spills during transport or while works are conducted in proximity to a watercourse also have the potential to indirectly affect the surrounding biota. Given the low rainfall in the area, if work is undertaken during the drier periods of the year, this impact would be unlikely.

The cumulative impact of the project activities, together with the existing activities in the area, could have the potential to reduce the integrity of the watercourses if not properly mitigated and managed. By implementing suitable buffers (i.e. wider floodplain for the larger rivers and 35 m for the smaller watercourses) along the watercourses and minimising the works within the river/stream corridors, the impact of the proposed project activities would be low and unlikely to impact the integrity of the aquatic ecosystems from a cumulative perspective.

6.2 Summary of Issues Identified during the Public Consultation Phase

During the scoping phase consultation process, the following comments were received that relate to aquatic biodiversity. These comments related more to the faunal specialist assessment but are responded to below in terms of relevance to aquatic ecosystems.

Table 3. Comments Received from Stakeholders during the Public Consultation Phase

Comment	Commenter	Response
Giant bullfrogs were found in De Aar area in pans after the recent rains. Most of the injuries and mortalities to this species occur from collisions with vehicles when moving between their breeding sites (pans) and their burrows. Their burrows can range from 200m to 1km from the pans and they are capable of estivating underground for 7 years. Herbicide and pesticide use should also be restricted near the sites (Yetman, undated).	Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform: Environmental Research and Development (ERD)	Response from the herpetologist on the ecology team: Firstly, *Pyxicephalus adspersus* (Giant Bullfrog, hereafter GB) is not considered to be a species of conservation concern as it has been evaluated as Least Concern (see: http://speciesstatus.sanbi.org/assessment/last-assessment/1533/). Secondly, this species has not been previously recorded on the quarter-degree grid cells (3024AD, 3024AB) which are overlapped by the project area, so it is not common in the area. However, it is still considered moderately likely that this species could occur across the project area. Because the pans and watercourses were already delineated and excluded from development infrastructure, it is only considered necessary to provide additional mitigation for this species if it is being impacted by vehicles operating in the PV area. This will require an ECO to record all incidences of GB roadkills in a spatial database to allow evaluation of hotspots of activity and migration corridors. Should this occur, mitigation will need to be applied to these areas through the creation of "frog underpasses" in combination with drift fences allowing migration to occur while continuing the safe operation of vehicles in the project area. It is, however, good practice to ensure that the majority of construction activity takes place during the dry winter months when frogs are inactive to limit the potential for roadkill (temporal avoidance). The pans are currently buffered by 50 m. The large floodplains are not buffered as the aquatic specialist noted no buffer is needed; and the smaller watercourses are buffered by 35 m. A 50 m buffer around pans is considered sufficient for GBs to breed successfully. Note that the raised

Comment	Commenter	Response
		solar panels will still allow for foraging options and migration to and from the breeding pans by this species, so this habitat is not considered completely removed from utilisation by GBs. New roads developed for the proposed project that will be regularly travelled/patrolled should ideally be placed >100 m from a pan and should be regularly inspected by an ECO to assess road kills. Note that only one pan was found within the study area on the Remaining Extent of the farm Wolve Kuilen No. 42. A 50 m buffer around this pan has been recommended. It does not intersect with the development footprint. Although a 50 m Aquatic buffer is applied to the pan, the development is more than 50 m from the pan identified. It is specifically more than 2 km away from the development footprints.

Comments were also received on the availability of groundwater. The project geohydrologist has responded to these comments in the relevant Geohydrology Assessment in Chapter 16 of this EIA Report. From an aquatic ecology perspective, this specialist is in agreement with the responses. In particular, the following points with regard to groundwater have been included in this assessment:

- *The GA for groundwater use in Quaternary Catchments D33B and D62F, where the proposed project study area is located, is limited to 45 m3/ha/a for the property extent where the abstraction is proposed. Should more than this be required for the proposed project, an integrated water use licence application would be required for the associated project.*
- *The water table typically occurs at depths of about 9.5 m below ground level, and the yield of the aquifer is less than 2 litres a second.*
- *The estimated groundwater recharge in the area is 12.2 mm/a. The aquifer is of low susceptibility and vulnerability.*

The demand for water during the construction phase could place pressure on the existing available water resources. This impact is assessed in the section below.

Minor comments related to aquatic biodiversity impacts associated with the proposed project were raised by Interested and Affected Parties during the review period of the Draft EIA Report. These comments mainly related to chemical pollution of grazing land; and recommendations around water use licence applications and general authorisations. Responses have been provided in Appendix H.7 of the Final EIA Report.

7 Impact Assessment

The impacts have been assessed according to the methodology captured in Appendix D of this chapter.

The potential aquatic biodiversity impacts of the proposed activities are likely to be low in terms of any potential impact on aquatic habitat, biota, water quality, or flow for all phases of the proposed development.

7.1 Potential Impacts during the Construction Phase

The main types of impacts are degradation of the ecological condition of aquatic ecosystems and water quality impacts during the construction phase. These impacts are detailed further and expanded on below.

7.1.1 Direct Impact 1: Disturbance of aquatic habitat and impact to aquatic biota:

Construction of the solar facility and associated infrastructure will require some disturbance of the surface area and removal of vegetation cover for clearing and preparation of the various project component footprints. This impact is rated as negative, with a site-specific spatial extent, short-term duration, high reversibility and low irreplaceability. The impact is rated with a slight consequence and unlikely probability, resulting in a very low impact significance without the implementation of mitigation measures. Should the proposed activities be setback from the aquatic features according to the recommendation in Section 4 of this report (i.e. the recommended buffer of at least 35 m for the smaller drainage features; and setback from the wider floodplain adjacent to the larger rivers), the potential impact would also be of very low significance.

7.1.2 Direct Impact 2: Removal of indigenous aquatic vegetation and associated loss of aquatic ecological integrity and functionality:

As indicated above, the removal of indigenous riparian and instream vegetation will reduce the ecological integrity and functionality of the watercourses. Construction works could result in the loss of riparian vegetation that provides ecosystem services within the site, especially where new access roads are required, or road upgrades will widen any current road crossings. This impact is rated as negative, with a site-specific spatial extent, medium-term duration, high reversibility and low irreplaceability. The impact is rated with a slight consequence and very unlikely probability, resulting in a very low impact significance without the implementation of mitigation measures. Recommended mitigation measures include the implementation of the recommended development setbacks to minimise works within aquatic ecosystems, as well as clearing of indigenous vegetation, which should not take place within the aquatic features and the recommended buffers, and rehabilitating disturbed aquatic habitats by revegetating with suitable local indigenous vegetation. With the implementation of mitigation measures, the impact significance would also be rated as very low.

7.1.3 Direct Impact 3: Water supply for construction and stress on available water resources

As indicated above, the demand for water during the construction phase could place pressure on the existing available water resources. This impact is rated as negative, with a local spatial extent, long-term duration, moderate reversibility, and moderate irreplaceability. The impact is rated with a moderate consequence and extremely unlikely probability, resulting in a very low impact significance without the implementation of mitigation measures. The recommended mitigation measures include minimising water use for construction as much as possible, and that the water should be obtained from an existing water allocation or other viable water sources for construction purposes. With the implementation of mitigation measures, the impact significance would also be rated as very low.

7.1.4 Direct Impact 4: Road crossing structures may impede flow in the aquatic features

Loss of riparian vegetation that provides ecosystem services within the site and impeding of flow in the aquatic features would occur especially where new access roads are required, or road upgrades will widen any current road crossings. As noted above, the impact would only be very localised at the proposed road crossings and would not impact the wider river reaches of the watercourses. This impact is rated as negative, with a site-specific spatial extent, long-term duration, high reversibility, and low irreplaceability. The impact is rated with a slight consequence and unlikely probability, resulting in a very low impact significance without the implementation of mitigation measures. The recommended mitigation measures include designing the road crossing structures in a manner that does not impede flow in watercourses, with low water crossings being preferred. In addition, making use of existing crossings is also recommended, as best as possible and

where allowable. The existing road infrastructure, particularly within the floodplain, should be utilised as far as possible to access new infrastructure to minimise the overall disturbance. It is recommended that any new linear type of infrastructure crossings over watercourses be placed where there are existing structures or road crossings within the watercourse corridors, where possible. With the implementation of mitigation measures, the impact significance would also be rated as very low.

7.1.5 Direct Impact 5: Alien vegetation infestation within the aquatic features due to disturbance

This potential impact deals with alien vegetation infestation within the aquatic features due to disturbance. The current presence of alien vegetation on the site is limited. This impact is rated as negative, with a site-specific spatial extent, medium or long-term duration, high reversibility, and low irreplaceability. The impact is rated with a moderate consequence and unlikely probability, resulting in a low impact significance without the implementation of mitigation measures. The recommended mitigation measures include:

- Avoid disturbing aquatic habitats;
- Construction materials brought onto the site should be free of alien plant seeds. Sources of alien seed should be prevented from being brought onto the site with imported materials;
- Rehabilitate disturbed aquatic habitats once construction works are complete; and
- Undertake monitoring for the growth of alien vegetation during the construction and post-construction phases.

With the implementation of mitigation measures, the impact significance would be rated as very low.

7.1.6 Direct Impact 6: Increased sedimentation and contamination of surface water runoff from construction activities

This potential impact deals with increased sedimentation and risks of contamination of surface water runoff during the construction phase as discussed in Section 5.1. Concrete foundations will need to be constructed. A construction camp with a temporary laydown area and the concrete batching plant would likely need to be placed within the site for the construction works. There is thus also the potential for some water quality impacts associated with the batching of concrete, from hydrocarbon spills or associated with the other construction activities on the site. This impact is rated as negative, with a site-specific spatial extent, short-term duration, high reversibility, and low irreplaceability. The impact is rated with a slight consequence and likely to unlikely probability, resulting in a very low impact significance without the implementation of mitigation measures. The recommended mitigation measures include:

- Any works within aquatic features should be undertaken in the dry season where possible;
- Sediment traps should be used where necessary;
- Construction sites and laydown areas should be located within the assessed buildable areas/development footprints; and
- Good housekeeping and site management measures must be implemented at the laydown areas and the construction site as per the project Environmental Management Programme (EMPr) and monitored by the appointed Environmental Control Officer (ECO). This should specifically address on-site stormwater management and prevention of pollution during construction. Any stormwater that does arise within the construction sites must be handled appropriately to trap sediments and pollutants.

With the implementation of mitigation measures, the impact significance would be rated as very low.

7.1.7 Impact Summary Tables: Construction Phase

The summary impact table for the potential aquatic ecosystem impacts discussed above is provided on the following pages.

Table 4. Impact table for the potential aquatic biodiversity impacts of the project during the construction phase

Impact	Impact Criteria		Significance Ranking (Pre-Mitigation)	Potential mitigation measures	Significance Ranking (Post-Mitigation)	Confidence Level
Disturbance of aquatic habitat and the associated impact on sensitive aquatic biota	Status	Negative	Very low (5)	▪ Implement recommended development setbacks to minimise works within medium sensitivity aquatic ecosystems (i.e. recommended buffer of at least 35 m for the smaller drainage features; and setback from the wider floodplain adjacent to the larger rivers)	Very low (5)	High
	Spatial Extent	Site-specific				
	Duration	Short term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	High				
	Irreplaceability	Low				
Removal of indigenous aquatic vegetation and associated loss of aquatic ecological integrity and functionality	Status	Negative	Very low (5)	▪ Implement development setbacks to minimise works within aquatic ecosystems (i.e. recommended buffer of at least 35 m for the smaller drainage features; and setback from the wider floodplain adjacent to the larger rivers). ▪ Clearing of indigenous vegetation should not take place within the aquatic features and the recommended buffers. ▪ Rehabilitate disturbed aquatic habitats by revegetating them with suitable local indigenous vegetation.	Very low (5)	High
	Spatial Extent	Site-specific				
	Duration	Medium-term				
	Consequence	Slight				
	Probability	Very Unlikely				
	Reversibility	High				
	Irreplaceability	Low				
Water supply for construction and the associated stress on available water resources	Status	Negative	Very low (5)	▪ Water use for construction should be minimised as much as possible. The water should be obtained from an existing water allocation or other viable water sources for construction purposes.	Very low (5)	High
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Extremely Unlikely				
	Reversibility	Moderate				
	Irreplaceability	Moderate				
Road crossing structures may impede flow in the aquatic features	Status	Negative	Very low (5)	▪ The road crossing structures should be designed to not impede flow in watercourses - low water crossing is preferred. Use existing crossings, as best as possible and where allowable.	Very low (5)	High
	Spatial Extent	Site specific				
	Duration	Long term				
	Consequence	Slight				

Impact	Impact Criteria		Significance Ranking (Pre-Mitigation)	Potential mitigation measures	Significance Ranking (Post-Mitigation)	Confidence Level
	Probability	Unlikely		▪ The existing road infrastructure, particularly within the floodplain, should be utilised as far as possible to access new infrastructure to minimise the overall disturbance. It is recommended that any new linear type of infrastructure crossings over watercourses be placed where there are existing structures or road crossings within the watercourse corridors, where possible.		
	Reversibility	High				
	Irreplaceability	Low				
Alien vegetation infestation may occur within the aquatic features due to disturbance	Status	Negative	Low (4)	▪ Avoid disturbing aquatic habitats as far as possible. ▪ Construction materials brought onto the site should be free of alien plant seeds. Sources of alien seed should be prevented from being brought onto the site with imported materials. ▪ Rehabilitate disturbed aquatic habitats once construction works are complete. ▪ Undertake monitoring for the growth of alien vegetation during the construction and post-construction phases.	Very low (5)	High
	Spatial Extent	Site specific				
	Duration	Medium or long term				
	Consequence	Moderate				
	Probability	Unlikely				
	Reversibility	High				
	Irreplaceability	Low				
Increased sedimentation and risks of contamination of surface water runoff may result from construction works	Status	Negative	Very low (5)	▪ Any work within aquatic features should be undertaken in the dry season where possible. ▪ Sediment traps should be used where necessary. ▪ Construction sites and laydown areas should be located within the assessed buildable areas/development footprints. ▪ Good housekeeping and site management measures must be implemented at the laydown areas and the construction site as per the project Environmental Management Programme (EMPr) and monitored by the appointed Environmental Control Officer (ECO).	Very low (5)	High
	Spatial Extent	Site specific				
	Duration	Short term				
	Consequence	Slight				
	Probability	Likely to Unlikely				
	Reversibility	High				
	Irreplaceability	Low				

7.2 Potential Impacts during the Operational Phase

The main impacts during the operational phase include degradation of the ecological condition of aquatic ecosystems; modification of flow and water quality; erosion; and alien vegetation invasion in aquatic features. These are discussed in detail below.

During the operation phase, the solar arrays will operate largely unattended and with low maintenance required for more than 20 years. The hard surfaces created by the development may lead to increased runoff, in particular on surfaces with a steeper gradient. This may lead to increased erosion and sedimentation of the downslope areas. A localised long-term impact (more than 20 years) of low intensity could be expected that would have a very low overall significance post-mitigation in terms of its impact on the identified aquatic ecosystems in the area. The only potentially toxic or hazardous materials which would be present in relatively small amounts would be lubricating oils and hydraulic and insulating fluids. Therefore, contamination of surface or groundwater or soils is highly unlikely.

7.2.1 Direct Impact: Ongoing disturbance of aquatic features and associated vegetation along access roads or adjacent to the infrastructure that needs to be maintained.

This impact relates to the ongoing disturbance of aquatic features and associated vegetation along access roads or adjacent to the infrastructure that needs to be maintained. However, the disturbance of aquatic habitat is unlikely if the activities are located outside the mapped aquatic features and the recommended buffers. The impact may also result in the indirect impact of the invasion of the disturbed aquatic habitats with alien vegetation and an increased potential for erosion within the disturbed areas that reduces the ecological integrity of the associated aquatic ecosystems. This impact is rated as negative, with a site-specific spatial extent, long-term duration, moderate reversibility, and low irreplaceability. The impact is rated with a slight to moderate consequence and likely to unlikely probability, resulting in a low to very low impact significance without the implementation of mitigation measures. The recommended mitigation measures include avoiding the medium-sensitivity aquatic habitats in the layout design, with only low-sensitivity habitats being disturbed during construction and operations. Monitoring and removal of invasive alien vegetation and signs of erosion within the disturbed areas is also recommended. Disturbance of these habitats would only result in a negligible alteration to aquatic ecosystems and processes. With the implementation of mitigation measures, the impact significance would be rated as very low.

7.2.2 Direct Impact: Modified runoff characteristics from hardened surfaces has the potential to result in erosion of adjacent watercourses.

This impact relates to the modified runoff characteristics from hardened surfaces, such as at the substation and along access roads, which has the potential to result in the erosion of nearby watercourses. Limited hardening of surfaces will take place that may concentrate and convey runoff with its associated erosion. This impact is rated as negative, with a site-specific spatial extent, long-term duration, moderate reversibility, and low irreplaceability. The impact is rated with a slight consequence and unlikely probability, resulting in a very low impact significance without the implementation of mitigation measures. The recommended mitigation measures include developing a stormwater management plan for the proposed development that addresses the stormwater runoff from the developed areas. Furthermore, stormwater run-off infrastructure must be designed to mitigate both the flow and water quality impacts of any stormwater leaving the developed areas. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate shaping of the road with berms or channels and swales adjacent to hardened surfaces where necessary. Should any erosion features develop, they should be stabilised immediately. With the implementation of mitigation measures, the impact significance would be rated as very low.

7.2.3 Direct Impact: Water supply and water quality impacts (e.g. contamination from sewage) as a result of the operation of the proposed Solar Facility and associated infrastructure.

This impact relates to water supply and water quality impacts (e.g. contamination from sewage) as a result of the operation of the proposed Solar Facility and associated infrastructure. This impact is rated as negative, with a site-specific spatial extent, long-term duration, low reversibility, and low irreplaceability. The impact is rated with a slight consequence and unlikely probability, resulting in a very low impact significance without the implementation of mitigation measures. The recommended mitigation measures include seeking a sustainable water supply, and ensuring that sewage generated at the facility should be discharged to a conservancy tank that is properly serviced and regularly evacuated to nearby wastewater treatment works. With the implementation of mitigation measures, the impact significance would be rated as very low.

The water consumption impact associated with the operation of the proposed PV infrastructure would be negligible as the water requirement during this phase is very low.

7.2.4 Impact Summary Tables: Operation Phase

The summary impact table for the potential aquatic ecosystem impacts discussed above is provided on the following page.

Table 5. Impact table for the potential aquatic biodiversity impacts of the project during the operation phase

Impact	Impact Criteria		Significance Ranking (Pre-Mitigation)	Potential mitigation measures	Significance Ranking (Post-Mitigation)	Confidence Level
Ongoing disturbance of aquatic features and associated vegetation along access roads or adjacent to the infrastructure that needs to be maintained	Status	Negative	Low to very low (4-5)	▪ The medium-sensitivity aquatic habitats should be avoided in the layout design, with only low-sensitivity habitats being disturbed during construction. ▪ Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants. ▪ Should any disturbance of aquatic habitats occur that is not associated with an improvement of the ecological condition, the habitat should be rehabilitated immediately following the disturbance activity by returning the habitat to the condition prior to that disturbance.	Very low (5)	High
	Spatial Extent	Site specific				
	Duration	Long term				
	Consequence	Slight to moderate				
	Probability	Likely to Unlikely				
	Reversibility	Moderate				
	Irreplaceability	Low				
Modified runoff characteristics from hardened surfaces at the substation and along access roads has the potential to result in erosion of adjacent watercourses	Status	Negative	Very low (5)	▪ Develop a stormwater management plan for the proposed development that addresses the stormwater runoff from the developed areas. ▪ Stormwater run-off infrastructure must be designed to mitigate both the flow and water quality impacts of any stormwater leaving the developed areas. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate shaping of the road with berms or channels and swales adjacent to hardened surfaces where necessary. Should any erosion features develop, they should be stabilised immediately.	Very low (5)	High
	Spatial Extent	Site specific				
	Duration	Long term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	Moderate				
	Irreplaceability	Low				
Water supply and water quality impacts (e.g. contamination from sewage) as a result of the operation of the site	Status	Negative	Very low (5)	▪ A sustainable water supply should be sought. ▪ Sewage generated within the site should be discharged to a conservancy tank that is properly serviced and regularly evacuated to nearby wastewater treatment works.	Very low (5)	High
	Spatial Extent	Site specific				
	Duration	Long term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	Low				
	Irreplaceability	Low				

7.3 Potential Impacts during the Decommissioning Phase

The main impacts include degradation of the ecological condition of aquatic ecosystems; modification of flow and water quality; erosion; and alien vegetation invasion in aquatic features. These are discussed below in detail.

7.3.1 Direct Impact: Increased disturbance of aquatic habitat due to the increased activity on the site:

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. This specific potential impact relates to increased disturbance of aquatic habitat due to the increased activity on the site. This impact is rated as negative, with a site-specific spatial extent, short-term duration, high reversibility, and low irreplaceability. The impact is rated with a slight consequence and unlikely probability, resulting in a very low impact significance without the implementation of mitigation measures. The recommended mitigation measures include minimising works within aquatic ecosystems (if the project layout avoided these areas, the decommissioning activities would also be able to avoid aquatic habitats within the study area); and ensuring that disturbed areas are rehabilitated and re-vegetated where required. Mitigation and follow-up monitoring of residual impacts (alien vegetation growth and erosion) may be required. The road network should be returned to that resembling pre-construction, with all additional roads removed where possible. With the implementation of mitigation measures, the impact significance would be rated as very low.

7.3.2 Direct Impact: Increased sedimentation and risks of contamination of surface water runoff:

This specific potential impact relates to increased sedimentation and risks of contamination of surface water runoff. This impact is rated as negative, with a site-specific spatial extent, short-term duration, high reversibility, and low irreplaceability. The impact is rated with a slight consequence and unlikely probability, resulting in a very low impact significance without the implementation of mitigation measures. The recommended mitigation measures include:

- Decommissioning activities within aquatic features should be undertaken in the dry season, where possible;
- Sediment traps should be used where necessary;
- Laydown areas should be placed within the approved PV footprint and layout; and
- Good housekeeping and site management measures should be implemented as per the project EMPr and monitored by the appointed ECO. This should specifically address on-site stormwater management and prevention of pollution during decommissioning. Any stormwater that does arise within the decommissioning site must be handled appropriately to trap sediments and pollutants.

With the implementation of mitigation measures, the impact significance would be rated as very low.

7.3.3 Impact Summary Tables: Decommissioning Phase

The summary impact table for the potential aquatic ecosystem impacts discussed above is provided on the following pages.

Table 6. Impact table for the potential aquatic biodiversity impacts of the project during the decommissioning phase

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
Increased disturbance of aquatic habitat due to the increased activity on the site	Status	Negative	Very low (5)	▪ Minimise works within aquatic ecosystems. If the project layout avoided these areas, the decommissioning works would also be able to avoid aquatic habitats as delineated. Note that all aquatic areas recommended for avoidance have been avoided in the EIA phase layout identification. ▪ Rehabilitate and revegetate disturbed areas, where required. ▪ Mitigation and follow-up monitoring of residual impacts (alien vegetation growth and erosion) may be required. ▪ The road network should be returned to that resembling pre-construction, with all additional roads removed where possible.	Very low (5)	High
	Spatial Extent	Site specific				
	Duration	Short term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	High				
	Irreplaceability	Low				
Increased sedimentation and risks of contamination of surface water runoff	Status	Negative	Very low (5)	▪ Decommissioning activities within aquatic features should be undertaken in the dry season where possible. ▪ Sediment traps should be used where necessary. ▪ Laydown areas should be placed within the approved PV footprint and layout. ▪ Good housekeeping measures should be implemented as per the project EMPr and monitored by the appointed ECO. This should specifically address on-site stormwater management and prevention of pollution during decommissioning. Any stormwater that does arise within the decommissioning site must be handled appropriately to trap sediments and pollutants.	Very low (5)	High
	Spatial Extent	Site specific				
	Duration	Short term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	High				
	Irreplaceability	Low				

7.4 Cumulative Impacts

7.4.1 Direct Impact: Increased disturbance and degradation of aquatic habitat:

Land use in the area currently consists of low-density livestock farming. Current land and water use impacts on the aquatic features within the larger study area are therefore low to very low significance. The nature of the proposed PV project allows it to have minimal impact on the surface water features, provided the project elements are placed far enough away from the freshwater features to not impact them significantly, as has been recommended. If the proposed project also makes use of existing disturbed areas such as roads, the impacts on the aquatic ecosystems will be further reduced and provides an opportunity to improve the current road infrastructure through the construction of low water crossings or properly sized box culverts instead of pipe culverts that are prone to blocking. ***One could thus expect that the cumulative impact of the proposed project would not be significant provided mitigation measures are implemented.***

During the construction phase and decommissioning phase, the potential cumulative impact of increased disturbance of the aquatic habitat due to the increased activity in the wider area is rated as a negative impact, with a site specific spatial extent, short-term duration, slight consequence, unlikely probability, high reversibility and low irreplaceability. The significance is rated as very low both without and with the implementation of mitigation measures.

The above also applies to the potential cumulative impact of degradation of the ecological condition of aquatic ecosystems during the operational phase.

Mitigation measures are discussed in Table 7 below.

The proposed or approved renewable energy projects and EGI that are within a 30km radius of the proposed projects are shown in Figure 11. The DWS quaternary catchment boundaries (cream lines) are also shown on the image as potential areas of influence in terms of water resources. In terms of renewable energy projects within the same quaternary catchment as this project study area (D33B and D62F), it is only Crossroads PV, Keren PV and Swartwater PV that would potentially impact the surface and groundwater resources. Availability of water is a limiting factor in the further development of this area, however, the water requirements of the project during the operation phase will be low. Surface water is not proposed as a water source for the construction and operational phases, as discussed above and in Chapter 2 of the EIA Report. However, groundwater is proposed as one of the potential water sources (either from existing boreholes or new boreholes). The latter will be subjected to separate assessment processes). The Geohydrology Assessment in Chapter 16 of this EIA Report has sufficiently assessed the impact of the proposed projects on groundwater resources, including the use of groundwater during the relevant project phases.

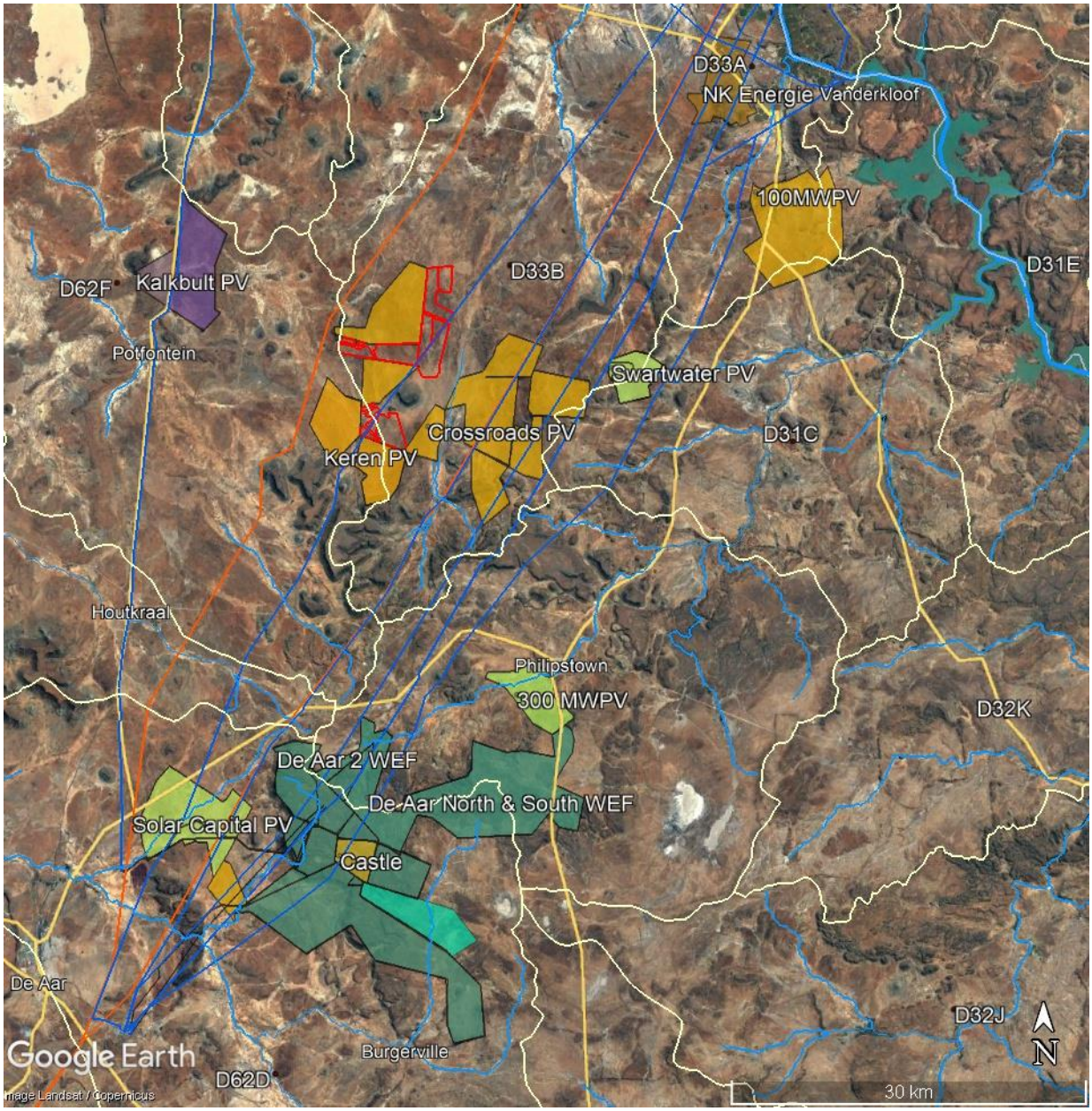


Figure 11. Google Earth image showing the location of the proposed or approved renewable energy projects and EGI within a 30km radius of the current proposed project. The DWS quaternary catchment boundaries (cream lines) are also shown on the image as potential areas of influence in terms of water resources. In terms of renewable energy projects within the same quaternary catchment as this project (D33B and D62F), it is only Crossroads PV, Keren PV and Swartwater PV that would potentially impact the surface and groundwater resources.

7.4.2 Impact Summary Tables: Cumulative Impacts

The summary impact table for the potential aquatic ecosystem impacts discussed above is provided on the following page.

Table 7. Impact table for the potential cumulative aquatic biodiversity impacts of the project during the construction, operation and decommissioning phases

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
CONSTRUCTION PHASE						
Increased disturbance of aquatic habitat due to the increased activity in the wider area	Status	Negative	Very low (5)	▪ Minimise works within aquatic ecosystems as far as possible. Construct in the dry season where possible. ▪ Rehabilitate disturbed areas. ▪ Rationalise infrastructure as far as possible by sharing the infrastructure or using existing disturbed areas. ▪ Manage stormwater impacts.	Very low (5)	High
	Spatial Extent	Site specific				
	Duration	Short term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	High				
	Irreplaceability	Low				
OPERATION PHASE						
Degradation of ecological condition of aquatic ecosystems	Status	Negative	Very low (5)	▪ Monitor and manage for impacts such as alien vegetation growth and erosion. ▪ Limit disturbance and rehabilitate disturbed areas. ▪ Ensure there is sufficient stormwater management to prevent erosion of watercourses. ▪ Ensure road crossing structures are properly designed to prevent blockage in the watercourses or erosion. ▪ Limit and monitor water use.	Very low (5)	High
	Spatial Extent	Site specific				
	Duration	Short term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	High				
	Irreplaceability	Low				
DECOMMISSIONING PHASE						
Increased disturbance of aquatic habitat due to the increased activity in the wider area	Status	Negative	Very low (5)	▪ Decommissioning works near aquatic features should preferably be undertaken in the dry season where possible. ▪ Minimise disturbance and rehabilitate.	Very low (5)	High
	Spatial Extent	Site specific				
	Duration	Short term				
	Consequence	Slight				
	Probability	Unlikely				
	Reversibility	High				
	Irreplaceability	Low				

7.5 Battery Energy Storage System

A Lithium-Ion BESS and Redox Flow BESS were both considered for the proposed project. For Redox Flow BESS, various chemical compositions are likely, such as Vanadium. Refer to Chapter 15 of this EIA Report for a High-Level Safety, Health and Environment Risk Assessment, which provides high-level information on the safety, health and environmental risks of the BESS technologies.

Both BESS technologies have been considered in this assessment. The proposed BESS within the site is not of aquatic ecosystem concern, given that the aquatic ecosystems are avoided and adequately buffered. Either BESS technology would thus be suitable.

7.6 No-Go Option

The watercourses and associated wetlands and floodplains are in a largely natural to moderate condition due to the low level of impact in the area. The no-go option will thus result in no additional impacts on aquatic biodiversity and will result in the ecological status quo being maintained, which will be to the advantage of aquatic systems and biodiversity. However, with that being said, no fatal flaws were discovered in the course of the investigations for the proposed Kudu Solar Facility. The potential aquatic ecosystem impact significance for the proposed activities, with mitigation, is rated as very low.

8 Impact Assessment Summary

This section provides the overall impact significance findings following the implementation of the proposed mitigation measures. These are shown in the table below:

Table 8. Overall Impact Significance (Post Mitigation)

Phase	Overall Impact Significance
Nature of Impact	Negative
Construction	Very low
Operational	Very low
Decommissioning	Very low
Cumulative – Construction	Very low
Cumulative – Operational	Very low
Cumulative – Decommissioning	Very low

9 Legislative and Authorisation Requirements

The main legislation associated with the protection of aquatic ecosystems and water resources over and above the NEMA, is the National Water Act (Act 36 of 1998, as amended) (NWA). The purpose of the NWA is to provide a framework for the equitable allocation and sustainable management of water resources. Both surface and groundwater sources are redefined by the Act as national resources which cannot be owned by any individual and rights which are not automatically coupled to land rights, but for which prospective users must apply for authorisation and register as users. The NWA also provides measures to prevent, control and remedy the pollution of surface and groundwater sources.

The Act aims to regulate the use of water and activities (as defined in Part 4, Section 21 of the NWA), which may impact water resources through the categorisation of ‘listed water uses’ encompassing water

abstraction and flow attenuation within catchments as well as the potential contamination of water resources, where the Department of Water and Sanitation (DWS) is the administering body in this regard. Defined water use activities require approval from DWS in the form of a General Authorisation (GA) or a Water Use Licence (WUL). There are restrictions on the extent and scale of listed activities for which GAs apply. According to the preamble to Part 6 of the NWA, 1998, "*This Part established a procedure to enable a responsible authority, after public consultation, to permit the use of water by publishing general authorisations in the Gazette*…" and further states that "*The use of water under a general authorisation does not require a licence until the general authorisation is revoked, in which case licensing will be necessary*…"

The GAs for Section 21 (c) and (i) water uses (impeding or diverting flow or changing the bed, banks or characteristics of a watercourse) as defined under the NWA were last revised in 2016 (Government Notice R509 of 2016). Determining if a water use licence is required for these water uses is now associated with the risk of degrading the ecological status of a watercourse. A low risk of impact could be authorised in terms of a GA. The risk of the proposed development altering the ecological integrity of the adjacent aquatic ecosystems, if mitigated as recommended, is likely to be low such that the associated water use activities in terms of Section 21 (c) (impeding or diverting flow in a watercourse) or Section 21 (i) (changing the bed, banks, course or characteristics of a watercourse) would fall within the ambit of the GAs. A risk assessment, summarised in Table 9, has been undertaken to inform the Section 21 (c) and (i) water use authorisation process for Kudu Solar Facility 4 and its associated infrastructure.

Table 9. A summary of the risk assessment for the proposed development

Phases	Activity	Aspect	Impact	Significance	Risk Rating
Construction	Construction of PV facilities and the associated infrastructure within the development footprints, taking into account the aquatic constraints as indicated in this report	Accessing site; Limited clearing of vegetation and movement of soil and construction of infrastructure and PV modules	Disturbance of aquatic habitat, runoff and water quality impacts	52.25	L
Operation	Maintenance of the PV facilities and associated infrastructure	Disturbance associated with maintenance works; altered stormwater runoff at the site		33	L
Decommissioning	Removal of PV facilities and associated infrastructure and rehabilitation of the site	Disturbance associated with decommissioning and rehabilitation works		33	L

The GA for groundwater use in Quaternary Catchments D33B and D62F, where the proposed project study area is located, is limited to 45 m^3/ha/a for the property extent where the abstraction is proposed. Should more than this be required for the proposed project, an integrated water use licence application would be required for the associated project. Various assessments of the current groundwater use and sustainability of the proposed groundwater use would need to be undertaken in support of such an application. Refer to the Geohydrology Assessment in Chapter 16 of this EIA Report for additional information in this regard.

The disposal of sewage from the developed site is likely to be stored in conservancy tanks for removal and treatment at the nearby wastewater treatment works of the local authority. This low volume would be within the GA for Section 21 (g) water use activities.

10 Environmental Management Programme Inputs

The following mitigation measures and impact management actions are recommended to minimise the potential impacts of the proposed activities on the aquatic features within the site. These measures should be addressed in the EMPr for the Construction and Operation Phases of the proposed project.

Table 10. Environmental Management Program Recommendations

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
DESIGN PHASE					
FRESHWATER ECOLOGY IMPACTS					
Potential impact on freshwater ecology as a result of the proposed PV and associated infrastructure.	Limit the disturbance of aquatic habitats. Minimise potential to modify flow/hydraulics-related impacts and increase the potential for erosion.	▪ Ensure the final layout of the PV facility and associated infrastructure avoids watercourses and recommended buffers as far as possible; utilisation should be made of existing disturbed areas where possible. The medium-sensitivity aquatic habitats should be avoided in the layout design, with only low-sensitivity habitats being disturbed during construction. Note that this has been achieved in the EIA Phase, whereby the recommended development setbacks (i.e. recommended buffer of at least 35 m for the smaller drainage features; and setback from the wider floodplain adjacent to the larger rivers) have been adopted in the identification of the development footprints. The recommended avoidance areas have been avoided. ▪ Construction sites and laydown areas should be located within the assessed buildable areas/development footprints. ▪ A comprehensive stormwater management plan should be compiled for the compacted surfaces within the site by the project engineer with input from the freshwater specialist. The plan should aim to reduce the intensity of runoff from the developed area, particularly on the steeper slopes and reduce the intensity of the discharge into the adjacent drainage lines. Where necessary measures to dissipate flow intensity or protect erosion should be included in the plan. The plan should encourage infiltration rather than runoff and should prevent the impedance of surface or sub-surface flows. The plan should also mitigate any contaminated runoff from the construction and operation activities from being discharged into any of the aquatic features within the site. ▪ Stormwater run-off infrastructure must be designed to mitigate both the flow and water quality impacts of any stormwater leaving the developed areas. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate shaping of the road with berms or channels and swales adjacent to hardened surfaces where necessary. Should any erosion features develop, they should be stabilised immediately. ▪ Adequate erosion mitigation measures should be incorporated into designs;	Ensure that this is taken into consideration during the planning and design phase.	During the design cycle and before construction commences.	Holder of the EA

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Use existing crossings, as best as possible and where allowable. The existing road infrastructure, particularly within the floodplain, should be utilised as far as possible to access new infrastructure to minimise the overall disturbance. It is recommended that any new linear type of infrastructure crossings over watercourses be placed where there are existing structures or road crossings within the watercourse corridors, where possible. For any new infrastructure placed within the watercourses: The structure should not impede or concentrate the flow in the watercourse, and should prevent blockages and erosion. It is recommended that low-water crossings should be utilised. Any rubble or waste associated with the construction works within the aquatic features should be removed once construction is complete. ▪ A sustainable water supply should be sought. Water consumption requirements for the construction and operation of the proposed project if not obtained from an authorised water user within the area, must be authorised by the DWS. ▪ No liquid waste should be discharged into any of the aquatic features within the site without the approval of the DWS. Wastewater should be properly contained on-site and removed to a licensed wastewater treatment facility that can treat the wastewater.			

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
CONSTRUCTION PHASE					
FRESHWATER ECOLOGY IMPACTS					
Potential impact on freshwater ecology as a result of the proposed PV and associated infrastructure.	Limit the disturbance of aquatic habitats. Limit the potential for contamination/pollution of aquatic ecosystems.	▪ Avoid disturbing aquatic habitats as far as possible. ▪ Minimise works within aquatic ecosystems as far as possible. ▪ For all project-related components within the site, the aquatic features of medium sensitivity should be treated as no-go areas during the construction phase. ▪ Any activities that require construction within the delineated aquatic features and the recommended buffers should be described in method statements that are approved by the Environmental Control Officer (ECO). ▪ Rehabilitation of any disturbed areas within the aquatic features and the recommended buffer areas should be undertaken immediately following completion of the disturbance activity according to rehabilitation measures as included in a method statement for that specific activity as described above. ▪ Invasive alien plant growth should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants. ▪ Any works within aquatic features should be undertaken in the dry season where possible. ▪ Sediment traps should be used where necessary. ▪ Ablution facilities should not be placed within 100m of any of the aquatic features delineated within the site; ▪ Liquid dispensing receptacles (e.g. lubricants, diesel, shutter oil etc.) must have drip trays beneath them/beneath the nozzle fixtures. Material safety data sheets (MSDS) must be available on site (if required) where products are stored so that in the event of an incident, the correct action can be taken. Depending on the types of materials stored on site during the construction activities, suitable product recovery materials must be readily available. Vehicles should ideally be washed at their storage yard as opposed to on site. ▪ Proper waste management should be undertaken within the site with facilities provided for the on site disposal of waste and the removal of stored waste to the nearest registered solid waste disposal facility.	▪ Monitoring that no-go areas and buffer areas are adhered to should be undertaken on an ongoing basis for the duration of the construction phase. ▪ Ongoing monitoring of the implementation of method statements should be undertaken. ▪ Ongoing monitoring of any rehabilitation measures, where required, should be undertaken. ▪ Ongoing monitoring of invasive alien plants within the site should be undertaken according to an approved method statement that makes use of alien clearing methods as provided by the Working for Water Programme and outlined on Resources | Department of Environmental Affairs (dffe.gov.za). Monitoring and control measures should take place at least biannually (every six months) for the construction phase. ▪ Ongoing visual inspections to ensure that no spills or risk of surface water contamination occur. ▪ Ongoing visual inspections to ensure that no sedimentation or solid water from the construction activities occur in adjacent surface water ecosystems.	Ongoing during construction	Proponent/ contractor and ECO

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Clearing of indigenous vegetation should not take place within the aquatic features and the recommended buffers. ▪ Rehabilitate disturbed aquatic habitats once construction works are complete by revegetating them with suitable local indigenous vegetation. ▪ Water use for construction should be minimised as much as possible. The water should be obtained from an existing water allocation or other viable water sources for construction purposes. ▪ Construction materials brought onto the site should be free of alien plant seed. Sources of alien seed should be prevented from being brought onto the site with imported materials. ▪ Good housekeeping and site management measures must be implemented at the laydown areas and the construction site as per the project Environmental Management Programme (EMPr) and monitored by the appointed ECO. ▪ Rationalise infrastructure as far as possible by sharing the infrastructure or using existing disturbed areas. ▪ Manage stormwater impacts.			

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
OPERATION PHASE					
FRESHWATER ECOLOGY IMPACTS					
Potential impact on freshwater ecology as a result of the proposed PV and associated infrastructure.	Limit the disturbance of aquatic habitat; Minimise potential to modify flow/hydraulics-related impacts and increase the potential for erosion; Control of invasive alien plants in riparian zones and wetland areas; Limit the potential for contamination/pollution of aquatic ecosystems	▪ Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants. Ongoing control of invasive alien plants within the site should be undertaken. ▪ Invasive alien plant material that has been cleared should be removed from the riparian zones and not left on the river banks or burnt within the riparian zone and buffer area. ▪ Ongoing monitoring of the road crossing structures, in particular before the rainfall period, should be undertaken to ensure that the integrity of the structures is intact and that they are not blocked with sediment or debris. Ongoing monitoring post large rainfall events should also be undertaken to identify and address any erosion occurring within the watercourses. ▪ Sewage generated within the site should be discharged to a conservancy tank that is properly serviced and regularly evacuated to nearby wastewater treatment works. ▪ Limit disturbance and rehabilitate disturbed areas. ▪ Ensure there is sufficient stormwater management to prevent erosion of watercourses. ▪ Limit and monitor water use.	▪ Monitoring that no-go areas and buffer areas are adhered to should be undertaken on an ongoing basis. ▪ Ongoing monitoring of any rehabilitation measures, where required, should be undertaken. ▪ Ongoing monitoring of invasive alien plants within the site should be undertaken according to an approved method statement that makes use of alien clearing methods as provided by the Working for Water Programme and outlined on Resources | Department of Environmental Affairs (dffe.gov.za). Monitoring and control measures should take place at least biannually (every six months) for the first 3 years of the project. ▪ Ongoing visual inspections to ensure that no spills or risk of surface water contamination occur. ▪ Ongoing visual inspections to ensure that no sedimentation or solid water from the operational activities occur in adjacent surface water ecosystems.	Ongoing during operation	Proponent/ contractor

Impact	Mitigation/ Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
DECOMMISSIONING PHASE					
FRESHWATER ECOLOGY IMPACTS					
Potential impact on freshwater ecology as a result of the potential decommissioning of the proposed PV and associated infrastructure.	Limit the disturbance of aquatic habitats.	▪ For all project-related components within the site, the aquatic features of medium sensitivity should be demarcated by the appointed ECO before the commencement of the decommissioning activities and treated as no-go areas during the decommissioning phase. ▪ Minimise works within aquatic ecosystems. If the project layout avoided these areas, the decommissioning works would also be able to avoid aquatic habitats as delineated. Note that all aquatic areas recommended for avoidance have been avoided in the EIA phase layout identification. ▪ Any activities that require decommissioning activities within the delineated aquatic features and the recommended buffers should be described in method statements that are approved by the ECO. ▪ Rehabilitate and revegetate disturbed areas, where required. ▪ Rehabilitation of any disturbed areas within the aquatic features and the recommended buffer areas should be undertaken immediately following the completion of the disturbance activity according to rehabilitation measures as included in a method statement for that specific activity. ▪ Control of invasive alien plants within the site should be undertaken according to the approved method statement. ▪ Mitigation and follow-up monitoring of residual impacts (alien vegetation growth and erosion) may be required. ▪ The road network should be returned to that resembling pre-construction, with all additional roads removed where possible. ▪ Decommissioning activities within aquatic features should be undertaken in the dry season where possible. ▪ Sediment traps should be used where necessary. ▪ Laydown areas should be placed within the approved PV footprint and layout. ▪ Good housekeeping measures should be implemented as per the project EMPr and monitored by the appointed ECO. This should specifically address on-site stormwater management and prevention of pollution during decommissioning. Any stormwater that does arise within the decommissioning site must be handled appropriately to trap sediments and pollutants.	▪ Monitoring that no-go areas are adhered to should be undertaken on an ongoing basis for the duration of the decommissioning phase. ▪ Ongoing monitoring of the implementation of method statements and rehabilitation measures should be undertaken in the decommissioning phase. ▪ Ongoing monitoring of invasive alien plants within the site should be undertaken according to an approved method statement that makes use of alien clearing methods as provided by the Working for Water Programme and outlined on Resources | Department of Environmental Affairs (dffe.gov.za).	Ongoing during decommissioning	Proponent/ contractor and ECO

Monitoring Requirements

Daily compliance monitoring of the implementation of the measures as laid out in the EMPr and associated method statements should be undertaken by the Site Manager in conjunction with the Environmental Control Officer (ECO). A record of the monitoring undertaken during the operation phase maintenance management activities should be kept.

Visual inspections and photographs should be taken weekly upstream and downstream of sites where construction activities will need to take place within aquatic features. Once the construction activities have ceased, the frequency of the monitoring can be reduced to monthly until DWS is satisfied that the site is adequately rehabilitated.

Ongoing monitoring of invasive alien plant growth and erosion within the aquatic features and the recommended buffers biannually (every six months) for the construction phase and the first three operational years of the project. Monitoring should preferably take place before the rainfall period and following high rainfall events.

11 Final Specialist Statement and Authorisation Recommendation

11.1 Statement and Reasoned Opinion

The aquatic features within the study area comprise ephemeral unnamed tributaries of the Orange River. The larger watercourses flow along the eastern and western extents of the study area, flowing in a northerly direction to join the Orange River downstream of Van der Kloof Dam. Associated with these larger watercourses are wide floodplains. Smaller watercourses and drainage features drain into the larger river corridors. The watercourses and associated wetlands and floodplains are in a largely natural to moderate condition due to the low level of impact in the area. It is recommended that the larger watercourses, floodplains and wetlands within the site are not allowed to degrade further from their current ecological condition of largely natural to moderately modified.

The catchments of the tributaries of the Orange River in which the proposed project is located are not within any FEPA river sub-catchments. The only FEPA Wetland within the study area is a largely artificial wetland associated with a farm dam or erosion control structure and is thus not considered of high aquatic biodiversity conservation significance. There is also a natural depression wetland that is within the valley floor of the river system to the west of the study area that is mapped as a FEPA Wetland. Both wetlands are located outside of the proposed activities and are unlikely to be impacted by the proposed project. The artificial wetland is more than 100 m from the proposed activities, while the natural wetland is more than 3 km from any of the proposed activities.

The National FEPA Wetlands, as well as the wider river floodplains associated with the unnamed tributaries of the Orange River located in the eastern and western portions of the wider study area, have been included in the National Wetland Map version 5. The wider floodplain areas have been excluded from the proposed development area for the project.

In the 2016 Northern Cape CBA mapping, the entire area within and surrounding the study area is mapped as Ecological Support Areas. In addition, wetland habitats included in the National FEPA Wetland mapping and smaller wetlands that are located largely within the river floodplain areas have been mapped as aquatic CBAs. None of these mapped wetlands occurs within the project areas, with the closest mapped wetland

being the artificial FEPA wetland that is more than 100 m from the proposed development area. The aquatic CBAs are thus unlikely to be impacted by the proposed project activities.

The deemed sensitivity for the larger unnamed tributaries of the Orange River and their floodplains is medium while the smaller feeder streams, drainage lines and dams are deemed to be low.

With mitigation, the potential freshwater impacts of the proposed PV Facility for the construction, operation and decommissioning phases are likely to be very low significance. One can also expect that the cumulative impact of the proposed project would not be significant provided mitigation measures are implemented.

Based on the findings of this specialist assessment, there is no reason from a freshwater perspective, why the proposed activity (with the implementation of the above-mentioned mitigation measures) should not be authorised. The proposed development footprint within the preferred development site (i.e. study area) has been amended through the project assessment process to ensure that it will be within aquatic ecosystem areas of “low” sensitivity as identified by the screening tool and verified through the initial Site Sensitivity Verification and is thus considered appropriate areas for development.

The risk assessment determined that the proposed development of the PV poses a low risk of impacting aquatic habitat, water flow and water quality. The water use activities associated with the proposed project could potentially be authorised through the general authorisations for Section 21 (c) and (i) water uses. The GA for groundwater use in Quaternary Catchments D33B and D62F, where the proposed project study area is located, is limited to 45 m^3/ha/a for the property extent where the abstraction is proposed. Should more than this be required for the proposed project, an integrated water use licence application would be required for the associated project. Various assessments of the current groundwater use and sustainability of the proposed groundwater use would need to be undertaken in support of such an application. Refer to the Geohydrology Assessment in Chapter 16 of this EIA Report for additional information in this regard. The disposal of sewage from the developed site is likely to be stored in conservancy tanks for removal and treatment at the nearby wastewater treatment works of the local authority. This low volume would be within the GA for Section 21 (g) water use activities.

11.2 EA Condition Recommendations

The recommended buffer area between the aquatic features and the project components to ensure these aquatic ecosystems are not impacted by the proposed activities is as follows:

- The larger tributary: the delineated edge of the surrounding floodplain wetland features (assigned as medium sensitivity). No buffer area is deemed to be required considering that the floodplain is a wide transitional area between the tributary and the surrounding terrestrial areas.
- Smaller streams and drainage features that are indicated to be of medium sensitivity: at least 35 m for the watercourse or the delineated edge of wetland features to allow for the movement of water along these streams. In addition, with regards to the BESS, it should preferably not be placed within 100 m of major rivers, watercourses and wetlands.
- Pans: One pan was found within the study area on the Remaining Extent of the farm Wolve Kuilen No. 42. A 50 m buffer around this pan has been recommended. It does not intersect with the development footprint. Although a 50 m Aquatic buffer is applied to the pan, the development is more than 50 m from the pan identified. It is specifically more than 2 km away from the development footprints.

Note that the features that have been allocated a low sensitivity (artificial features and minor drainage channels) do not need to be avoided by the proposed development as they do not have any significant aquatic habitat or functionality that would be lost.

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

Construction phase:

- Implement recommended development setbacks to minimise works within aquatic ecosystems (i.e. recommended buffer of at least 35 m for the smaller drainage features; and setback from the wider floodplain adjacent to the larger rivers)
- Clearing of indigenous vegetation should not take place within the aquatic features and the recommended buffers.
- Rehabilitate disturbed aquatic habitats by revegetating them with suitable local indigenous vegetation.
- Water use for construction should be minimised as much as possible. The water should be obtained from an existing water allocation or other viable water sources for construction purposes.
- The road crossing structures should be designed to not impede flow in watercourses - low water crossing is preferred. Use existing crossings, as best as possible and where allowable.
- The existing road infrastructure, particularly within the floodplain, should be utilised as far as possible to access new infrastructure to minimise the overall disturbance. It is recommended that any new linear type of infrastructure crossings over watercourses be placed where there are existing structures or road crossings within the watercourse corridors, where possible.
- Avoid disturbing aquatic habitats.
- Construction materials brought onto the site should be free of alien plant seeds. Sources of alien seed should be prevented from being brought onto the site with imported materials.
- Rehabilitate disturbed aquatic habitats once construction works are complete.
- Any work within aquatic features should be undertaken in the dry season where possible.
- Sediment traps should be used where necessary.
- Construction sites and laydown areas should be located within the assessed buildable areas/development footprints.
- Good housekeeping and site management measures must be implemented at the laydown areas and the construction site as per the project EMPr and monitored by the appointed ECO.

Operation phase:

- The medium-sensitivity aquatic habitats should be avoided in the layout design, with only low-sensitivity habitats being disturbed during construction.
- Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants.
- Should any disturbance of aquatic habitats occur that is not associated with an improvement of the ecological condition, the habitat should be rehabilitated immediately following the disturbance activity by returning the habitat to the condition prior to that disturbance.
- Develop a stormwater management plan for the proposed development that addresses the stormwater runoff from the developed areas.
- Stormwater run-off infrastructure must be designed to mitigate both the flow and water quality impacts of any stormwater leaving the developed areas. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate shaping of the road with berms or channels and swales adjacent to hardened surfaces where necessary. Should any erosion features develop, they should be stabilised immediately.
- A sustainable water supply should be sought.

- Sewage generated within the site should be discharged to a conservancy tank that is properly serviced and regularly evacuated to nearby wastewater treatment works.

Decommissioning phase:

- Minimise works within aquatic ecosystems. If the project layout avoided these areas, the decommissioning works would also be able to avoid aquatic habitats as delineated. Note that all aquatic areas recommended for avoidance have been avoided in the EIA phase layout identification.
- Rehabilitate and revegetate disturbed areas, where required.
- Mitigation and follow-up monitoring of residual impacts (alien vegetation growth and erosion) may be required.
- The road network should be returned to that resembling pre-construction, with all additional roads removed where possible.
- Decommissioning activities within aquatic features should be undertaken in the dry season where possible.
- Sediment traps should be used where necessary.
- Laydown areas should be placed within the approved PV footprint and layout.
- Good housekeeping measures should be implemented as per the project EMPr and monitored by the appointed ECO. This should specifically address on-site stormwater management and prevention of pollution during decommissioning. Any stormwater that does arise within the decommissioning site must be handled appropriately to trap sediments and pollutants.

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Appendix A: Specialist Expertise

TONI BELCHER

Full Name	Antonia Belcher
Cell Number	083 883 8055
Email	toni@bluescience.co.za
Address	53 Dummer St, Somerset West, 7130
Profession	Aquatic Ecologist and Environmental Management (P. Sci. Nat. 400040/10)
Years in Profession	31+ years

Toni Belcher worked for the Department of Water Affairs and Forestry for more than 17 years. During this period, she worked for the Directorate Water Quality Management, the Institute for Water Quality Studies and the Western Cape Regional Office and has built up a wide skills base on water resource management and water resource quality for rivers, estuaries and the coastal marine environment. Since leaving the Department in 2007, she has been working in her private capacity and was co-owner of BlueScience (Pty) Ltd, working in the field of water resource management and has been involved in more than 500 aquatic ecosystem assessments for environmental impact assessment and water use authorisation purposes. In 2006 she was awarded a Woman in Water award for Environmental Education and was a runner up for the Woman in Water prize for Water Research.

Professional Qualifications:

1984 Matriculation Lawson Brown High School
1987 B.Sc. – Mathematics, Applied Mathematics University of Port Elizabeth
1989 B.Sc. (Hons) – Oceanography University of Port Elizabeth
1998 M.Sc. – Environmental Management (*cum laude*) Potchefstroom University

Key Skills:

Areas of specialisation: Aquatic ecosystem assessments, Monitoring and evaluation of water resources, Water resource legislation and authorisations, River classification and Resource Quality Objectives, River Reserve determination and implementation, Water Quality Assessments, Biomonitoring, River and Wetland Rehabilitation Plans, Catchment management, River maintenance management, Water education.

Summary of Experience:

1987 – 1988 Part-time field researcher, Department of Oceanography, University of Port Elizabeth
1989 – 1990 Mathematics tutor and administrator, Master Maths, Randburg and Braamfontein Colleges, Johannesburg
1991 – 1995 Water Pollution Control Officer, Water Quality Management, Department of Water Affairs, Pretoria
1995 – 1999 Hydrologist and Assistant Director, Institute for Water Quality Studies, Department of Water Affairs and Forestry, Pretoria
1999 – 2007 Assistant and Deputy Director, Water Resource Protection, Western Cape Regional Office, Department of Water Affairs, Cape Town
2007 – 2012 Self-employed
2013 – 2020 Senior Aquatic Specialist and part owner, BlueScience
2020 – present Self employed, Associate of BlueScience

Dana Grobler

NATIONALITY:	South African
PROFESSION:	Professional Environmental Scientist (*Pr. Sci. Nat* 400058/93)
POSITION:	Director: BlueScience (Pty) Ltd
SPECIALISATION:	Water resources management and IWRM
YEARS EXPERIENCE:	30
CONTACT DETAILS:	BlueScience (Pty) Ltd, PO Box 455, Somerset Mall, 7137
TELEPHONE:	+27 (0)21 851 0555 (Business Cape Town)

EDUCATION AND PROFESSIONAL STATUS

HED (1989)	Higher Education Diploma (Biology and Mathematics), University of Pretoria, South Africa
BSc (Hons) (1987)	University of Pretoria, South Africa. Terrestrial plant ecology.

PROFESSIONAL MEMBERSHIP

Registered Environmental Scientist - South African Council for Natural Scientific Professions (No 400058/93)
Member of the Southern African Society for Aquatic Scientists
Member of the Water Institute of Southern Africa (WISA)
Member of the South African Branch of the International Association of Impact Assessments (IAIA)
Member of the South African Botanical Society

SUMMARISED EMPLOYMENT RECORD

2013 -	Director BlueScience® (Pty) Ltd
2003 – 2013	Managing member of Blue Science ®Consulting cc.
2006 – 2012	Managing member of Blue Science® Consulting cc and Associate of WAMTechnology cc.
1999 – 2006	Independent Consultant.
1997 - 1999	Assistant Director, Institute for Water Quality Services, Department of Water Affairs and Forestry
1994 - 1996	Principle Hydrologist, Institute for Water Quality Services, Department of Water Affairs and Forestry (Roodeplaat Dam, Pretoria).
1992 - 1994	Senior Hydrologist, Institute for Water Quality Services, Department of Water Affairs and Forestry (Roodeplaat Dam, Pretoria).
1988 - 1992	Hydrologist, Institute for Water Quality Studies, Department of Water Affairs and Forestry (Roodeplaat Dam, Pretoria).

KEY EXPERIENCE RECORD and project involvement

- Project manager for the compilation of Maintenance and Management Plans for the Upper Berg River, Upper Olifants River, and the Poesjesnels, Konings and Keysers Rivers
- Project manager for the design and rehabilitation of the Klein Zeekoevlei Wetland Somerset West
- Project manager for the rehabilitation and re-vegetation of the Teslaarsdal wetland rehabilitation project
- Project manager for the Ecological Reserve Determination in the Sandveld (G30 and F60 Catchments)
- Project manager for the Berg River riparian zone restoration project. A 3-year Department of Environmental Affairs and Development Planning (South Africa) project.
- Project manager for the restoration and rehabilitation of vegetation 14km of pipeline routes in the Steenbras deep water aquifer water supply area (a City of Cape Town project);
- Project manager and rehabilitation advisor for the implementation of the Eerste River rehabilitation project in Stellenbosch. A two-year project (Client Remgro);
- Compilation of an alien invasive plant removal plan for Cape Town Film Studios, Faure Cape Town.
- Freshwater impact assessment studies and water use authorisation applications for various proposed developments.
- More than 20 power line and substation applications and more than 15 alternative energy projects.

Appendix B: Specialist Statement of Independence

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

Scoping and Environmental Impact Assessment Processes for the Proposed Development of 12 Solar Photovoltaic (PV) Facilities and associated infrastructure (i.e. Kudu Solar Facility 1 - 12), near De Aar, Northern Cape

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

Details of Specialist, Declaration and Undertaking Under Oath

Page 1 of 3

1. SPECIALIST INFORMATION

Specialist Company Name:	Toni Belcher Sole Proprietary			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 4 EME	Percentage Procurement recognition	
Specialist name:	Toni Belcher			
Specialist Qualifications:	M.Sc			
Professional affiliation/registration:	SACNASP (400040/10 Ecological and Environmental Science)			
Physical address:	53 Dummer Street, Somerset West			
Postal address:	53 Dummer Street, Somerset West			
Postal code:	7130	Cell:	+27 82 883 8055	
Telephone:	+27 82 883 8055	Fax:	-	
E-mail:	toni@BlueScience.co.za			

2. DECLARATION BY THE SPECIALIST

I, Antonia Belcher, 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

Toni Belcher Sole Proprietary

Name of Company:

18 May 2023

Date

Details of Specialist, Declaration and Undertaking Under Oath

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Antonia Belcher, 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

Toni Belcher Sole Proprietary

Name of Company

18 May 2023

Date

Signature of the Commissioner of Oaths

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2023 -05- 17
SOMERSET WEST
AMAPOLISA OMZANTSHI AFRICA

2023/05/18

Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 3 of 3

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

Scoping and Environmental Impact Assessment Processes for the Proposed Development of 12 Solar Photovoltaic (PV) Facilities and associated infrastructure (i.e. Kudu Solar Facility 1 - 12), near De Aar, Northern Cape

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

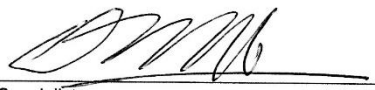
SPECIALIST INFORMATION

Specialist Company Name:	BlueScience (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 4 EME	Percentage Procurement recognition	
Specialist name:	Dana Grobler			
Specialist Qualifications:	B.Sc (Hons)			
Professional affiliation/registration:	002272			
Physical address:	Unit 13 | Technostell Building | 9 Quantum Street | Technopark | Stellenbosch | 7600			
Postal address:	PO Box 455, Somerset Mall			
Postal code:	7137	Cell:	-	
Telephone:	021 851 0555	Fax:	-	
E-mail:	dana@bluescience.co.za			

1. DECLARATION BY THE SPECIALIST

I, Daniel Frederik Grobler, 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

BlueScience (Pty) Ltd

Name of Company:

18 May 2023

Date

Details of Specialist, Declaration and Undertaking Under Oath

2. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Daniel Frederik Grobler, 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

BlueScience (Pty) Ltd

Name of Company

18 May 2023

Date

Signature of the Commissioner of Oaths

2023/05/18

Date

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2023 -05- 17
SOMERSET WEST
AMAPOLISA OMZANTSHI AFRICA

Details of Specialist, Declaration and Undertaking Under Oath

Page 3 of 3

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Daniel Frederik Grobler

Registration Number: 002272

is a registered scientist

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

Environmental Science (Professional Natural Scientist)
Water Resources Science (Professional Natural Scientist)
Aquatic Science (Professional Natural Scientist)

Effective **13 May 1993** Expires **31 March 2024**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

Appendix C: Site Sensitivity Verification

Prior to commencing with the Aquatic Biodiversity Specialist Assessment in accordance with the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity (Government Notice 320, dated 20 March 2020), a site sensitivity verification was undertaken to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

Date of Site Visit	4 March 2022
Specialist Name	Toni Belcher
Professional Registration Number	400040/10
Specialist Affiliation / Company	-

The proposed site for the **Solar Photovoltaic (PV) Facilities and associated infrastructure, near De-Aar, Northern Cape Province**, was assessed in terms of its aquatic biodiversity sensitivity using a desktop analysis using available aquatic ecosystem mapping, aerial imagery and a site visit, undertaken on 4 March 2022. A literature survey was also undertaken to determine any aquatic biodiversity sensitivities that may occur in the surrounding area.

The field visit comprised delineation, characterisation and integrity assessments of the aquatic habitats within the site. Mapping of the freshwater features was undertaken using a GPS Tracker and mapped in PlanetGIS and Google Earth Professional.

The following techniques and methodologies were utilised to undertake the assessments:

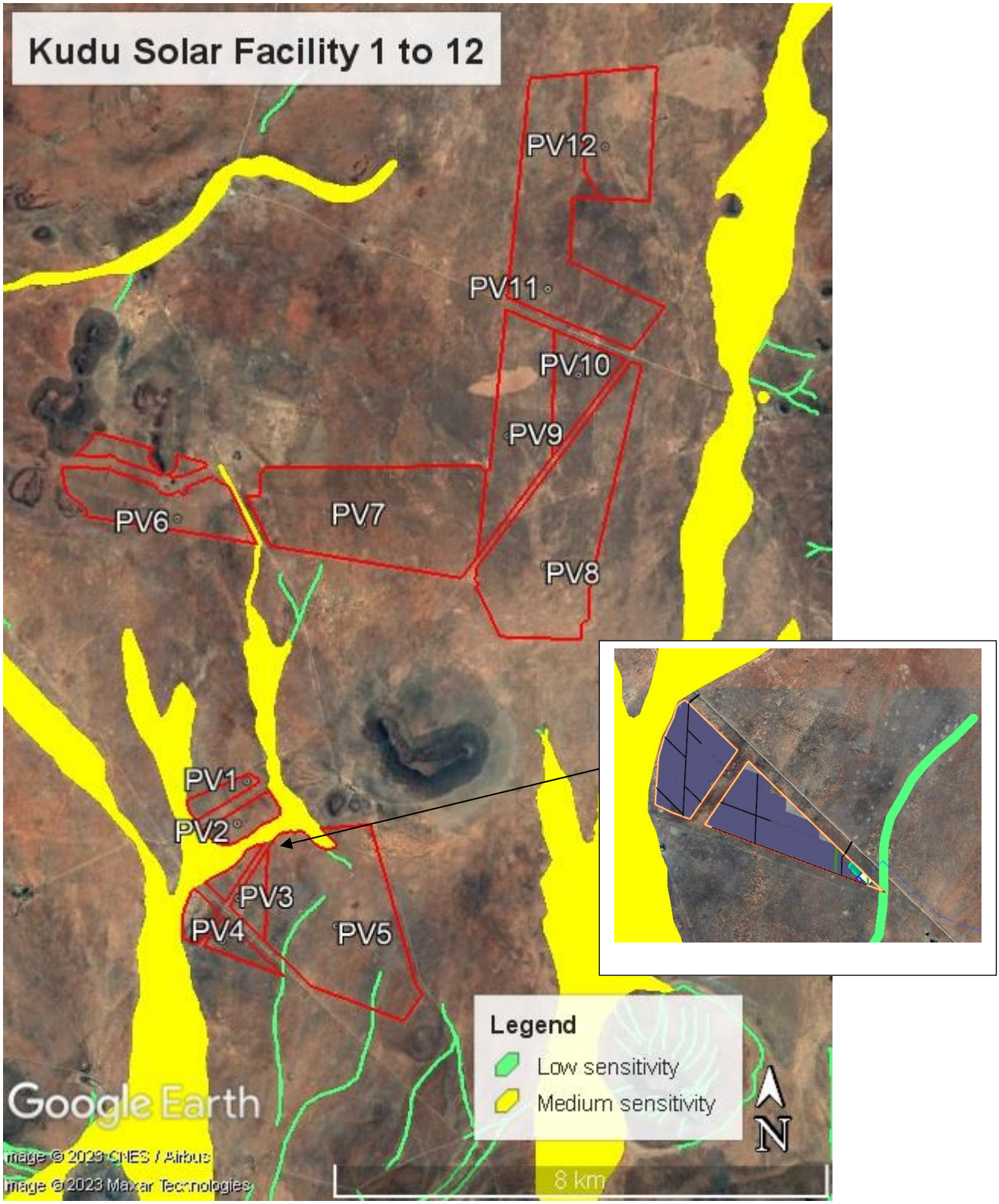
- The guideline document, “A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas” document, as published by the former Department of Water Affairs and Forestry (DWAF) (2005) (currently operating as the Department of Water and Sanitation (DWS), was followed for the delineation of the aquatic habitats;
- The present ecological condition of the watercourses was determined using the National River Health Programme and Wet-Health methodologies;
- The ecological importance and ecological sensitivity (EI&ES) assessment of the watercourses was conducted according to the guidelines as developed by DWAF (1999); and
- Recommendations made concerning the adoption of buffer zones within the study area were based on watercourse functioning and site characteristics as well as the DWS buffer tool.

The aquatic features within the study area comprise ephemeral unnamed tributaries of the Orange River. The larger watercourses flow along the eastern and western extents of the study area, flowing in a northerly direction to join the Orange River downstream of Van der Kloof Dam. Associated with these larger watercourses are wide floodplains. Smaller watercourses and drainage features drain into the larger river corridors. The rivers can all be characterised as foothill and lowland rivers within the Nama Karoo Ecoregion. The watercourses and associated wetlands and floodplains are in a largely natural to moderately modified condition due to the low level of impact in the area. It is recommended that the larger watercourses, floodplains and wetlands within the site are not allowed to degrade further from their current ecological condition of largely natural to moderately modified.

Impacts on the watercourses in the study area are associated with agricultural encroachment, livestock grazing and infrastructure (road and powerline) construction and maintenance. The ephemeral aquatic ecosystems are particularly vulnerable to changes in hydrology as they are specifically adapted to the sporadic flow conditions that naturally occur. Contaminants and sediment are not regularly flushed from these streams.

The Screening Tool has indicated that the wider area surrounding the site is generally of low Aquatic Biodiversity Combined Sensitivity. The very high sensitivity mapped within the study site is linked to the mapped wetlands in the National Wetland Map version 5 (the wider river floodplains associated with the unnamed tributaries of the Orange River located in the eastern and western portions of the wider study area). The proposed project components have avoided the areas indicated as being of very high sensitivity such that they are only located in areas of low sensitivity.

Below is the aquatic ecosystem sensitivity mapping for the study area, based on the site verification assessment undertaken.



Google Earth image showing the mapped aquatic sensitivities for the proposed projects. This report is focused on Kudu Solar Facility 4 shown in the insert.

Appendix D: Impact Assessment Methodology

The impact assessment includes:

- *the nature, status, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

Terminology used in impact assessment can overlap. To avoid ambiguity, please note the following clarifications (that are based on NEMA and the EIA Regulations):

- *The term environment is understood to have a broad interpretation that includes both the natural (biophysical) environment and the socio-economic environment. The term socio-ecological system is also used to describe the natural and socio-economic environment and the interactions amongst these components.*
- *Significance = Consequence x Probability, which means that significance is equivalent to risk.*
- *The impact can have a positive or negative status. The significance of a negative impact may be called a risk, and the significance of a positive impact may be called an opportunity.*

The following principles are to underpin the application of this methodology:

- *Transparent and repeatable process - specialists are to describe the thresholds and limits they apply in their assessment, wherever possible.*
- *Adapt parameters to context (where justified) – the methodology proposes some thresholds (e.g. for spatial extent, in Step 3 below), however, if the nature of the impact requires a different definition of the categories of spatial extent, then this can be provided and described.*
- *Combination of a quantitative and qualitative assessment – where possible, specialists are to provide quantitative assessments (e.g. areas of habitat affected, decibels of noise, number of jobs), however, it is recognised that not all impacts can be quantified, and then qualitative assessments are to be provided.*

As per the DFFE Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *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. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *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. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the aspects described below.

- ***Step 1**: **Nature** of impact/risk - The type of effect that a proposed activity will have on the environment.*

- ***Step 2**: **Status** - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- ***Step 3**: **Qualitatively** determine the **consequence** of the impact/risk by identifying the **a) SPATIAL EXTENT; b) DURATION; c) REVERSIBILITY; AND d) IRREPLACEABILITY**.*

    - ***A) Spatial extent** – The size of the area that will be affected by the impact/risk:*
        - *Site specific;*
        - *Local (<10 km from site);*
        - *Regional (<100 km of site);*
        - *National; or*
        - *International (e.g. Greenhouse Gas emissions or migrant birds).*

    - ***B) Duration** – The timeframe during which the impact/risk will be experienced:*
        - *Very short term (instantaneous);*
        - *Short term (less than 1 year);*
        - *Medium term (1 to 10 years);*
        - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
        - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

    - ***C) Reversibility** of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
        - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
        - *Moderate reversibility of impacts;*
        - *Low reversibility of impacts; or*
        - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

    - ***D) Irreplaceability** of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
        - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
        - *Moderate irreplaceability of resources;*
        - *Low irreplaceability of resources; or*
        - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

*Some of the criteria are quantitative (e.g. spatial extent and duration) and some may be described in a quantitative or qualitative manner (e.g. reversibility and irreplaceability). The specialist then combines these criteria in a qualitative manner to determine the **consequence**.*

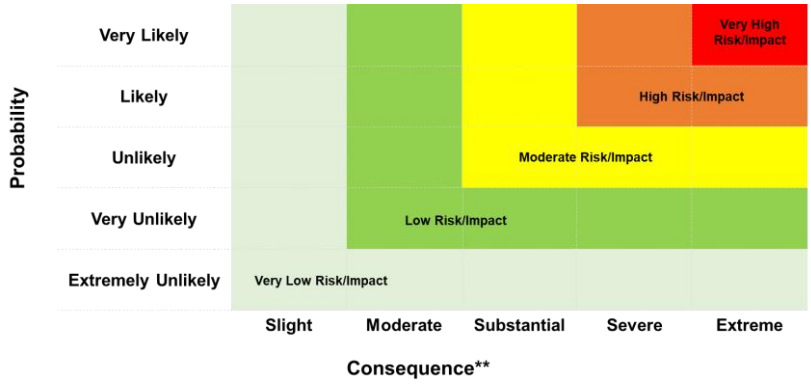
The consequence terms ranging from slight to extreme must be calibrated per Specialist Study so that there is transparency and consistency in the way a risk/impact is measured. For example, from a biodiversity and ecology perspective, the consequence ratings could be defined according to a reduction in population or occupied area in relation to Species of Conservation Concern (SCC) status, ranging from slight consequence for defined areas of Least Concern, to extreme consequence for defined areas that are Critically Endangered. For example, from a social perspective, a slight consequence could refer to small and manageable impacts, or impacts on small sections of the community; a moderate consequence could refer to impacts which affect the bulk of the local population negatively or may produce a net negative impact on the community; and an extreme consequence could refer to impacts which could result in social or political violence or institutional collapse.

- ***Consequence*** *– The anticipated consequence of the risk/impact is generally defined as follows:*
    - *Extreme (extreme alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they temporarily or permanently cease);*
    - *Substantial (substantial alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they temporarily or permanently cease;*
    - *Moderate (notable alteration of natural or socio-economic systems, patterns or processes, i.e. where the natural or socio-economic environment continues to function but in a modified manner; or*
    - *Slight (negligible and transient alteration of natural or socio-economic systems, patterns or processes, i.e. where natural systems/environmental or socio-economic functions, patterns, or processes are not affected in a measurable manner, or if affected, that effect is transient and the system recovers).*

- ***Step 4****: Rate the* ***probability*** *of the impact/risk using the criteria below:*

    - ***Probability*** *– The probability of the impact/risk occurring:*
        - *Extremely unlikely (little to no chance of occurring);*
        - *Very unlikely (<30% chance of occurring);*
        - *Unlikely (30-50% chance of occurring)*
        - *Likely (51 – 90% chance of occurring); or*
        - *Very Likely (>90% chance of occurring regardless of prevention measures).*

- ***Step 5****: Use both the* ***consequence*** *and* ***probability*** *to determine the* ***significance*** *of the identified impact/risk (qualitatively as shown in Figure 1). Significance definitions and rankings are provided below:*



[Qualitatively determined based on Spatial Extent, Duration, Reversibility and Irreplaceability]

Figure 1. Guide to assessing risk/impact significance as a result of consequence and probability.

- ***Significance*** *– Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

The specialists must provide a written supporting motivation of the assessment ratings provided.

- ***Step 6****: Determine the* ***Confidence Level*** *– The degree of confidence in predictions based on available information and specialist knowledge:*
    - *Low;*
    - *Medium; or*
    - *High.*

Appendix E: Compliance with the Aquatic Biodiversity Protocol (GN 320, 20 March 2020)

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	Section where this has been addressed in the Specialist Report
2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects: 2.3.1. a description of the aquatic biodiversity and ecosystems on the site, including; a) aquatic ecosystem types; and b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns;	Section 4.2, Section 4.3 and Section 4.4
2.3.2. the threat status of the ecosystem and species as identified by the screening tool;	Section 4.3 and Section 4.4
2.3.3. an indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free -flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area); and	Section 4.2
2.3.4. a description of the ecological importance and sensitivity of the aquatic ecosystem including: a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and b) the historic ecological condition (reference) as well as present ecological state of rivers (in- stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).	Section 4.2
2.4. The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.	Section 5
2.5. Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: 2.5.1. Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal? 2.5.2. Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present? 2.5.3. How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include: a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes);	Section 4.4 and Section 6

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	Section where this has been addressed in the Specialist Report
b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub -catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns); c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary I seasonal I permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and d) to what extent will the risks associated with water uses and related activities change;	
2.5.4. how will the proposed development impact on the functioning of the aquatic feature? This must include: a) base flows (e.g. too little or too much water in terms of characteristics and requirements of the system); b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over -abstraction or instream or off stream impoundment of a wetland or river); c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley- bottom wetland to a channelled valley -bottom wetland); d) quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); e) fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);	Section 6 and 7
2.5.5. how will the proposed development impact on key ecosystems regulating and supporting services especially: a) flood attenuation; b) streamflow regulation; c) sediment trapping; d) phosphate assimilation; e) nitrate assimilation; f) toxicant assimilation; g) erosion control; and h) carbon storage?	Section 6 and 7
2.5.6. how will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 6 and 7
2.6. In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: a) size of the estuary; b) availability of sediment; c) wave action in the mouth; d) protection of the mouth; e) beach slope;	N/A

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	Section where this has been addressed in the Specialist Report
f) volume of mean annual runoff; and g) extent of saline intrusion (especially relevant to permanently open systems).	
2.7. The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	
2.7.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Section 1.2 and Appendix A
2.7.2. a signed statement of independence by the specialist;	Appendix B
2.7.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2
2.7.4. the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;	Section 2
2.7.5. a description of the assumptions made, any uncertainties or gaps in knowledge or data;	Section 2.2
2.7.6. the location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;	Section 4.4
2.7.7. additional environmental impacts expected from the proposed development;	Section 7
2.7.8. any direct, indirect and cumulative impacts of the proposed development on site;	Section 6 and Section 7
2.7.9. the degree to which impacts and risks can be mitigated;	Section 7
2.7.10. the degree to which the impacts and risks can be reversed;	Section 7
2.7.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	Section 7
2.7.12. a suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies;	Section 4.4
2.7.13. proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr);	Section 10
2.7.14. a motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate;	Not Applicable
2.7.15. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	Section 11.1
2.7.16. any conditions to which this statement is subjected.	Section 11.2
2.8. The findings of the Aquatic Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation and monitoring measures as identified, that are to be included in the EMPr.	This Aquatic Biodiversity and Species Assessment serves as Chapter 8 of the EIA Report, and the findings therefore are included herein. The mitigation and monitoring measures are also included herein, as well as in the EMPrs included as Appendix I and Appendix J of the EIA Report.

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	Section where this has been addressed in the Specialist Report
2.9. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	This Aquatic Biodiversity and Species Assessment serves as Chapter 8 of the EIA Report, and it has been signed (refer to Appendix B of this chapter).

CHAPTER 9:

Avifauna Assessment

CSIR
Touching lives through innovation

AVIFAUNAL SPECIALIST ASSESSMENT REPORT:

Scoping and Environmental Impact Assessment (EIA) Process for the Proposed Development of a Solar Photovoltaic Facility (Kudu Solar Facility 4) and associated infrastructure, near De Aar, Northern Cape Province

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services P O Box 320 Stellenbosch 7599 South Africa	Chris van Rooyen Consulting P.O Box 2676 Fourways 2055 South Africa

V1: 26 April 2023

The Project Applicant, Kudu Solar Facility 4 (Pty) Ltd, is proposing to develop the Kudu Solar Photovoltaic (PV) cluster and associated Electricity Grid Infrastructure (EGI) near De Aar in the Northern Cape. The Kudu Project will entail the proposed development of up to 12 Solar PV Facilities, as well as their associated infrastructure and EGI.

This Avifauna Specialist Assessment is focused on the full extent of the Study Area. The proposed Solar Facilities will make use of PV solar technology to generate electricity from energy derived from the sun. Each solar PV facility will have a range of associated infrastructure, including, but not limited to, an on-site substation complex, battery energy storage systems (BESS) and is proposed to connect to an existing 400 kV power line via dedicated 132 kV power lines.

It is estimated that each PV facility will have a capacity ranging from up to 50 MWac to 350 MWac. Each of the PV facilities would be its own project and would require its own, separate Environmental Authorisation (EA).

This report serves as the Avifaunal Specialist Assessment Report input that was prepared as part of the Scoping and Environmental Impact Assessment (S&EIA) for the proposed Kudu Solar Photovoltaic (PV) cluster. The EGI components would be subjected to a separate Environmental Assessment process.

Separate reports have been compiled for each PV facility. This report covers the Kudu Solar Facility 4 and associated infrastructure.

1. Avifauna

A total of 85 species could potentially occur within the Broader Area where the project is located (see Appendix 9.E). Of these, 21 are classified as priority species for solar developments. Of the 21 priority species, 17 were recorded during the monitoring, and 15 priority species have a medium to high probability of occurring regularly in the Study Area. Five SCC were recorded during the site surveys, namely Blue Crane, Martial Eagle, Verreaux's Eagle, Cape Vultures and White-backed Vulture.

2. Identification of Potential Impacts/Risks

The potential impacts identified in the course of the study are listed below.

Construction Phase

- Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure.

Operational Phase

- Displacement due to habitat transformation associated with the presence of the solar PV plant and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions in the onsite substation complex
- Electrocution of priority species on the internal 33kV powerlines.

Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure.

Cumulative Impacts

- Displacement due to disturbance associated with the construction and decommissioning of the solar PV plants and associated infrastructure.
- Displacement due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure.
- Collisions with the solar panels.
- Entrapment in perimeter fences.
- Electrocutions in the onsite substation complexes.
- Electrocution of priority species on the internal 33kV powerlines.

3. Sensitivities identified by the National Web-Based Environmental Screening Tool

The Screening Tool currently assigns a low to medium sensitivity to birds as per the Animal Species Theme. However, based on the field surveys, the classification of **High** sensitivity for avifauna is proposed **for all 12** proposed development footprints. None of the development footprints has a specific habitat feature that distinguishes it from the rest of the Study Area which would warrant a lesser rating. The Kudu Solar Facility 4 has a **High sensitivity for avifauna**.

4. Specialist Sensitivity Analysis and Verification

4.1 Very High sensitivity: No Go

4.1.1 All infrastructure exclusion zones

Verreaux's Eagle nest: A 1km all infrastructure exclusion zone is recommended to prevent the displacement of the breeding pair during the construction phase due to disturbance. In addition, the buffer area will reduce the risk of injury to the juvenile bird due to collision with the solar panels, when it starts flying and practicing its hunting technique around the nest. None of the development footprints fall within this zone. The 1km no disturbance buffer is based on personal observations, and is also the recommended no disturbance buffer in the latest best practice guidelines for Verreaux's Eagles and wind farm developments. (Ralston – Patton, S & Murgatroyd M. 2021. Verreaux's Eagles and Wind Farms. Guidelines for impact assessment, monitoring, and mitigation. Second edition. Birdlife South Africa). In any event, the closest development area is located 2km away from the Verreaux's Eagle nest which is more than adequate to prevent any disturbance of the breeding birds.

4.1.2 Solar panel exclusion zones (other infrastructure allowed)

Waterpoints: Surface water in this semi-arid habitat is crucially important for priority avifauna and many non-priority species. The development footprints and the immediate surrounding area contain several boreholes which are sources of surface water. It is preferable to leave some open space where possible with no solar panels, for birds to access and leave the surface water area unhindered[1]. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. This will also benefit Blue Cranes which prefer to breed close to water bodies. It is noted that the area surrounding the development footprints contain several boreholes that will not be affected by the proposed development, and these boreholes will ensure that the local avifauna will still have access to adequate sources of surface water.

4.2 High sensitivity zones

The entire Study Area is a high sensitivity zone due to the potential presence of several Species of Conservation Concern (SCCs) (see Section 4.4.1) including Ludwig's Bustard, Secretarybird, Martial Eagle, Cape Vulture and White-backed Vulture which could utilise the whole Study Area for foraging. However, these species do not require specific avoidance measures at this stage because there is still adequate habitat available outside the Study Area.

[1] While some of the waterpoints in the development footprint will be removed, the applicant has agreed to retain some water points which will be buffered by a minimum circular solar panel exclusion zone of 50m. The removal of some of the water points will therefore not be a significant impact.

5. Impact Assessment Summary

The overall impact significance is provided in the table below, in terms of pre- and post-mitigation.

Overall Impact Significance (Pre- and Post-Mitigation)

Phase	**Overall Impact Significance (Pre-Mitigation)**	**Overall Impact Significance (Post Mitigation)**
Construction	Moderate (3)	Low (4)
Operational	Low (4) to Moderate (3)	Very Low (5) to Low (4)
Decommissioning	Moderate (3)	Low (4)
Nature of Impact	**Overall Impact Significance**	**Overall Impact Significance**
Cumulative - Construction	Moderate (3)	Low (4)
Cumulative - Operational	High (2)	Moderate (3)
Cumulative - Decommissioning	Moderate (3)	Low (4)

6. Final Specialist Statement and Authorisation Recommendation

The proposed Kudu Solar Facility 4 will have a range of potential pre-mitigation impacts on priority avifauna ranging from low to high, which is expected to be reduced to medium and low with the appropriate mitigation. No fatal flaws were discovered during the investigations. The Project is supported with the understanding that all mitigation measures provided in this report will be strictly implemented.

TABLES

FIGURES

ABBREVIATIONS

Abbreviations	
BLSA	BirdLife South Africa
DFFE	Department of Forestry, Fisheries and the Environment
NEMA	National Environmental Management Act 107 of 1998 (as amended)
REDZ	Renewable Energy Development Zone
S&EIA	Scoping and Environmental Impact Assessment
SABAP	South African Bird Atlas Project
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SEF	Solar Energy Facility

Definitions	
Priority species	South African Red Data species, South African endemics and near-endemics, raptors and waterbirds.
Broader Area	The area encompassed by the 9 pentads where the project is located.
Study Area	The area covered by the eight land parcels where the solar PV projects will be located, totalling approximately 8 150 hectares.
Development Footprint	The area where the actual development will be located, i.e. the footprint containing the PV solar arrays and associated infrastructure. Original Scoping Buildable Areas were considered at the commencement of the EIA Process and following the identification of sensitivities and other considerations, Revised Scoping Buildable Areas were determined at the end of the Scoping Phase. The Original and Revised Scoping Buildable Areas served as development footprints. The aim of the EIA Phase is to identify the preferred development footprint or layout within the approved site as contemplated in the accepted Scoping Report, which in this case is the Study Area.
Pentad	A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km.

9. AVIFAUNAL SPECIALIST ASSESSMENT REPORT

This chapter includes the Avifaunal Specialist Assessment Report that was prepared by Chris van Rooyen and Albert Froneman of Chris van Rooyen Consulting, as part of the Scoping and Environmental Impact Assessment (EIA) Process for the proposed development of the Kudu Solar Facility 4 and associated infrastructure, near De-Aar, Northern Cape Province.

9.1 Introduction

The Project Applicant, Kudu Solar Facility 4 (Pty) Ltd, is proposing to develop the Kudu Solar Photovoltaic (PV) cluster and associated Electricity Grid Infrastructure (EGI). The Kudu Project will entail the proposed development of up to 12 Solar PV Facilities, as well as their associated infrastructure and EGI. The EGI components would be subjected to a separate Environmental Assessment process.

It is estimated that each PV facility will have a capacity ranging from up to 50 MWac to 350 MWac. Each of the PV facilities would be its own project and would require its own, separate Environmental Authorisation (EA). Separate reports have been compiled for each PV facility. **This report covers the Kudu Solar Facility 4 and associated infrastructure**.

9.1.1 Scope, Purpose and Objectives of this Specialist Assessment Report

The purpose of the report is to determine the main issues and potential impacts of the proposed project on avifauna, through a combination of desktop analysis and field work. The report was prepared to provide inputs to the EIA Process for the project as required by the EIA Regulations promulgated in terms of the National Environmental Management Act 107 of 1998, as amended, (NEMA). This Specialist Assessment Report fulfils the requirements of the Animal Species Protocol published in Government Notice (GN) 1150 in October 2020, as well as the Species Environmental Assessment Guideline (Version 3.1, 2022) published by the South African National Biodiversity Institute (SANBI), and the BirdLife South Africa (BLSA) Guideline for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa.

9.1.2 Details of Specialists

This specialist assessment has been undertaken by Chris van Rooyen and Albert Froneman of Chris van Rooyen Consulting. Chris van Rooyen works in association with and under the supervision of Albert Froneman, who is registered with the South African Council for Natural and Scientific Professions (SACNASP), with Registration Number 400177/09 in the field of Zoological Science.

Chris van Rooyen (Avifaunal Specialist) vanrooyen.chris@gmail.com

Chris has decades of experience in the management of wildlife interactions with electricity infrastructure. He was head of the Eskom-Endangered Wildlife Trust (EWT) Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global

expert in this field and has worked in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. Chris also has extensive project management experience and has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author of 15 academic papers (some with co-authors), co-author of two book chapters and several research reports. He has been involved as ornithological consultant in numerous power line and renewable energy projects. Chris is also co-author of the Best Practice for Avian Monitoring and Impact Mitigation at Wind Development Sites in Southern Africa, which is the industry standard. Chris also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

Albert Froneman (Avifaunal Specialist) albert.fronmena@gmail.com

Albert has a Master of Science degree in Conservation Biology from the University of Cape Town and started his career in the natural sciences as a Geographic Information Systems (GIS) specialist at Council for Scientific and Industrial Research (CSIR). In 1998, he joined the Endangered Wildlife Trust where he headed up the Airports Company South Africa – EWT Strategic Partnership, a position he held until he resigned in 2008 to work as a private ornithological consultant. Albert's specialist field is the management of wildlife, especially bird related hazards at airports. His expertise is recognized internationally; in 2005 he was elected as Vice Chairman of the International Bird Strike Committee. Since 2010, Albert has worked closely with Chris van Rooyen in developing a protocol for pre-construction monitoring at wind energy facilities, and he is currently jointly coordinating pre-construction monitoring programmes at several renewable energy facilities. Albert also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

A curriculum vitae is included in Appendix 9.A of this chapter. In addition, a signed specialist statement of independence is included in Appendix 9.B of this chapter.

9.1.3 Terms of Reference

The overall terms of reference for this assessment report are as follows, as per the accepted Plan of Study for the EIA:

- Describe the methodology used to undertake the Site Sensitivity Verification, impact assessment and site inspection, including equipment and modelling used where relevant;
- State the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;
- Describe the mean density of observations/number of sample sites per unit area of site inspection observations, where possible, as noted in the Species Environmental Assessment Guideline;
- Describe the affected environment from an avifaunal perspective, including the details of all Species of Conservation Concern (SCC) found or suspected to occur on site, ensuring sensitive species are appropriately reported, as well as consideration of the surrounding habitats and avifaunal features (e.g. Ramsar sites, Important Bird Areas, wetlands, migration routes, feeding, roosting and nesting areas, etc.);

- Finalise the findings and outcomes of the pre-construction avifaunal monitoring programme that was conducted over a period of six months in accordance with the BLSA guideline for Solar PV developments (i.e. Regime 2);
- Describe and map bird habitats on the site, based on on-site monitoring, desk-top review, collation of available information, studies in the local area and previous experience. The assessment must also consider the maps generated by the Screening Tool. Include a section indicating how the Screening Tool was interrogated and whether classification of the site is accurate or not. If not, it must be motivated why the classification is not accurate;
- Determine the baseline environmental condition and sensitivity of the study area in terms of avifaunal features such as habitat use, roosting, feeding and nesting/breeding;
- Assessment of the project alternatives and identification of a preferred alternative with motivation for this selection;
- Discuss gaps in baseline data and other limitations and describe the expected impacts associated with the proposed solar facility and associated infrastructure;
- A description of the assumptions made, any uncertainties or gaps in knowledge or data, and limitations in the report;
- Identify potential sensitive environments and receptors that may be impacted on by the proposed solar facility;
- Specify development setbacks or buffers required, and provide clear motivations for these recommendations, including a description of the location of areas not suitable for development and to be avoided during construction and operation i.e. identify 'No-Go' areas, where applicable;
- Provide review input on the preferred infrastructure layout following the sensitivity analysis and layout identification;
- Determine the nature and extent of potential impacts i.e. potential direct, indirect and cumulative impacts of the proposed development on birds;
- Provide an impact statement / reasoned opinion, based on the findings of the specialist assessment, with regard to the acceptability of the project from an avifaunal impact perspective and a recommendation if the development should receive approval or not; and any conditions to which the opinion is subjected if relevant; and
- Recommend mitigation measures to reduce the impact of the expected impacts and recommend potential monitoring programmes. Also, identify best practice management actions, monitoring requirements, and rehabilitation guidelines for all identified impacts. This will be included in the EMPr. Also confirm if there are any specific environmental sensitivities or attributes present on the project site and any resultant site-specific impact management outcomes and actions that are not included in the pre-approved Generic Substation EMPr (GN 435).
- Identification of any additional protocols, licensing and/or permitting requirements that are relevant to the project and the implications thereof;
- Determine mitigation, impact management actions and outcomes, which could be implemented to as far as possible, reduce the effect of negative impacts and enhance the effect of positive impacts.

9.2 Approach and Methodology

The following methods were used to compile this report:

- Bird distribution data of the South African Bird Atlas 2 (SABAP2) was obtained from the University of Cape Town, as a means to ascertain which species occurs within the Broader Area i.e. within a block consisting of 9 pentad grid cells each within which the proposed projects are situated (see Figure 9-1). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 3 full protocol lists (i.e. surveys lasting a minimum of two hours each) have been completed for this area. In addition, 4 ad hoc protocol lists (i.e. surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2022.2) International Union for Conservation of Nature (IUCN) Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the habitat in the Study Area was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2012 beta2) from the South African National Biodiversity Institute (SANBI) website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org). Study Area is the area covered by the land parcels where the PV projects will be located.
- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2023) was used in order to view the Study Area on a landscape level and to help identify sensitive bird habitat.
- Priority species were defined as follows:
  - South African Red Data species: High conservation significance
  - South African endemics and near-endemics: High conservation significance
  - Raptors: High conservation significance. Raptors are at the top of the food chain and play a key role in their ecosystems. When populations of birds of prey go down, then the numbers of their prey species go up, creating an imbalance in the ecosystem.
  - Waterbirds: Evidence indicate that waterbirds may be particularly susceptible to collisions with solar arrays due to the so-called lake effect, caused by the reflection of the sun of the smooth surface of solar panels.
- The SANBI BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas and National Protected Areas Expansion Strategy (NPAES) focus areas.
- The Department of Forestry, Fisheries and the Environment (DFFE) National Screening Tool was used to determine the assigned avian sensitivity of the proposed Study Areas.
- Data collected during previous site visits to the Broader Area was also considered as far as habitat classes and the occurrence of priority species are concerned.
- The habitat suitability model developed by BLSA was used to determine where suitable breeding habitat is available for Verreaux's Eagles.
- The study was undertaken based on a combination of the following documents:
  - Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes (i.e. Terrestrial Animal Species) in terms of sections 24(5)(a) and

(h) and 44 of NEMA when applying for Environmental Authorisation (Gazetted in Government Notice 1150 in October 2020);

- Guidelines for the Implementation of the Terrestrial Flora & Terrestrial Fauna Species Protocols for EIAs in South Africa produced by the SANBI and BirdLife South Africa (BLSA) on behalf of the DFFE (2022); and
- The BLSA Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. BirdLife South Africa by Jenkins, A.R., Ralston-Patton, Smit-Robinson, A.H. 2017 (hereafter referred to as the Solar Guidelines) were consulted to determine the level of survey effort that is required.

- The main source of information on the avifaunal diversity and abundance at the Study Area is an integrated pre-construction monitoring programme which was implemented between March and May 2022, covering the proposed 12 Kudu PV projects. The pre-construction avifaunal monitoring programme followed an adapted Regime 2 protocol as defined in the Birds and Solar Energy best practice guidelines (Jenkins *et al.* 2017) which require a minimum of two surveys over a six-month period (see **Appendix 9.F of this chapter for more details**).
- The potential impacts have been assessed according to the Impact Assessment Methodology contained in Chapter 4 of the EIA Report and Appendix 9.D of this chapter. The methodology includes the degree to which impacts and risks can be mitigated; reversed; and can cause loss of irreplaceable resources. Impact significance is rated both without and with mitigation, and covers the construction, operational and decommissioning phases of the project.

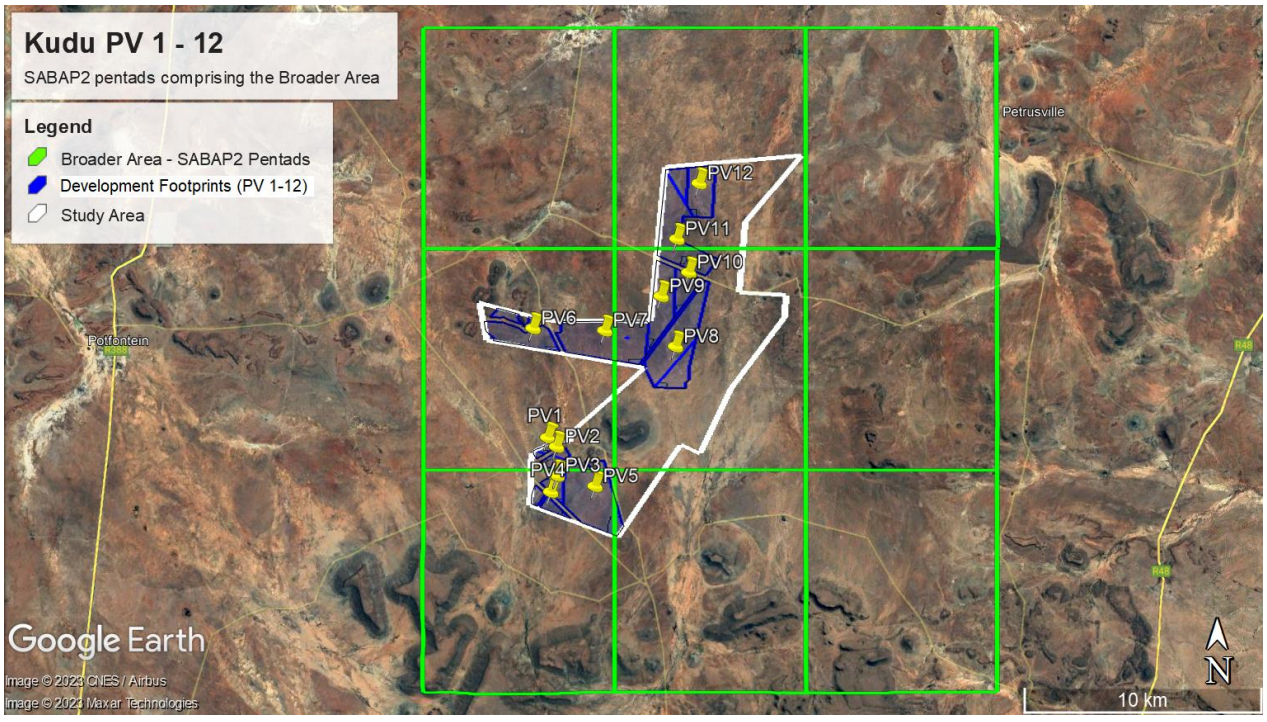


Figure 9-1: The 9 SABAP2 pentads comprising the Broader Area where the Study Area is located.

9.2.1 Information Sources

The following data sources were used to compile this report:

Data / Information	Source	Date	Type	Description
South African Protected Areas Database (SAPAD)	Department of Forestry, Fisheries and the Environment (DFFE)	2022, Q3	Spatial	• Spatial delineation of protected areas in South Africa. Updated quarterly
Atlas of Southern African Birds 1 (SABAP1)	University of Cape Town	1987-1991	Spatial, reference	• SABAP1, which took place from 1987-1991.
South African Bird Atlas Project 2 (SABAP2)	University of Cape Town	May 2022	Spatial, database	• SABAP2 is the follow-up project to the SABAP1. The second bird atlas project started on 1 July 2007 and is still growing. The project aims to map the distribution and relative abundance of birds in southern Africa.
National Vegetation Map	South African National Biodiversity Institute (SANBI) (BGIS)	2018	Spatial	• The National Vegetation Map Project (VEGMAP) is a large collaborative project established to classify, map and sample the vegetation of South Africa, Lesotho and Swaziland.
Red Data Book of Birds of South Africa, Lesotho and Swaziland	BirdLife South Africa	2015	Reference	• The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland is an updated and peer-reviewed conservation status assessment of the 854 bird species occurring in South Africa undertaken in collaboration between BirdLife South Africa, the Animal Demography Unit of the University of Cape Town, and the SANBI.
International Union for Conservation of Nature (IUCN) Red List of Threatened Species (2022.2)	IUCN	2022.2	Online reference source	• Established in 1964, the IUCN's Red List of Threatened Species is the world's most comprehensive information source on the global extinction risk status of animal, fungus and plant species.

Data / Information	Source	Date	Type	Description
Important Bird and Biodiversity Areas of South Africa	BirdLife South Africa	2015	Reference work	• Important Bird and Biodiversity Areas (IBAs), as defined by BirdLife International, 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 nationally through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria.
Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa	Department of Environmental Affairs, 2015. Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa. CSIR Report Number: CSIR/CAS/EMS/ER/2015/0001/B. Stellenbosch.	2015	SEA	• The SEA identifies areas where large scale wind and solar PV energy facilities can be developed in terms of Strategic Infrastructure Project (SIP) 8 and in a manner that limits significant negative impacts on the natural environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZs).
Phase 2 Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa	Department of Environment, Forestry and Fisheries, 2019. Phase 2 Strategic Environmental Assessment for wind and solar PV energy in South Africa. CSIR Report Number: CSIR/SPLA/SECO/ER/2019/0085 Stellenbosch, Western Cape.	2019	SEA	• The SEA identifies additional areas where large scale wind and solar PV energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the natural environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZs). These are referred to as REDZ 9 eMalahleni (solar PV), REDZ 10 Klerksdorp (solar PV) and REDZ 11 Beaufort West (wind and solar PV). The numbers are a continuation from the already gazetted eight REDZs from the Phase 1 wind and solar PV SEA.
The National Screening Tool	DFFE	2023	Spatial	• The National Web based Environmental Screening Tool is a geographically based web-enabled application which allows a proponent

Data / Information	Source	Date	Type	Description
				intending to submit an application for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended to screen their proposed site for any environmental sensitivity.
National Protected Areas and National Protected Areas Expansion Strategy (NPAES)	DFFE	2016	Spatial	• The goal of NPAES is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion.
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 when applying for Environmental Authorisation (Gazetted October 2020)	NEMA	2020	Regulations	• Prescribe protocols in respect of specific environmental themes (i.e. Terrestrial Animal Species and Terrestrial Plant Species) for the assessment of, as well as the minimum report content requirements on, the environmental impacts for activities requiring environmental authorisation.
Guidelines for the Implementation of the Terrestrial Flora & Terrestrial Fauna Species Protocols for EIAs in South Africa produced by the South African National Biodiversity Institute on behalf of the Department of Environment, Forestry and Fisheries (2022)	South African National Biodiversity Institute (SANBI) (BGIS)	2022.V3.1	Guidelines	• The purpose of the Species Environmental Assessment Guideline is to provide background and context to the assessment and minimum reporting criteria contained within the Terrestrial Animal and Plant Species Protocols; as well as to provide guidance on sampling and data collection methodologies for the different taxonomic groups that are represented in the respective protocols. This guideline is intended for specialist studies undertaken for activities that have triggered a listed and specified activity in terms of the National Environmental Management Act, 1998 (No. 107 of 1998)

Data / Information	Source	Date	Type	Description
				(NEMA), as identified by the EIA Regulations, 2014 (as amended) and Listing Notices 1-3.
The BirdLife South Africa (BLSA) Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. BirdLife South Africa by Jenkins, A.R., Ralston-Patton, Smit- Robinson, A.H. 2017	BirdLife South Africa	2017	Guidelines	• These guidelines were developed to ensure that any negative impacts on threatened or potentially threatened bird species are identified and effectively mitigated using structured, methodical and scientific methods. The guidelines prescribe the best practice approach to gathering bird data at proposed utility-scale solar energy plants, primarily for the purposes of accurate and effective impact assessment.
The BirdLife South Africa habitat suitability model for Verreaux's Eagle to establish if there is suitable habitat for the species in the Study Area.	BirdLife South Africa	2023	Spatial	• This is a GIS layer developed by BirdLife South Africa that indicates the suitability of the habitat in a graded manner from a potential breeding perspective.
The results of the avifaunal pre-construction monitoring implemented at the Study Area between March and May 2022.	Chris van Rooyen Consulting	2022	Spatial and quantitative	• The data consist of the results of the transect and incidental counts and nest searches which were implemented at the 12 proposed Kudu solar facilities.

9.2.2 Assumptions, Knowledge Gaps and Limitations

This study assumed that the sources of information used in this report are reliable. In this respect, the following must be noted:

- The SABAP2 data is not regarded as an adequate indicator of the avifauna which could occur at the Study Area, and it was therefore further supplemented by data collected during the on-site surveys to date.
- The focus of the study was on the potential impacts of the proposed solar PV facility on priority species.
- Only one published scientific study on the impact of PV facilities on avifauna in South Africa (Visser *et al.* 2018) currently exists. Some reliance was therefore placed on expert opinion and data from existing monitoring programmes at solar facilities in the USA, where monitoring has been ongoing since 2013. The pre-cautionary principle was applied throughout, as the full extent of impacts on avifauna at solar facilities is not presently known.
- The assessment of impacts is based on the baseline environment as it currently exists at the Study Area.
- Cumulative impacts include all renewable energy projects (i.e. Wind and Solar PV Facilities) within a 30km radius that have received an authorisation or is in process. Refer to Chapter 4 of the EIA Report for a complete list of projects that have been considered for the cumulative impact assessment.
- Conclusions drawn in this study are based on experience of the specialist on the species found on site and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The **Broader Area** is defined as the area encompassed by the 9 pentads where the project is located (see Figure 9-1 above). The **Study Area** is defined as the area covered by the land parcels where the proposed PV projects will be located (i.e. the full extent of the eight affected farm properties totalling approximately 8150 hectares (ha)). The full extent of these properties has been assessed in this study in order to identify environmental sensitivities and no-go areas. At the commencement of this Scoping and EIA Process, Original Scoping Buildable Areas were identified by the Project Developer following the completion of high-level environmental screening based on the Screening Tool. Following the identification of sensitivities during the Scoping Phase, the Project Developer took the sensitivities into account and formulated the **Revised Scoping Buildable Areas**. The Revised Scoping Buildable Areas were used to inform the design of the layout and were further assessed during this EIA Phase in order to identify the preferred development footprint of the proposed project on the approved site as contemplated in the accepted Scoping Report. The **development footprint** is where the actual development will be located, i.e. the footprint containing the PV solar arrays and associated infrastructure.

9.3 Description of Project Aspects relevant to the Avifaunal Specialist Assessment

The details of the Kudu Solar Facility 4 project are provided below. However, all the Solar Energy Facilities (SEFs) have the following relevant project components from an avifaunal perspective:

Kudu Solar Facility 4		
Component	**Description / dimensions**	
Area of PV Array	Proposed area occupied by PV Modules: Refer to the Chapter 2 of the EIA Report for feedback in this regard.	
Total developable area that includes all associated infrastructure within the fenced off area of the PV facility (excluding Access Roads)	Refer to the Chapter 2 of the EIA Report for feedback in this regard.	
Area occupied by inverter-transformer stations and height	Inverter-Transformer stations: 0.5 ha for the PV site (on average). The inverter stations will have a height of ± 3m each.	
On-site substation complex	The On-Site Substation Complex could include the following: • On-site Independent Power Producer (IPP) or Facility Substation (+-1 ha). • Battery Energy Storage System (BESS) (+-1 ha). • Switching Station and Collector Station (+-2 ha). This forms part of a separate Environmental Assessment or Registration process. The substation complex will approximately to 8 ha in area and will have a height of up to 10 m	
Temporary laydown area	This will extend up to 7 ha.	
Internal roads	New internal service roads will need to be established and these would either comprise farm (compacted dirt/gravel) roads or be paved.	
Upgrading of existing access road/s	Existing roads will be used as far as practically achievable and widened where required.	
Auxiliary buildings (e.g. Warehouses, Workshop, Site office, Operational and Maintenance building / centre, Guard houses, staff lockers, and Ablution facilities)	Maximum height (m):	Up to 10 m
	Footprint (m^2):	All Auxiliary buildings i.e. cumulative footprint up to 0.5 ha (i.e., 5000 m^2)
Battery storage	Battery technology type:	Lithium-ion or redox flow technology were assessed.
	Approximate footprint (ha):	A BESS would be developed within the on-site substation complex footprint (Covering approximately 8 ha)
	Maximum height (m):	Up to 10 m
	Capacity:	500MW/ 500MWh
Underground low voltage cables or cable trays	Maximum depth (m):	Up to 1.5 m
On-site medium voltage internal cables	Placement: Capacity: Depth:	Underground or above ground in certain sections 22 or 33 kV Maximum depth of 1.5 m
Fencing	The type of fencing will either be of palisade, mesh type or a fully electrified option (up to 3 m high). A single perimeter fence is proposed around the PV Facility.	

Refer to Chapter 2 of the EIA Report for a detailed description of the project components.

9.4 Baseline Environmental Description

9.4.1 Study Area Definition

The study area for the proposed Kudu Solar Facilities 1 to 12 is the full extent of the eight affected farm properties on which the proposed PV Facilities will be constructed. The full extent of these properties has been assessed in this study in order to identify environmental sensitivities and no-go areas. The total **study area** for the Kudu Solar Facilities 1 to 12 is approximately 8 150 hectares (ha).

At the commencement of this Scoping and EIA Process, the **Original Scoping Buildable Areas** were identified by the Project Developer following the completion of high-level environmental screening based on the Screening Tool.

Following the identification of sensitivities during the Scoping Phase, the Project Developer considered such sensitivities and formulated the **Revised Scoping Buildable Areas**. The **Revised Scoping Buildable Areas** were used to inform the design of the layout and further assessed during this EIA Phase in order to identify the preferred development footprint of the proposed project on the approved site as contemplated in the accepted Scoping Report. The **development footprint** is where the actual development will be located, i.e. the footprint containing the PV solar arrays and associated infrastructure and that also constitute the Project Area of Influence (PAOI).

9.4.2 General Description

9.4.2.1 Biomes and vegetation types

The Study Area is situated on a wide flat plain, with its centre approximately 32km southwest of the small town of Petrusville, and 23km from Potfontein railway stop in the Northern Cape Province, in the Nama Karoo biome, in the Upper Karoo Bioregion (Mucina & Rutherford 2006). The habitat in the Study Area is highly homogenous and consists of extensive plains with low shrub and a very prominent grass component. Mucina & Rutherford (2006) classify the vegetation in the Study Area as a mixture of Northern and Eastern Upper Karoo on the plains, with Besemkaree Koppies Shrubland on the ridges. Northern and Eastern Upper Karoo consist of shrubland dominated by dwarf microphyllous shrubs, with 'white' grasses of the genera *Aristida* and *Eragrostis* (these become prominent especially in the early autumn months after good summer rains, as is the case currently in the Study Area). Besemkaree Koppies Shrubland consist of two-layered karroid shrubland. The lower (closed-canopy) layer is dominated by dwarf small-leaved shrubs and, especially in precipitation-rich years, also by abundant grasses, while the upper (loose canopy) layer is dominated by tall shrubs (Mucina & Rutherford). There are no prominent rivers or drainage lines in the Study Area, however additional information is provided in the separate Aquatic Biodiversity Assessment (Chapter 8 of the EIA Report).

SABAP1 recognises six primary vegetation divisions (biomes) within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison *et al.* 1997). The criteria used by the authors to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of

previously published data. Using this classification system, the natural vegetation in the Study Area is classified as Grassy Karoo, a sub-category of the Nama Karoo biome. Grassy Karoo can be viewed as a transitional zone between the Nama Karoo and grassland biomes, although also primarily a dwarf shrub habitat, it shows a higher proportion of grass cover (Harrison *et al*. 1997).

The Potfontein area is semi - arid with extreme temperature variation. Mean annual precipitation averages around 204mm. The least amount of rainfall occurs in July with an average of 7mm. In February, the precipitation reaches its peak, with an average of 30mm. The temperatures are highest on average in January, with a mean daily maximum of 32 °C. With a mean daily maximum of 16 °C, July is the coldest month of the year, with temperatures dropping at night to - 4°C on cold nights (meteoblue.com 2022).

9.4.2.2 Important Bird Areas (IBAs)

The Study Area is located in the Platberg-Karoo Conservancy IBA (Marnewick *et al.* 2015).

The Platberg–Karoo Conservancy IBA covers the entire districts of De Aar, Philipstown and Hanover, including suburban towns. The landscape consists of extensive flat to gently undulating plains that are broken by dolerite hills and flat-topped inselbergs. The ephemeral Brak River flows in an arc from south-east to north-west, eventually feeding into the Orange River basin. Other ephemeral rivers include the Hondeblaf, Seekoei, Elandsfontein and Ongers rivers with a network of tributaries. Vanderkloof Dam is on the north-eastern boundary (Marnewick *et al.* 2015). This IBA is in the Nama Karoo and Grassland Biomes. The eastern Nama Karoo has the highest rainfall of all the Nama Karoo vegetation types and is thus ecotonal to grassland, with a complex mix of grass- and shrub-dominated vegetation types (Marnewick et al. 2015).

The land is used primarily for grazing and agriculture. Commercial livestock farming is mostly extensive wool and mutton production, with some cattle and game farming. Less than 5% of this IBA is cultivated under dry-land or irrigated conditions, and includes lucerne and prickly pear *Opuntia ficus-indica* orchards (Marnewick et al. 2015).

This IBA contributes significantly to the conservation of large terrestrial birds and raptors. These include Blue Crane *Anthropoides paradiseus*, Ludwig's Bustard *Neotis ludwigii*, Kori Bustard *Ardeotis kori*, Blue Korhaan *Eupodotis caerulescens*, Black Stork *Ciconia nigra*, Secretarybird *Sagittarius serpentarius*, Martial Eagle *Polemaetus bellicosus*, Verreauxs' Eagle *Aquila verreauxii* and Tawny Eagle *Aquila rapax*.

A total of 289 bird species are known to occur here. IBA trigger species that are expected to occur in the Study Area are the following:

- Blue Crane (Globally Vulnerable, Regionally Near-threatened)
- Blue Korhaan (Globally Near-threatened)
- Martial Eagle (Globally and regionally Endangered)
- Verreaux's Eagle (Regionally Vulnerable)
- Ludwig's Bustard (Globally and Regionally Endangered)
- Secretarybird (Globally Endangered, Regionally Vulnerable)

9.4.2.3 National Protected Areas and National Protected Areas Expansion Strategy (NPAES) focus areas

The Study Area does not fall within a protected area or an NPAES focus area.

9.4.2.4 The Renewable Energy Development Zones (REDZ)

The Study Area is not located in a REDZ.

9.4.2.5 The Strategic Transmission Corridors

The Study Area is located within the Central Strategic Transmission Corridor that was gazetted in GN 113 in 2018.

9.4.2.6 Verreaux's Eagle Habitat Suitability Model

The habitat suitability model developed by BLSA was overlayed on the Study Area to establish if the development footprint contains suitable breeding habitat. None of the development footprints for all 12 Solar PV Facilities contain highly suitable breeding habitat for the species. There is only one nest in the Study Area which is located on the Hydra-Perseus 1 765kV powerline, and this nest has been buffered appropriately (see Section 9.4.4.2).

9.4.2.7 Avifauna

A total of 85 species could potentially occur within the Broader Area where the project is located (**Appendix 9.E**). Of these, 21 are classified as priority species for solar developments. Of the 21 priority species, 17 were recorded during the monitoring, and 15 priority species have a medium to high probability of occurring regularly in the Study Area. Five SCC were recorded during the site surveys, namely Blue Crane, Martial Eagle, Verreaux's Eagle, Cape Vulture and White-backed Vulture.

See **Appendix 9.E** for a list of species potentially occurring in the Broader Area and **Appendix 9.F** for the species recorded during the pre-construction monitoring. The possibility of priority species. Including SCC, occurring in the Study Area and potential impacts on them by the proposed PV facilities and associated infrastructure, are listed in Table 9-1 below.

Table 9-1: Priority species potentially occurring in the Study Area.

CR = Critically Endangered EN = Endangered VU = Vulnerable NT = Near-threatened LC = Least concern

Species name	Scientific name	SABAP2 reporting rate		Status					Recorded during monitoring	Likelihood of regular occurrence	Habitat					Impacts				
		Full protocol	Ad hoc protocol	Red List Global	Red List Regional	Endemic (SA)	Endemic (SA) - detail	IBA trigger species			Grassy Karoo	Alien trees	Surface water	Ridges (koppies)	High voltage lines	Collisions with solar panels	Displacement: Disturbance	Displacement: Habitat transformation	Entrapment in fences	Electrocution in substations and 33kV overhead lines
Black-headed Canary	*Serinus alario*	0.00	33.33	-	-	x	Near endemic			L	x		x			x	x	x		
Blue Crane	*Grus paradisea*	33.33	16.67	VU	NT			x	x	H	x		x				x	x	x	
Blue Korhaan	*Eupodotis caerulescens*	0.00	8.33	NT	LC	x	Endemic (SA, Lesotho, Swaziland)	x		L	x					x	x	x	x	
Cloud Cisticola	*Cisticola textrix*	0.00	0.00	-	-	x	Near endemic		x	L	x					x	x	x		
Egyptian Goose	*Alopochen aegyptiaca*	33.33	16.67	-	-				x	M		x	x		x	x				x
Fairy Flycatcher	*Stenostira scita*	0.00	0.00	-	-	x	Near endemic		x	L	x					x	x	x		
Greater Kestrel	*Falco rupicoloides*	33.33	16.67	-	-				x	H	x	x			x		x	x		x
Jackal Buzzard	*Buteo rufofuscus*	0.00	8.33	-	-	x	Near endemic		x	M	x	x	x	x	x		x	x		x
Karoo Prinia	*Prinia maculosa*	0.00	0.00	-	-	x	Near endemic		x	L	x					x	x	x		
Large-billed Lark	*Galerida magnirostris*	33.33	8.33	-	-	x	Near endemic		x	H	x					x	x	x		

Species name	Scientific name	SABAP2 reporting rate		Status					Recorded during monitoring	Likelihood of regular occurrence	Habitat					Impacts				
		Full protocol	Ad hoc protocol	Red List Global	Red List Regional	Endemic (SA)	Endemic (SA) - detail	IBA trigger species			Grassy Karoo	Alien trees	Surface water	Ridges (koppies)	High voltage lines	Collisions with solar panels	Displacement: Disturbance	Displacement: Habitat transformation	Entrapment in fences	Electrocution in substations and 33kV overhead lines
Martial Eagle	*Polemaetus bellicosus*	0.00	0.00	EN	EN			x	x	M	x	x	x	x	x		x	x		x
Pale Chanting Goshawk	*Melierax canorus*	100.00	41.67	-	-				x	H	x	x	x		x		x	x		x
Pied Starling	*Lamprotornis bicolor*	33.33	8.33	-	-	x	Endemic (SA, Lesotho, Swaziland)		x	H	x	x	x			x	x	x		
Rock Kestrel	*Falco rupicolus*	0.00	0.00	-	-				x	M	x	x		x				x		x
South African Cliff Swallow	*Petrochelidon spilodera*	33.33	0.00	-	-	x	Endemic (SA, Lesotho, Swaziland) Breeding		x	M	x					x		x		
Three-banded Plover	*Charadrius tricollaris*	0.00	0.00	-	-				x	L			x			x				
Verreaux's Eagle	*Aquila verreauxii*	66.67	0.00	-	VU			x	x	H		x	x	x	x	x	x	x		x
Cape Vulture	*Gyps coprotheres*	0.00	0.00	VU	EN	x	Near endemic		x	M	x	x	x	x	x			x		x
White-backed Vulture	*Gyps africanus*	0.00	0.00	CR	CR				x	M	x	x	x		x			x		x
Ludwig's Bustard	*Neotis ludwigii*	0.00	0	EN	EN			x		H	x						x	x	x	
Secretarybird	*Sagittarius serpentarius*	0.00	0	EN	VU			x		M	x	x	x				x	x	x	

9.4.3 Project Specific Description

The habitat in the development footprints for Kudu Solar Facility 1 - 12 is similar in that all the footprints contain the following avifaunal habitat features:

- Grassy Karoo;
- Boreholes with reservoirs;
- Alien trees;
- Proximity to high voltage lines (<2km); and
- Proximity to surface water (<1km).

None of the development footprints has a specific significant habitat feature that distinguishes it from any of the other development footprints.

9.4.3.1 Bird Habitat

Please refer to Section 9.4.2.1 for a detailed description of the Biome and main Vegetation Type of the Study Area and Development Footprints. Below follows a discussion of the bird specific habitats identified in the Study Area:

- **Grassy Karoo**

This habitat feature is described above under Section 9.4.2.1. See Table 9-1 for a list of priority avifauna that could utilise this habitat feature.

See Figures 9-2 and 9-3 for examples of the Grassy Karoo habitat.

Figure 9-2: Typical Grassy Karoo on the plains in the Study Area.

Figure 9-3: A patch of dwarf shrubs in the Study Area

- **Surface water**

Surface water is of specific importance to avifauna in this semi-arid Study Area. The Study Area contains many boreholes with water reservoirs and a few small ground dams (Figure 9-4). Boreholes with open water troughs are important sources of surface water for priority avifauna for drinking and bathing. See Table 9-1 for a list of priority avifauna that could utlise this habitat feature.

Figure 9-4: A typical borehole and water trough in the Study Area.

- **Trees**

The Study Area is generally devoid of trees, except for isolated clumps of trees at homesteads and boreholes, where a mixture of alien and indigenous trees is growing (Figure 9-5). The trees could attract a variety of bird species for purposes of nesting and roosting. See Table 9-1 for a list of priority avifauna that could utlise this habitat feature.

Figure 9-5: Trees are typically found at localities in the Study Area with surface water.

- **High voltage lines**

High voltage lines are an important potential roosting and breeding substrate for large raptors in the Karoo (Jenkins *et al*. 2013). The Hydra – Perseus 1 765kV high voltage line bisects the Study Area from south to north, the Gamma – Perseus 1 765kV high voltage line runs just west of the Study Area, and the Hydra – Perseus 400kV high voltage line runs approximately 4km east of the closest border of the Study Area. A suspected Verreaux's Eagle nest is present at -30.227660° 24.329773° on the Hydra – Perseus 1 765kV high voltage line. Five White-backed Vultures and a Cape Vulture were also observed perching on the high voltage lines in the Study Area during the first survey. There is increasing evidence that vultures are using high voltage lines in the Karoo (personal observation), mostly in the non-breeding season (January to March), and that they could be encountered anywhere in the Broader Area. See Table 9-1 for a list of priority avifauna that could utlise this habitat feature.

See Figure 9.6 for an image of the suspected Verreaux's Eagle nest in the Study Area.

Figure 9-6: Suspected Verreaux's Eagle nest in the Study Area.

- **Ridges (koppies)**

The Study Area contains one prominent ridge (koppie) known as Basberg in the south of the Study Area, which rises to a height of 1 465m/asl. There are also a cluster of lower ridges on the extreme western side of the Study Area, just north of PV 6. There are a number of ridges in the Broader Area, starting approximately 4km to the south of the Study Area and continuing further south, with names like Perdekop and Tierberg, rising to a height of 1 615m/asl. See Table 9-1 for a list of priority avifauna that could utlise this habitat feature.

9.4.3.2 Results of the pre-construction monitoring

Pre-construction surveys were conducted at the Study Area in the following periods:

- Autumn: 29 March to 01 April 2022
- Winter: 10 – 13 May 2022

See Appendix 9.F for details and the results of the pre-construction monitoring.

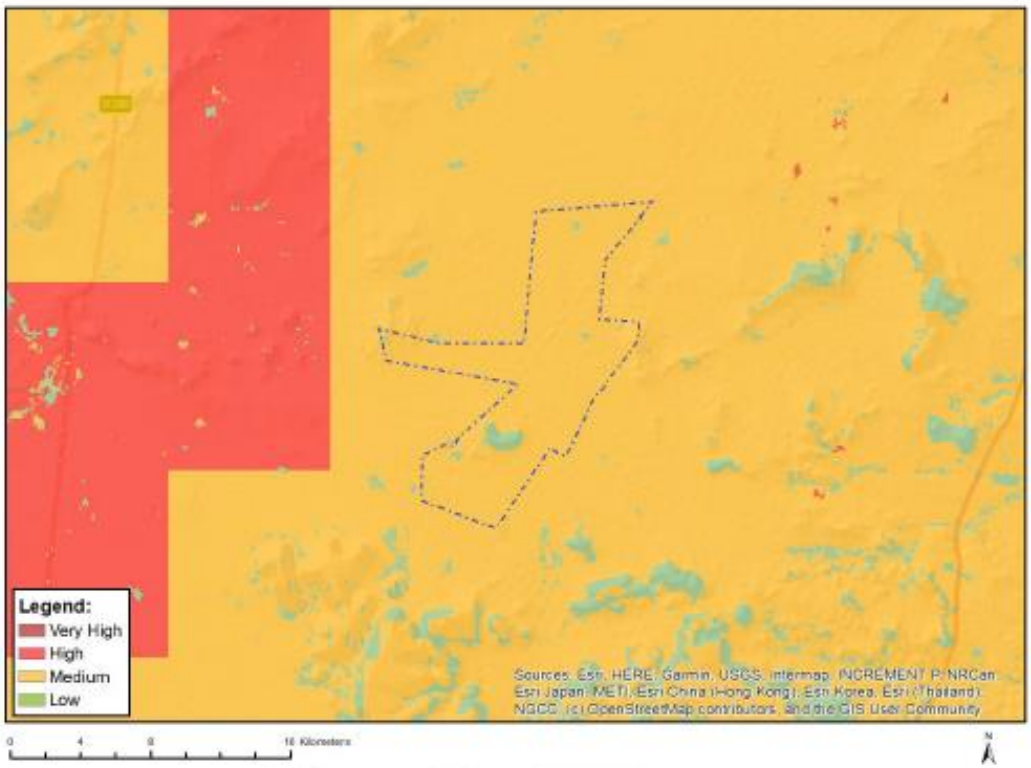
9.4.4 Identification of Environmental Sensitivities

9.4.4.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

The Study Area and immediate environment is classified as **Medium** and **Low** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme. The development footprints for the 12 Solar Facilities specifically are all classified as **Medium**. The Medium classification is linked to the potential occurrence of Ludwig's Bustard (Globally and Regionally Endangered), Verreaux's Eagle (Regionally Vulnerable) and Tawny Eagle (Regionally Endangered). The Study Area contains confirmed habitat for SCC as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, Government Notice 1150, 30 October 2020). The occurrence of SCC was confirmed during the on-site surveys i.e. Martial Eagle (Globally and Regionally Endangered), Verreaux's Eagle (Regionally Vulnerable), Blue Crane (Globally Vulnerable and Regionally Near-threatened), Cape Vulture (Globally Vulnerable and Regionally Endangered) and White-backed Vulture (Globally and Regionally Endangered) were recorded in the Study Area, and habitat for Secretarybird (Globally and Regionally Endangered) and Ludwig's Bustard.

Based on the Site Sensitivity Verification survey (**Appendix 9.C**) conducted on 28 March - 1 April 2022, and the on-site surveys during the pre-construction monitoring (**Appendix 9.F**), the classification of **Medium** sensitivity for avifauna in the screening tool is therefore disputed **for all 12** development footprints, and it is suggested that a **High** rating would be more appropriate due to the presence of the above SCC. **None of the development footprints has a specific habitat feature that distinguishes it from the other development footprints which would justify a lesser rating (7). Therefore, Kudu Solar Facility 4 is rated with a High sensitivity.**

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)
Low	Subject to confirmation
Medium	Aves-Aquila rapax
Medium	Aves-Aquila verreauxii
Medium	Aves-Neotis ludwigii

Figure 9-7: The National Web-Based Environmental Screening Tool map of the Study Area, indicating sensitivities for the Terrestrial Animal Species theme. The Medium sensitivity classification is linked to Ludwig's Bustard (*Neotis ludwigii*), Tawny Eagle (*Aquila rapax*) and Verreaux's Eagle (*Aquila verreauxii*).

9.4.4.2 Specialist Sensitivity Analysis and Verification

9.4.4.2.1 All infrastructure exclusion zones

Verreaux's Eagle nest: A 1km all infrastructure exclusion zone is recommended to prevent the displacement of the breeding pair during the construction phase due to disturbance (Figure 9-8). In addition, the buffer area will reduce the risk of injury to the juvenile bird due to collision with the solar panels, when it starts flying and practicing its hunting technique around the nest. None of the development footprints fall within this zone. The 1km no disturbance buffer is based on personal observations, and is also the recommended no disturbance buffer in the latest best practice guidelines for Verreaux's Eagles and wind farm developments. (Ralston – Patton, S & Murgatroyd M. 2021. Verreaux's Eagles and Wind Farms. Guidelines for impact assessment, monitoring, and mitigation. Second edition. Birdlife South Africa). In any event, the closest development area is located 2km away from the Verreaux's Eagle nest which is more than adequate to prevent any disturbance of the breeding birds.

9.4.4.2.2 Solar panel exclusion zones (other infrastructure allowed)

Waterpoints: Surface water in this semi-arid habitat is crucially important for priority avifauna and many non-priority species. The development footprints and the immediate surrounding area contain several boreholes which are sources of surface water. It is preferable to leave some open space where possible with no solar panels, for birds to access and leave the surface water area unhindered[2]. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. This will also benefit Blue Cranes which prefer to breed close to water bodies. It is noted that the area surrounding the development footprints contain several boreholes that will not be affected by the proposed development, and these boreholes will ensure that the local avifauna will still have access to adequate sources of surface water.

9.4.4.2.3 High sensitivity zones

The entire Study Area is a high sensitivity zone due to the potential presence of several SCC (see 4.4.1) including Ludwig's Bustard, Secretarybird, Martial Eagle, Cape Vulture and White-backed Vulture which could utilise the whole Study Area for foraging. However, these species do not require specific avoidance measures because there is still adequate habitat available outside the Study Area.

Figures 9-8 and 9-9 below are avifaunal sensitivity maps, indicating sensitivity areas identified for PV developments for the Study Area and Kudu PV 4, respectively. Figure 9-10[3] contains the final layout of Kudu PV 4, which has taken the avifaunal sensitivities into account.

[2] While some of the waterpoints in the development footprint will be removed, the applicant has agreed to retain some water points which will be buffered by a minimum circular solar panel exclusion zone of 50m. The removal of some of the waterpoints will therefore not be a significant impact.

[3] From a mapping aesthetic perspective, the laydown areas and larger on-site substation complex are not displayed on the map in Figure 9.10, however they have been considered in this assessment, along with all project components discussed in the project description. Refer to Chapter 2 of the EIA Report for additional layout maps.

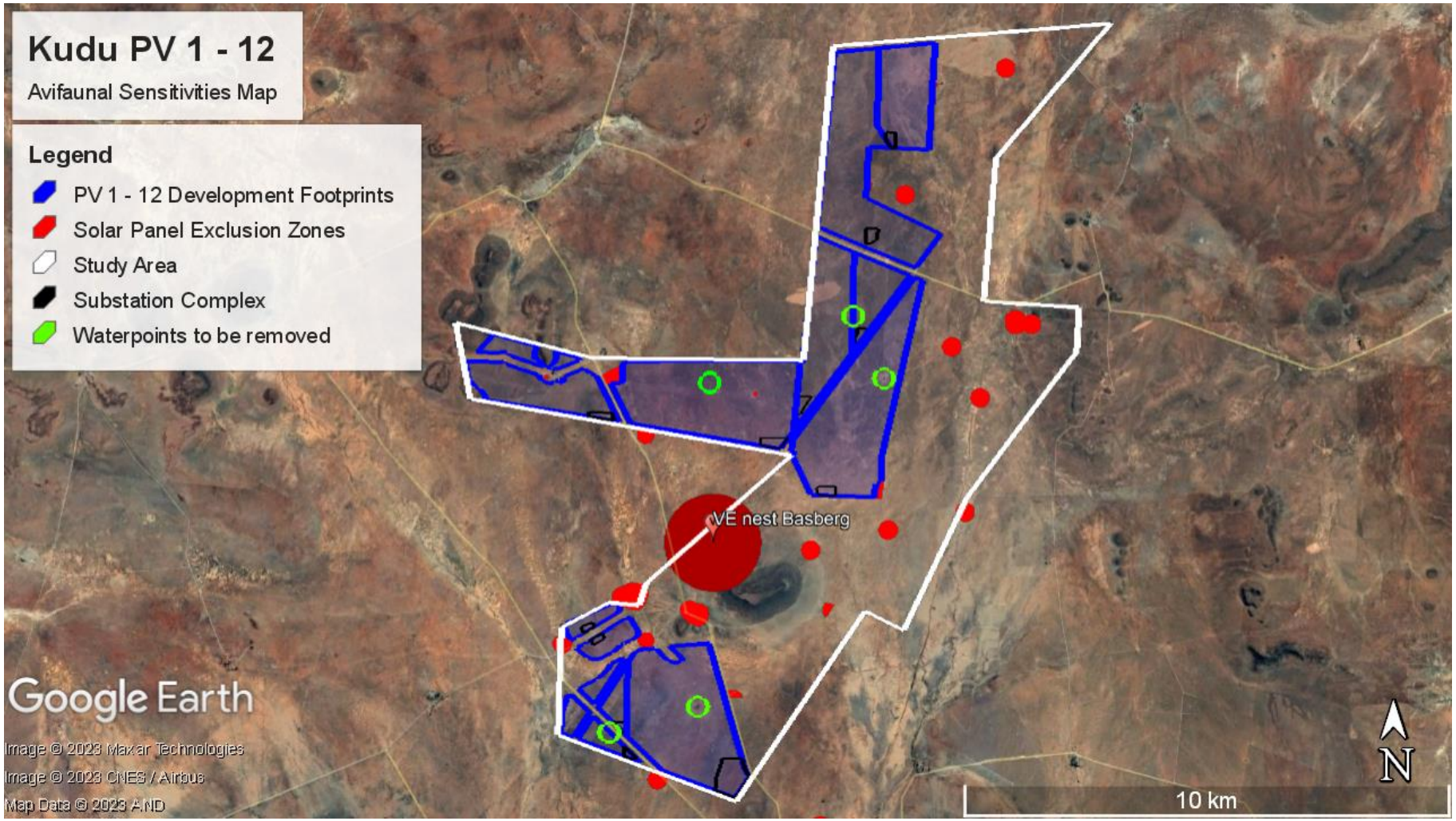


Figure 9-8: Avifaunal sensitivity zones identified for the Study Area and Kudu PV 1 – 12.

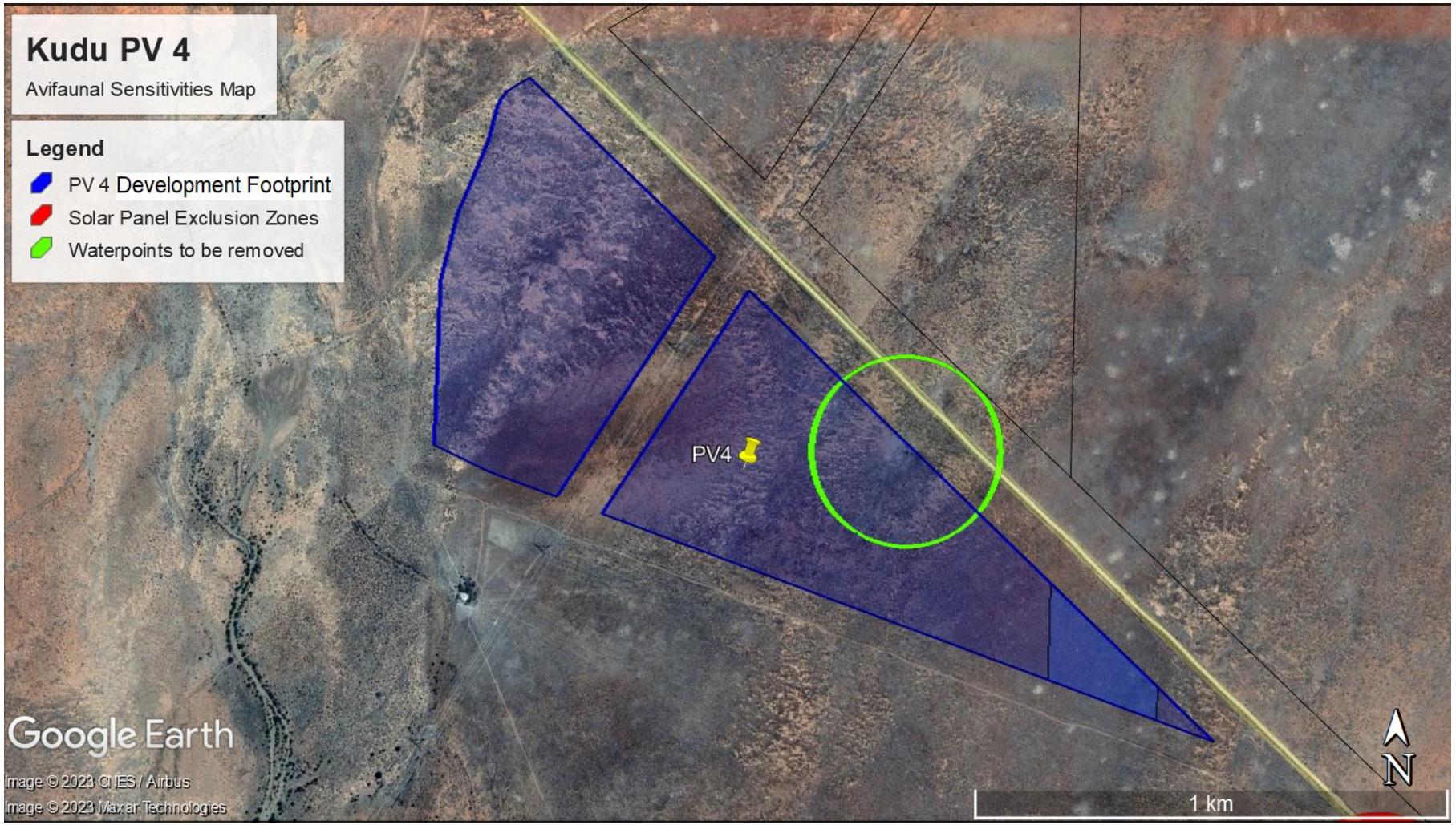


Figure 9-9: Avifaunal sensitivity zones identified for Kudu PV 4.

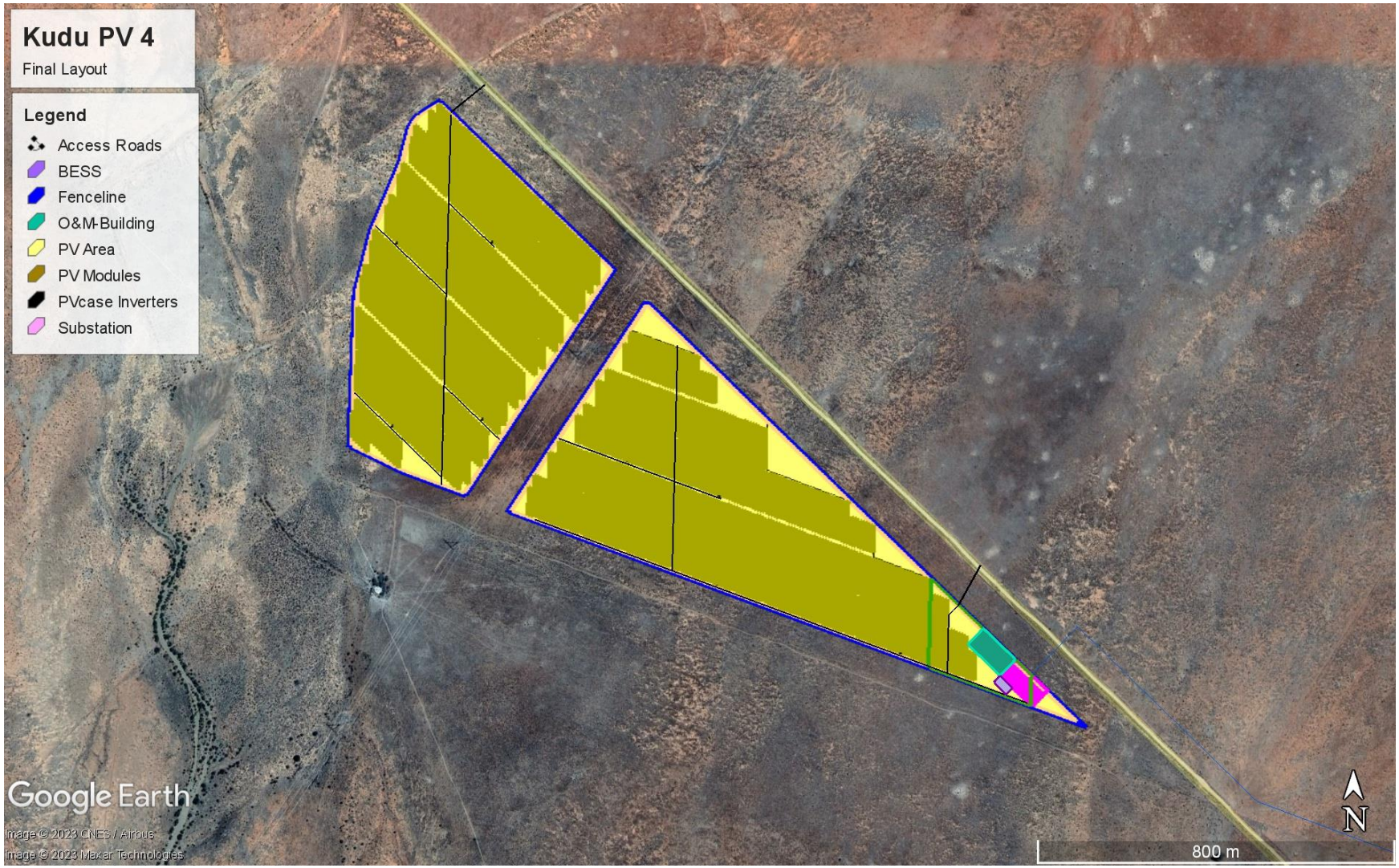


Figure 9-10: Final layout of Kudu PV 4, which has taken the avifaunal sensitivities into account.

9.4.4.2.4 Kudu Solar Facility 4 and associated infrastructure

The entire development footprint is High Sensitivity. The development footprint does not overlap with any waterpoint solar panel exclusion zones, it overlaps with a waterpoint which will be removed, as discussed above, and this does not present a significant risk to avifauna (**Figure 9-9** above).

9.4.4.3 Sensitivity Analysis Summary Statement

Based on the field surveys, the reclassification to High sensitivity for avifauna in the screening tool is suggested for all 12 proposed projects, including Kudu Solar Facility 4, which is the subject of this report. The presence of and suitable habitat for SCC in the whole Study Area was confirmed during the surveys i.e. Martial Eagle (Globally and Regionally Endangered), Verreaux's Eagle (Regionally Vulnerable), Blue Crane (Globally Vulnerable and Regionally Near-threatened), Cape Vulture (Globally Vulnerable and Regionally Endangered) and White-backed Vulture (Globally and Regionally Endangered). The Study Area also contain habitat for Secretarybird (Globally and Regionally Endangered) and Ludwig's Bustard (Globally and Regionally Endangered).

9.5 Alternative Development Footprints

The Animal Species Protocol (GN 1150) states that the study must identify any alternative development footprints within the preferred site which would be of "low" or "medium" sensitivity as identified by the screening tool and verified through the site sensitivity verification. The protocol further states that a motivation must be provided if there were any development footprints identified as per the latter that were identified as having "low" or "medium" terrestrial animal species sensitivity and were not considered appropriate. Note that the entire study area was assessed in this Scoping and EIA Process, and it was confirmed that the entire study area is High sensitivity. Furthermore, as indicated in Chapter 5 of the EIA Report, no other site alternatives were considered as the site was deemed feasible based on various site suitability factors. Therefore, no other alternative development footprints of low or medium sensitivity were identified and not considered appropriate for this study.

As indicated above, following the identification of sensitivities during the Scoping Phase, the Project Developer considered such sensitivities and formulated the Revised Scoping Buildable Areas. The Revised Scoping Buildable Areas led to the identification of the development footprints and detailed layouts in the EIA Phase. The development footprint and detailed layout are considered suitable from an avifaunal perspective, as the sensitivities identified above have been taken into consideration. The development footprint and detailed layout are shown in Figure 9-10. Changes to the detailed layouts are deemed acceptable if the changes remain within the approved buildable areas / development footprints and area assessed during the Scoping and EIA Process with no-go sensitive areas avoided.

9.6 Issues, Risks and Impacts

9.6.1 Identification of Potential Impacts/ Risks

A literature review reveals a scarcity of published, scientifically examined information regarding large-scale PV plants and birds. The reason for this is mainly that large-scale PV plants is a relatively recent phenomenon. The main source of information for these types of impacts are from compliance reports and a few government-sponsored studies relating to recently constructed solar plants in the south-western United States. In South Africa, only two published scientific studies have been conducted on the environmental impacts of PV plants in a South African context (Rudman et al., 2017; Visser et al., 2018). A related scientific study has also been conducted upon the effects of concentrated solar power facilities on wildlife in South Africa (Jeal et al., 2019).

The potential impacts that have been identified are listed and discussed below.

9.6.1.1 Construction Phase

- Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure.

9.6.1.2 Operational Phase

- Displacement due to habitat transformation associated with the presence of the solar PV plant and associated infrastructure.
- Collisions with the solar panels.
- Entrapment in perimeter fences.
- Electrocutions in the onsite substation complex.
- Electrocution of priority species on the internal 33kV powerlines.

9.6.1.3 Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure.

9.6.1.4 Cumulative Impacts

- Displacement due to disturbance associated with the construction and decommissioning of the solar PV plants and associated infrastructure.
- Displacement due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure.
- Collisions with the solar panels.
- Entrapment in perimeter fences.
- Electrocutions in the onsite substation complexes.
- Electrocution of priority species on the internal 33kV powerlines.

- **Impact Trauma (Collisions)**

This impact refers to collision-related fatality i.e., fatality resulting from the direct contact of the bird with a project structure(s). This type of fatality has been occasionally documented at solar projects of all technology types (McCrary *et al.* 1986; Hernandez *et al.* 2014; Kagan *et al.* 2014). In some instances, the bird is not killed outright by the collision impact, but succumbs to predation later, as it cannot avoid predators due to its injured state.

Sheet glass used in commercial and residential buildings has been well established as a hazard for birds. When the sky is reflected in the sheet glass, birds fail to see the building as an obstacle and attempt to fly through the glass, mistaking it for empty space (Loss *et al.* 2014). Although very few cases have been reported it is possible that the reflective surfaces of solar panels could constitute a similar risk to avifauna.

An extremely rare but potentially related problem is the so-called “lake effect” i.e. it seems possible that reflections from solar facilities' infrastructure, particularly large sheets of dark blue PV panels, may attract birds in flight across the open desert, who mistake the broad reflective surfaces for water (Kagan *et al.* 2014)[4]. The unusually high percentage of waterbird mortalities at the Desert Sunlight PV facility (44%) may support the “lake effect” hypothesis (West 2014). Although in the case of Desert Sunlight, the proximity of evaporation ponds may act as an additional risk increasing factor, in that birds are both attracted to the water feature and habituated to the presence of an accessible aquatic environment in the area. This may translate into the misinterpretation of diffusely reflected sky or horizontal polarised light source as a body of water. However, due to limited data it would be premature to make any general conclusions about the influence of the lake effect or other factors that contribute to fatality of water-dependent birds. None of the proposed Kudu PV developments are situated near a large waterbody. The activity and abundance of water-dependent species near solar facilities may depend on other site-specific or regional factors, such as the surrounding landscape (Walston *et al.* 2015). Koskiuch *et al.* (2020) found that water-obligate birds, which rely on water for take-off and landing, occurred at 90% (9/10) of site-years at 7 sites in the Sonoran and Mojave Deserts Bird Conservation Region in the USA from January 2013 to September 2018. However, they stressed that their statements should not be interpreted as evidence that there will be water-obligate bird mortality at PV facilities developed in areas with concentrations of migrating or overwintering water obligates because the causal mechanism for fatality risk is unknown. Although scientific evidence is limited, the potential impact was considered.

Weekly mortality searches at 20% coverage were conducted at the 250MW, 1300ha California Valley Solar Ranch PV site (Harvey & Associates 2014a and 2014b). According to the information that could be sourced from the internet (two quarterly reports), 152 avian mortalities were reported for the period 16 November 2013 – 15 February 2014, and 54 for the period 16 February 2014 – 15 May 2014, of which approximately 90% were based on feather spots which precluded a finding on the cause of death. These figures give an estimated unadjusted 1 030 mortalities per year, which is obviously an underestimate as it does not include adjustments for carcasses removed by scavengers and missed by searchers. The authors stated clearly that these quarterly reports do not include the results of

[4] This could either result in birds colliding directly with the solar panels or getting stranded and unable to take off again because many aquatic bird species find it very difficult and sometimes impossible to take off from dry land e.g. grebes and cormorants. This exposes them to predation, even if they do not get injured through direct collisions with the panels.

searcher efficiency trials, carcass removal trials, or data analyses, nor does it include detailed discussions.

In a report by the National Fish and Wildlife Forensic Laboratory (Kagan *et al.* 2014), the cause of avian mortalities was estimated based on opportunistic avian carcass collections at several solar facilities, including the 550MW, 1 600ha Desert Sunlight PV plant. Impact trauma emerged as the highest identifiable cause of avian mortality, but most mortality could not be traced to an identifiable cause.

Walston *et al.* (2015) conducted a comprehensive review of avian fatality data from large scale solar facilities (all technology types) in the USA. Collision as cause of death (19 birds) ranked second at Desert Sunlight PV plant and California Valley Solar Ranch (CVSR) PV plant, after unknown causes. Cause of death could not be determined for over 50% of the fatality observations and many carcasses included in these analyses consisted only of feather spots (feathers concentrated together in a small area) or partial carcasses, thus making determination of cause of death difficult. It is anticipated that some unknown fatalities were caused by predation or some other factor unrelated to the solar project. However, they found that the lack of systematic data collection and standardization was a major impediment in establishing the actual extent and causes of fatalities across all projects.

The only scientific investigation of potential avifaunal impacts that has been performed at a South African PV facility was completed in 2016 at the 96MW Jasper PV solar facility (28°17′53″S, 23°21′56″E) which is located on the Humansrus Farm, approximately 4 km south-east of Groenwater and 30km east of Postmasburg in the Northern Cape Province (Visser *et al.* 2018). The Jasper PV facility contains 325 360 solar panels over a footprint of 180 hectares with the capacity to deliver 180 000 MWh of renewable electricity annually. The solar panels face north at a fixed 20° angle, reaching a height of approximately 1.86 m relative to ground level with a distance of 3.11 m between successive rows of panels. Mortality surveys were conducted from the 14th of September 2015 until the 6th of December 2015, with a total of seven mortalities recorded among the solar panels which gives an average rate of 0.003 birds per hectare surveyed per month. All fatalities were inferred from feather spots. Extrapolated bird mortality within the solar field at the Jasper PV facility was 435 birds/yr (95% CI 133 - 805). The broad confidence intervals result from the small number of birds detected. The mortality estimate is likely conservative because detection probabilities were based on intact birds, and probably decrease for older carcasses and feather spots. The study concluded inter alia that the short study period, and lack of comparable results from other sources made it difficult to provide a meaningful assessment of avian mortality at PV facilities. It further stated that despite these limitations, the few bird fatalities that were recorded might suggest that there is no significant collision-related mortality at the study site. The conclusion was that to fully understand the risk of solar energy development on birds, further collation and analysis of data from solar energy facilities across spatial and temporal scales, based on scientifically rigorous research designs, is required (Visser *et al.* 2018).

The results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. Kosciuch *et al*. (2020) synthesized results from fatality monitoring studies at 10 PV solar facilities across 13 site years in California and Nevada in the USA. Annual fatality rates never exceeded 2.99 fatalities/MW/year (1.03 fatalities/hectare/year), and three of the four top species detected were ground-dwelling species.

It is clear from this limited literature survey that the lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely speculative and based on professional opinion.

Based on the lack of evidence to the contrary, it is not foreseen that collisions with the solar panels at the PV facility will be a significant impact. The priority species which would most likely be potentially affected by this impact are mostly small, ground-dwelling birds which forage between the solar panels, and possibly raptors which prey on them.

See Table 9.1 for list of species which could potentially be affected by this impact.

- **Entrapment in Perimeter Fences**

Visser et al. (2018) recorded a fence-line fatality of an Orange River Francolin *Scleroptila gutturalis* resulting being trapped between the inner and outer perimeter fence of the facility; additionally, three Red-crested Korhaans were claimed to be unable to escape between these two fences without intervention from facility personnel. Considering that one would expect the birds to be able to take off in the lengthwise direction (parallel to the fences), it seems possible that the birds panicked when they were approached by observers and thus flew into the fence. Potentially, too-close a parallel configuration of double-fenced perimeters can cause fatalities, particularly of larger terrestrial birds, by way of entrapment, and especially if disturbed by people. This risk remains low, however, with Visser et al. (2018) tentatively presenting a fatality rate of 0.002 birds per km per month from this risk factor, although qualifying that the single documented fatality was inadequate for robust extrapolations. Owls are also prone to getting entangled in barbed wire fences (personal observation).

See Table 9.1 for list of species which could potentially be affected by this impact.

- **Displacement due to habitat transformation associated with the operation of the solar PV facility and associated infrastructure**

Ground-disturbing activities affect a variety of processes in arid areas, including soil density, water infiltration rate, vulnerability to erosion, secondary plant succession, invasion by exotic plant species, and stability of cryptobiotic soil crusts. These processes have the ability – individually and together – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the desert landscape, including the construction and decommissioning of utility-scale solar energy facilities, has the potential to increase soil erosion. Erosion can physically and physiologically affect plant species and can thus adversely influence primary production and food availability for wildlife (Lovich & Ennen 2011).

Solar energy facilities require substantial site preparation (including the removal of vegetation) that alters topography and, thus, drainage patterns to divert the surface flow associated with rainfall away from facility infrastructure. Channelling runoff away from plant communities can have dramatic negative effects on water availability and habitat quality in arid areas. Areas deprived of runoff from sheet flow support less biomass of perennial and annual plants relative to adjacent areas with uninterrupted water-flow patterns (Lovich & Ennen 2011).

The activities listed below are typically associated with the **construction and operation** of solar facilities and could have direct impacts on avifauna through the transformation of habitat (County of Merced 2014):

- Preparation of solar panel areas for installation, including vegetation clearing, grading, cut and fill;
- Excavation/trenching for water pipelines, cables, fibre-optic lines, and the septic system;
- Construction of piers and building foundations;
- Construction of new dirt or gravel roads and improvement of existing roads;
- Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes;
- Soil compaction, dust, and water runoff from construction sites;
- Degradation of water quality in drainages and other water bodies resulting from project runoff;
- Maintenance of fire breaks and roads; and
- Weed removal, brush clearing, and similar land management activities related to the ongoing operation of the project.

These activities could have an impact on birds breeding, foraging and roosting in or in close proximity through transformation of habitat, which could result in temporary or permanent displacement.

In a study comparing the avifaunal habitat use in PV arrays with adjoining managed grassland at airports in the USA, DeVault *et al.* (2014) found that species diversity in PV arrays was reduced compared to the grasslands (37 vs 46), supporting the view that solar development is generally detrimental to wildlife on a local scale.

In order to identify functional and structural changes in bird communities in and around the development footprint, Visser *et al.* (2018) gathered bird transect data at the 180 hectares, 96MW Jasper PV solar facility in the Northern Cape, representing the solar development, boundary, and untransformed landscape. The study found both bird density and diversity per unit area was higher in the boundary and untransformed landscape, however, the extent therefore was not considered to be statistically significant. This indicates that the PV facility matrix is permeable to most species. However, key environmental features, including available habitat and vegetation quality are most likely the overriding factors influencing species' occurrence and their relative density within the development footprint. The most significant finding was that the distribution of birds in the landscape changed, from a shrubland to open country and grassland bird community, in response to changes in the distribution and abundance of habitat resources such as food, water and nesting sites. These changes in resource availability patterns were detrimental to some bird species and beneficial to others. Shrubland specialists appeared to be negatively affected by the presence of the PV facility. In contrast, open country/grassland and generalist species, were favoured by its development (Visser *et al.* 2018).

See Table 9.1 for list of species which could potentially be affected by this impact.

- **Displacement due to disturbance associated with the construction of the solar PV facility and associated infrastructure**

As far as disturbance is concerned, it is likely that all the avifauna, including all the priority species, will be temporarily displaced in the footprint area, either completely or more likely partially (reduced

densities) during the construction phase, due to the disturbance associated with the construction activities e.g., increased vehicle traffic, and short-term construction-related noise (from equipment) and visual disturbance.

- **Electrocution in the onsite substation and the 33kV overhead lines**

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). The electrocution risk is largely determined by the design of the electrical hardware. There could be an electrocution risk to certain species, mostly raptors, but also some waterbirds, on the internal 33kV powerlines within the footprint of the PV facilities, should the decision be to not go underground with the reticulation network. This is especially a major problem for the larger Red Listed species, e.g. Martial Eagle, as it is envisaged that they will frequently perch on the power poles. Electrocution of priority avifauna in the onsite substations could also potentially happen, but this is likely to be a rare event and unlikely to affect SCC.

9.6.2 Summary of Issues identified during the Public Consultation Phase

This section discusses the comments received from stakeholders and Interested and Affected Parties (I&APs) relating to avifauna during the Scoping Phase. Responses have been provided below to indicate how such comments have been addressed or considered during the EIA Phase. Note that the comments below were made by the Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform: Environmental Research and Development.

Comment 1: *The 1km around the Verreaux eagle nests are questioned in light of the associated power lines that will be constructed for the each of these PV developments. It is recommended that habitat fragmentation must be looked at during the assessment for this species. Verreaux eagle habitat mapping is also recommended. Please liaise with Birdlife South Africa in this regard, contact person Samantha Ralston-Paton, energy@birdlife.org.za.*

Response 1: As indicated above, in Section 9.4.4.2, a Very High sensitivity, no go area (i.e. all infrastructure exclusion zone), has been demarcated around the Verreaux's Eagle nest. Specifically, a 1 km all infrastructure exclusion zone is recommended to prevent the displacement of the breeding pair during the construction phase due to disturbance. The buffer area will also reduce the risk of injury to the juvenile bird due to collision with the solar panels, when it starts flying and practicing its hunting technique around the nest. The development footprint for the proposed project does not encroach onto this area.

Note that the power lines from the PV Facilities will be subjected to separate Environmental Assessment processes. However, this 1 km exclusion zone will be abided by for the placement of the power lines also. The exclusion zone recommended by the specialists is in line with exclusion zones for both Solar PV and associated EGI, such as power lines. Wind energy developments usually have larger exclusion zones for such species. Habitat fragmentation is not a factor as the habitat in the PV development footprints is not suitable for Verreaux's Eagle. As noted in Section 9.4.2.6 of this chapter, mapping of Verreaux's Eagle habitat has been considered during the EIA Phase for this species. The

habitat suitability model developed by BLSA was overlayed on the Study Area, and none of the development footprints contain highly suitable breeding habitat for this species. There is only one nest in the Study Area, which has been buffered appropriately (see Section 9.4.4.2).

Comment 2: *Lake effect on birds (mortalities and injuries on birds) as the site is located in an Important Bird Area.*

Response 2: This has been discussed in detail in Section 9.6.2 of this chapter (Impact Trauma (Collisions)). The lake effect has so far proven not to be a major cause of avifaunal impact mortality and seems to be associated with large permanent waterbodies in close proximity to the proposed development. As noted above, the unusually high percentage of waterbird mortalities at the Desert Sunlight PV facility (44%) in California in the USA may support the "lake effect" hypothesis (West 2014). Although in the case of Desert Sunlight, the proximity of evaporation ponds may act as an additional risk increasing factor, in that birds are both attracted to the water feature and habituated to the presence of an accessible aquatic environment in the area. This may translate into the misinterpretation of diffusely reflected sky or horizontal polarised light source as a body of water. However, due to limited data it would be premature to make any general conclusions about the influence of the lake effect or other factors that contribute to fatality of water-dependent birds. None of the proposed Kudu PV developments are situated near a large waterbody.

9.7 Impact Assessment

9.7.1 Potential Impacts during the Construction Phase

9.7.1.1 Impact 1: Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure

The noise and movement associated with the construction activities at the proposed PV plant will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site-specific spatial extent and a short-term duration due to the temporary nature of the construction phase. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed **Section 9.7.1.2** below.

9.7.1.2 Impact Summary Tables: Construction Phase

The rating of the impacts identified for the construction phase is discussed in this section.

Impact 1	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
CONSTRUCTION PHASE						
Impact 1: Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure	*Status*	*Negative*	*Moderate (3)*	• Activity should as far as possible be restricted to the footprint of the infrastructure. • Measures to control noise and dust should be applied according to best practice in the industry at the time. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. • Access to the rest of the property must be restricted. • The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned. • A 1km all infrastructure exclusion zone around the Verreaux's Eagle nest at -30.227660° 24.329773° must be implemented to provide unhindered access to the nest (see sensitivity map in Figure 9. 8 and Figure 9.9). The development footprint assessed in this report does not infringe on this buffer (Figures 9.8, 9.9 and 9.10).	*Low (4)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

9.7.2 Potential Impacts during the Operational Phase

9.7.2.1 Impact 1: Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plant and associated infrastructure.

This impact relates to the total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plant and associated infrastructure. This impact is rated as negative, with a site-specific spatial extent and a long-term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and very likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed **Section 9.7.2.5** below.

9.7.2.2 Impact 2: Bird mortality and injury as a result of collisions with the solar panels.

This impact relates to the bird mortalities as a result of potential collisions with the solar panels, including the so-called lake effect. This impact is rated as negative, with a site-specific spatial extent and a long-term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a slight consequence and unlikely probability, which will render the impact significance as very low. As detailed in **Section 9.7.2.5** below, no mitigation is required due to the very low impact significance.

9.7.2.3 Impact 3: Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.

This impact pertains to the entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality. This impact is rated as negative, with a site-specific spatial extent and a long-term duration due to the long timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is rated with a moderate consequence and likely probability, which will result in a low impact significance, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to very low. The recommended mitigation measure is to use a single perimeter fence around the PV Facilities.

9.7.2.4 Impact 4: Electrocution of priority species in the onsite substation complex.

This impact deals with the potential electrocution of priority species in the onsite substation complex. This impact is rated as negative, with a local spatial extent and a long-term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence but unlikely probability, which will result in an impact significance of moderate, without the implementation of mitigation measures. With the implementation of mitigation measures (i.e. reactive insulation of electrical hardware), the significance of the impact is reduced to very low.

9.7.2.5 Impact 5: Electrocution of priority species on the internal 33kV powerlines.

This impact deals with the potential electrocution of priority species on the internal 33kV powerlines in those instances where underground cabling cannot be utilised. This impact is rated as negative, with a local spatial extent and a long-term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will result in an impact significance of high, without the implementation of mitigation measures. With the implementation of mitigation measures (i.e. use underground cabling as far as possible, and where the use of overhead lines are unavoidable due to technical constraints, a bird-friendly pole design must be used and the avifaunal specialist must sign off on the pole design), the significance of the impact is reduced to very low.

9.7.2.6 Impact Summary Tables: Operational Phase

The rating of the impacts identified for the operational phase is discussed in this section.

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE						
Impact 1: Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plant and associated infrastructure.	*Status*	*Negative*	*High (2)*	• The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned. • Where possible, surface water (pans, dams and water troughs) must be buffered by a minimum of 50m to ensure unhindered access of priority species to the water. No PV panels should be constructed in this zone (**see sensitivity map Figure 9.8 and Figure 9.9**). Note that some of the waterpoints in the development footprint will be removed, however, since the minimum circular solar panel exclusion zone of 50m will be applied, the removal of some of the waterpoints will therefore not be a significant impact.	*Moderate (3)*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				
Impact 2: Bird mortality and injury as a result of collisions with the solar panels.	*Status*	*Negative*	*Very low (5)*	• No mitigation is required due to the very low significance	*Very low (5)*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Slight*				
	Probability	*Unlikely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				
	Status	*Negative*	*Low (4)*	• A single perimeter fence should be used.	*Very low (5)*	*High*

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
Impact 3: Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	*Spatial Extent*	*Site specific*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				
Impact 4: Electrocution of priority species in the onsite substation complex.	*Status*	*Negative*	*Moderate (3)*	• The hardware within the proposed substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site-specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List priority species are unlikely to frequent the substation and be electrocuted.	*Very low (5)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Unlikely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				
Impact 5: Electrocution of priority species on the internal 33kV powerlines.	*Status*	*Negative*	*High (2)*	• Use underground cabling as far as possible. • Where the use overhead lines are unavoidable due to technical constraints, a bird-friendly pole design must be used. The avifaunal specialist must sign off on the pole design.	*Very Low (5)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

9.7.3 Potential Impacts during the Decommissioning Phase

9.7.3.1 Impact 1: Displacement due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure.

The noise and movement associated with the potential decommissioning activities will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site-specific spatial extent and a short term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed in Section 9.7.3.2 below.

9.7.3.2 Impact Summary Tables: Decommissioning Phase

The rating of the impacts identified for the operational phase is discussed in this section.

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
DECOMMISSIONING PHASE						
The noise and movement associated with the activities at the Study Area will be a source of disturbance which would lead to the displacement of avifauna from the area.	*Status*	*Negative*	*Moderate (3)*	• Activity should as far as possible be restricted to the footprint of the infrastructure. • Measures to control noise and dust should be applied according to best practice in the industry at the time. • Maximum use should be made of existing access roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical. • The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.	*Low (4)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

9.7.4 Cumulative Impacts

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore needs to consider all renewable energy developments that have received an Environmental Authorisation or in process within at least a 30km radius of the proposed site, as well as the 12 proposed Kudu Solar PV developments. Currently, there are 12 other renewable energy cluster projects (either approved or in process) within a 30km radius of the Kudu PV Cluster (**Figure 9-11**).

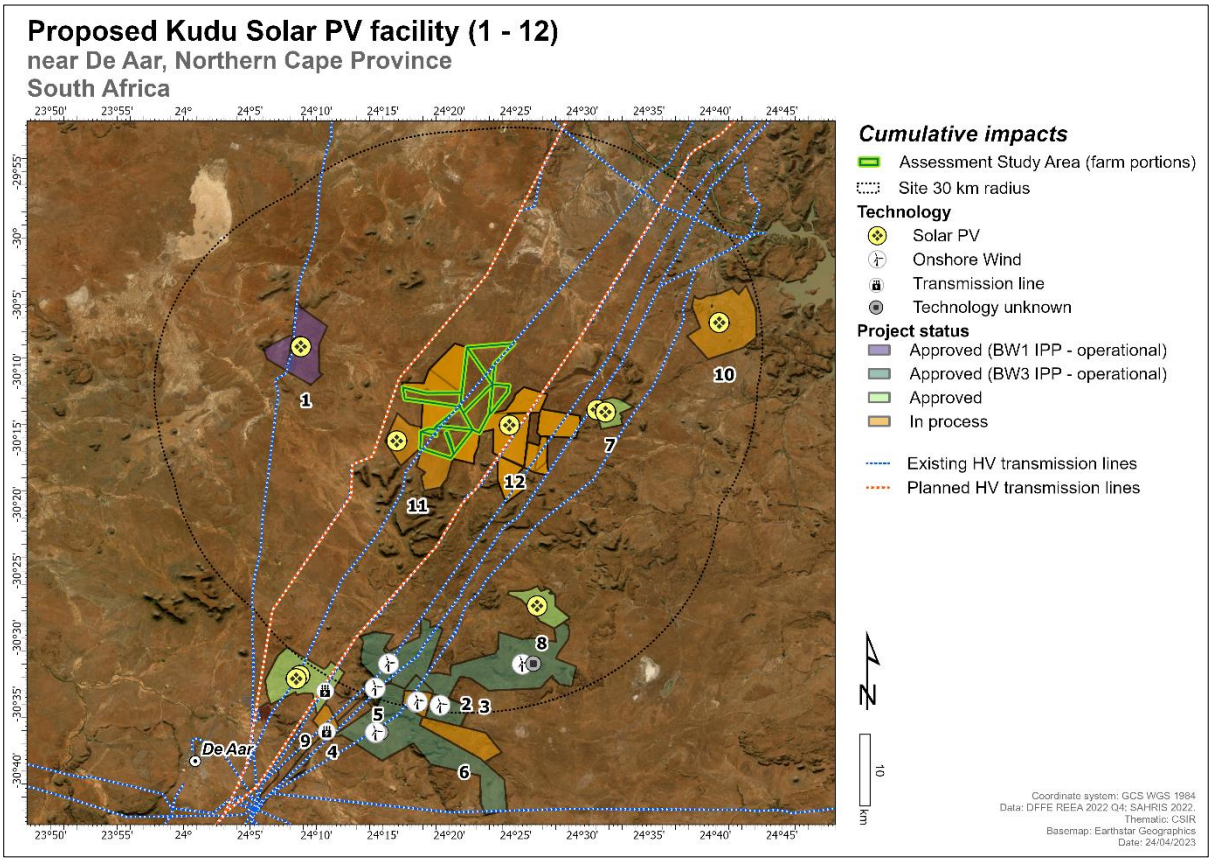


Figure 9-11: Renewable Energy and EGI Projects with 30km radius of the Kudu PV Solar Cluster Study Area.

The table below provides a list and details of all the renewable energy and EGI projects (as displayed in **Figure 9-11** above) within a 30km radius of the Kudu PV Solar Cluster.

Table 9-2: Proposed renewable energy projects, located within 30 km of the proposed Kudu Solar Facilities, that will be considered in the Cumulative Impact Assessment (in addition to the Kudu Solar Facilities and EGI Projects) (Source: DFFE REEA, Quarter 4, 2022; and SAHRIS)

CSIR NUMBER	DFFE REFERENCE	TECHNOLOGY	MW/KV	STATUS	PROJECT TITLE	EIA REGULATIONS	ASSESSMENT PROCESS	APPLICANT	EAP
1	• 12/12/20/2258 • 12/12/20/2258/1	Solar PV	75	Approved and Preferred Bidder (Operational)	• The Proposed Establishment of Photovoltaic (Solar Power) Farms in the Northern Cape Province - Kalkbult	2010	Scoping and EIA	Scatec Solar SA Pty Ltd	Sustainable Development Projects cc
2	• 12/12/20/2463/1 • 12/12/20/2463/1/2 • 12/12/20/2463/1/A2 • 12/12/20/2463/1/AM3 • 12/12/20/2463/1/AM4 • 12/12/20/2463/1/AM5	Onshore Wind	140	Approved and Preferred Bidder (Operational)	• Longyuan Mulilo De Aar 2 North Wind Energy Facility • Longyuan Mulilo De Aar Maanhaarberg Wind Energy Facility • The Wind Energy Facility (North and South) situated on the Plateau Near De Aar, Northern Cape Province	2010 and 2014	Scoping and EIA and Amendment	Longyuan Mulilo De Aar 2 South (Pty)	Aurecon South Africa (Pty) Ltd and Holland and Associates Environmental Consultants
3	• 12/12/20/2463/2 • 12/12/20/2463/2/AM2	Onshore Wind	100	Approved and Preferred Bidder (Operational)	• Longyuan Mulilo De Aar Maanhaarberg Wind Energy Facility • The Wind Energy Facility (North and South) Situated On The Plateau Near De Aar, Northern Cape Province	2010 and 2014	Scoping and EIA and Amendment	Mulilo Renewable Energy (Pty) Ltd	Aurecon South Africa (Pty) Ltd
4	• 14/12/16/3/3/1/1166 14/12/16/3/3/1/1166/AM3 14/12/16/3/3/1/1166/AM4	Transmission line	132	Approved	• Basic Assessment for the proposed construction of a 132 kV transmission line corridor adjacent to the existing Eskom transmission line from Longyuan Mulilo De Aar 2 North Wind Energy Facility (WEF) to the Hydra Substation in De Aar, Northern Cape	2010 and 2014	Basic Assessment	Longyuan Mulilo De Aar 2 North (Pty) Ltd	Aurecon South Africa (Pty) Ltd
5	• 14/12/16/3/3/1/785	Transmission line	132	Approved	• Proposed construction of two 132kV transmission lines from the South & North Wind Energy Facilities on the Eastern Plateau (De Aar 2) near De Aar, Northern Cape.	2010	Basic Assessment	Mulilo Renewable Energy (Pty) Ltd	Aurecon South Africa (Pty) Ltd
6	• 14/12/16/3/3/2/278 • 14/12/16/3/3/2/278/1 • 14/12/16/3/3/2/278/2	Onshore Wind	118	Approved	• Proposed Castle Wind Energy Facility Project, located near De Aar, Northern Cape	2010 and 2014	Scoping and EIA	Castle Wind Farm (Pty) Ltd	Aurecon South Africa (Pty) Ltd; and Savannah Environmental Consultants (Pty) Ltd
7	• 14/12/16/3/3/2/564 • 14/12/16/3/3/2/564/AM1 • 14/12/16/3/3/2/564/AM2	Solar PV	75	To be confirmed	• Proposed Swartwater 75MW solar PV power facility in Petrusville within Renosterburg Local Municipality, Northern Cape	2010 and 2014	Scoping and EIA and Amendment	AE-AMD Renewable Energy (Pty) Ltd	USK Environmental and Waste Engineering (Pty) Ltd
8	• 14/12/16/3/3/2/740	Solar PV	300	Approved	• Proposed 300MW Solar Power Plant in Phillipstown area in Renosterberg Local Municipality	2010	Scoping and EIA	To be confirmed	Tshikovha Environmental and Communication Consultants
9	• 14/12/16/3/3/2/744	Solar PV	Unknown	Approved	• Proposed PV facility on farm Jakhalsfontein near De Aar	2010	Scoping and EIA	Solar Capital (Pty) Ltd	Eco Compliance (Pty) Ltd
10	• 14/12/16/3/3/2/739	Solar PV	70 - 100	To be confirmed	• Proposed 70 - 100 MW Solar Power Plant in Petrusville	2010	Scoping and EIA	To be confirmed	Tshikovha Environmental and Communication Consultants
11	• Not issued yet (it is understood that the project is still within the pre-application stage)	Solar PV	800 (Maximum)	Pre-Application	• The Proposed Keren Energy Odyssey Solar PV Facilities (Odyssey Solar 1, Odyssey Solar 2, Odyssey Solar 3, Odyssey Solar 4, Odyssey Solar 5, Odyssey Solar 6, Odyssey Solar 7 And Odyssey Solar 8)	2014	Scoping and EIA	Keren Energy Group Holdings	EnviroAfrica cc
12	• To be confirmed	Solar PV	3050	Scoping	• The Proposed Development of the Crossroads (formally referred to as the Hydra B) Green Energy Cluster of Renewable Energy Facilities and Grid Connection Infrastructure, Pixley Ka Seme District Municipality, Northern Cape Province. The Cluster entails the development of up to 21 solar energy facilities, with the Scoping and EIA Processes consisting of three phases. Phases 1, 2 and 3 consist of 9, 6 and 6 solar facilities, respectively. The Phase 1 Scoping and EIA Processes were launched in January 2023.	2014	Scoping and EIA	Akuo Energy Afrique	Savannah Environmental Consultants (Pty) Ltd

CSIR NUMBER	DFFE REFERENCE	TECHNOLOGY	MW/KV	STATUS	PROJECT TITLE	EIA REGULATIONS	ASSESSMENT PROCESS	APPLICANT	EAP
Study area shown on map	• 14/12/16/3/3/2/2244 • 14/12/16/3/3/2/2245 • 14/12/16/3/3/2/2246 • 14/12/16/3/3/2/2247 • 14/12/16/3/3/2/2248 • 14/12/16/3/3/2/2249 • 14/12/16/3/3/2/2250 • 14/12/16/3/3/2/2251 • 14/12/16/3/3/2/2252 • 14/12/16/3/3/2/2253 • 14/12/16/3/3/2/2254 • 14/12/16/3/3/2/2255	Solar PV	2180	Scoping and EIA Process underway	• Proposed Development of 12 Solar Photovoltaic (PV) Facilities (Kudu Solar Facility 1 to 12) and associated infrastructure, near De Aar, Northern Cape Province	2014	Scoping and EIA	Kudu Solar Facility 1 (Pty) Ltd to Kudu Solar Facility 12 (Pty) Ltd	CSIR
Shown on map as Existing HV Lines	• N/A	Transmission Line	220	Existing Power Line	• HYDRA ROODEKUIL 2	-	-	-	-
Shown on map as Existing HV Lines	• N/A	Transmission Line	132	Existing Power Line	• HYDRA ROODEKUIL 1	-	-	-	-
Shown on map as Existing HV Lines	• N/A	Transmission Line	765	Existing Power Line	• BETA HYDRA 2	-	-	-	-
Shown on map as Existing HV Lines	• N/A	Transmission Line	400	Existing Power Line	• HYDRA PERSEUS 3	-	-	-	-
Shown on map as Existing HV Lines	• N/A	Transmission Line	220	Existing Power Line	• VAN DER KLOOF ROODEKUIL 2	-	-	-	-
Shown on map as Existing HV Lines	• N/A	Transmission Line	220	Existing Power Line	• VAN DER KLOOF ROODEKUIL 1	-	-	-	-
Shown on map as Existing HV Lines	• N/A	Transmission Line	400	Existing Power Line	• BETA HYDRA 1	-	-	-	-
Shown on map as Existing HV Lines	• N/A	Transmission Line	400	Existing Power Line	• HYDRA PERSEUS 2	-	-	-	-
Shown on map as Existing HV Lines	• N/A	Transmission Line	132	Existing Power Line	• KALKBULT/KAREEBOSCHPAN 1	-	-	-	-
Shown on map as Existing HV Lines	• N/A	Transmission Line	132	Existing Power Line	• ROODEKUIL/ORANIA 1	-	-	-	-

CSIR NUMBER	DFFE REFERENCE	TECHNOLOGY	MW/KV	STATUS	PROJECT TITLE	EIA REGULATIONS	ASSESSMENT PROCESS	APPLICANT	EAP
Shown on map as Planned HV Lines	• N/A	Transmission Line	765	Planned Power Line	• Perseus to Gamma 2nd 765 kV line • Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line	-	-	-	-
Shown on map as Planned HV Lines	• N/A	Transmission Line	765	Planned Power Line	• Relocate Beta-Hydra 765kV line to form Perseus-Hydra 1st 765kV line • Cape Corridor Phase 2: Zeus - Hydra 765kV Integration	-	-	-	-
Shown on map as Planned HV Lines	• N/A	Transmission Line	765	Planned Power Line	• Perseus to Gamma 2nd 765 kV line • Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line	-	-	-	-

Note that in addition to the above, all 12 Kudu Solar Facilities have been considered in this cumulative assessment. The Kudu EGI projects (i.e. Projects 13 to 26) will be the subject of separate assessments, which have not commenced with yet. Refer to Chapter 4 of the EIA Report for additional information on the cumulative impact assessment.

The total affected land parcel area taken up by other authorised renewable energy projects and the grid connection projects within the 30km radius is approximately 43 973 ha. The total affected land parcel area of the 12 Kudu Solar PV projects comprises approximately 8150 ha. If one assumes that all 12 Kudu Solar PV projects will be authorised, the combined land parcel area affected by renewable energy developments within the 30km radius around and including the Kudu Solar PV projects will equal 52 123 ha. The total area within the 30km radius around the proposed projects equates to about 282 743 ha of similar habitat. The total combined size of the land parcels affected by renewable energy projects and grid connections will thus equate to 18.4 % of the available habitat in the 30km radius. However, the actual physical footprint of the renewable energy facilities will be much smaller than the land parcel areas themselves, for example in the case of wind energy, the physical footprint comprises less than 5% of the project area. Furthermore, eight of the renewable energy cluster projects must still be subject to a competitive bidding process where only the most competitive projects will win a power purchase agreement required for the project to proceed to construction; or they must enter into private offtake agreements.

The following cumulative impacts have been identified:

9.7.4.1 Impact 1: Construction Phase - Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure

The noise and movement associated with the construction activities of similar projects within the 30 km radius will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site-specific spatial extent and a short-term duration due to the temporary nature of the construction phase. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 9.7.4.4 below.

9.7.4.2 Impact 2: Operational Phase - Habitat transformation, collisions with the solar panels, entrapment in fences, and electrocution in onsite substation complexes and 33kV overhead lines

This impact deals with the following during the operational phase with regards to other similar projects in the 30 km radius:

- Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure.
- Bird mortality and injury as a result of collisions with the solar panels.
- Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality; and

- Electrocution of priority species in the onsite substation complexes.
- Electrocution of priority species on the 33kV overhead powerlines.

This impact is rated as negative, with a regional spatial extent and a long-term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 9.7.4.4 below.

9.7.4.3 Impact 3: Decommissioning Phase - Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The noise and movement associated with the potential decommissioning activities (in terms of other similar projects in the 30 km radius) will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site-specific spatial extent and a short-term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 9.7.4.4 below.

9.7.4.4 Impact Summary Tables: Cumulative Impacts

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
CONSTRUCTION PHASE						
Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure	*Status* *Spatial Extent* *Duration* *Consequence* *Probability* *Reversibility* *Irreplaceability*	*Negative* *Site specific* *Short term* *Substantial* *Very likely* *High* *Low*	*Moderate (3)*	• Activity should as far as possible be restricted to the footprint of the infrastructure. • Measures to control noise and dust should be applied according to best practice in the industry at the time. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. • Access to the rest of the property must be restricted. • The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned. • Appropriate buffer zones must be implemented around Species of Conservation Concern (SCC) nests.	*Low (4)*	*High*
OPERATIONAL PHASE						
Habitat transformation, collisions with the solar panels, entrapment in fences, and electrocution in onsite substation	*Status* *Spatial Extent* *Duration* *Consequence* *Probability* *Reversibility*	*Negative* *Regional* *Long term* *Severe* *Likely* *High*	*High (2)*	• The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.	*Moderate (3)*	*High*

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
complexes and 33kV overhead powerlines.	*Irreplaceability*	*Low*		• Where possible, solar panel-free buffers must be maintained around the pans, dams and water troughs. • A single perimeter fence should be used. • The hardware within the proposed substation yards is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site-specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List priority species are unlikely to frequent the substation and be electrocuted. • Use underground cabling as far as possible. • Where the use overhead lines are unavoidable due to technical constraints, a bird-friendly pole design must be used. The avifaunal specialist must sign off on the pole design.		
DECOMMISSIONING PHASE						
The noise and movement associated with the activities at the Study Area will be a source of disturbance which would	*Status*	*Negative*	*Moderate (3)*	• Activity should as far as possible be restricted to the footprint of the infrastructure. • Measures to control noise and dust should be applied according to best practice in the industry at the time.	*Low (4)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*High*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
lead to the displacement of avifauna from the area	*Irreplaceability*	*Low*		• Maximum use should be made of existing access roads and the construction of new roads during the decommissioning phase should be kept to a minimum as far as practical. • The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned		

9.7.5 Battery Energy Storage System

As indicated above, a Lithium-Ion Battery Energy Storage System (BESS) and Redox Flow BESS were both considered for the proposed project. For Redox Flow BESS, various chemical compositions are likely, such as Vanadium. Refer to Chapter 15 of this EIA Report for a High-Level Safety, Health and Environment Risk Assessment, which provides high level information on the safety, health and environmental risks of the BESS technologies.

Both BESS technologies have been considered in this assessment. The type of technology will have no influence on avifauna; therefore both are considered viable from an avifaunal perspective. The impacts of habitat transformation and disturbance associated with the BESS are covered in Sections 9.7.1 and 9.7.2.

9.7.6 No-Go Option

The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained, which will be to the advantage of the avifauna. However, with that being said, no fatal flaws were discovered in the course of the investigations for the proposed Kudu Solar Facilities, and with mitigation the potential impact significance is rated as mainly low.

9.7.7 Impact Assessment Summary

The overall impact significance is provided in this section, in terms of pre- and post-mitigation.

Table 9-3: Avifauna - Overall Impact Significance (Pre- and Post-Mitigation)

Phase	**Overall Impact Significance (Pre-Mitigation)**	**Overall Impact Significance (Post Mitigation)**
Construction	Moderate (3)	Low (4)
Operational	Low (4) to Moderate (3)	Very Low (5) to Low (4)
Decommissioning	Moderate (3)	Low (4)
Nature of Impact	**Overall Impact Significance**	**Overall Impact Significance**
Cumulative - Construction	Moderate (3)	Low (4)
Cumulative - Operational	High (2)	Moderate (3)
Cumulative - Decommissioning	Moderate (3)	Low (4)

9.8 Legislative and Permit Requirements

There is no legislation pertaining specifically to the impact of solar facilities and associated electrical infrastructure on avifauna. Agreements, conventions, and legislation pertaining to the conservation of avifauna are discussed below.

9.8.1 Agreements and conventions

Table 9-4 below lists agreements and conventions which South Africa is party to, and which is relevant to the conservation of avifauna[5].

Table 9-4: Agreements and conventions which South Africa is party to, and which is relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: • The conservation of biological diversity • The sustainable use of the components of biological diversity • The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global

[5] (BirdLife International (2022) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa.

Convention name	Description	Geographic scope
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

9.8.2 National legislation

9.8.2.1 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –

(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.

9.8.2.2 The National Environmental Management Act 107 of 1998, as amended (NEMA)

The National Environmental Management Act 107 of 1998, as amended, (NEMA) creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated. NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment or basic assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette Number 43855, Government Notice 1150, 30 October 2020) is applicable in the case of solar PV developments. Refer to Appendix 9.G of this chapter for a table of compliance with this protocol.

9.8.2.3 The National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) and the Threatened or Protected Species Regulations (TOPS Regulations)

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act (Act 10 of 2004 (as amended)) (NEMBA) read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Note that updated TOPS Regulations were published in Government Gazette 47984, Government Notice 3009 on 3 February 2023, and takes effect on 1 April 2023. Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals. The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

9.8.2.4 Provincial Legislation

The current legislation applicable to the conservation of fauna and flora in the Northern Cape is the Northern Cape Nature Conservation Act (Act No 9 of 2009). It provides 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; describes offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; provides for the issuing of permits and other authorisations; and provides for matters connected therewith.

9.9 Environmental Management Programme Inputs

Please see a description of the key mitigation and monitoring recommendations for each applicable mitigation measure identified for all phases of the project below.

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
Avifauna: Entrapment					
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	Prevent mortality of avifauna	• A single perimeter fence should be used[6].	Design the facility with a single perimeter fence.	Once-off during the planning phase.	Project Developer
Avifauna: Displacement					
Displacement of avifauna due to disturbance during construction activities.	Prevent displacement of avifauna	• A 1km all infrastructure exclusion zone around the Verreaux's Eagle nest at -30.227660° 24.329773° must be implemented to provide unhindered access to the nest (see sensitivity map in Figure 9.8 and Figure 9.9). **The development footprint assessed in**	• Design the facility with a 1km all infrastructure exclusion zone around the Verreaux's Eagle nest at -30.227660° 24.329773° to provide	Once-off during the planning phase.	Project Developer

[6] If a fence is used consisting of an outer diamond mesh fence and inner electric fence with a separation distance of approximately 100 mm or less, it should not pose any risk of entrapment for large terrestrial species and can be considered a single fence.

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		this report does not infringe on this buffer (Figure 9.8 and Figure 9.9). • Where possible, surface water (pans, dams and water troughs) must be buffered by a minimum of 50m to ensure unhindered access of priority species to the water. No PV panels should be constructed in this zone (see sensitivity map Figure 9.8 and Figure 9.9). Note that some of the waterpoints in the development footprint will be removed, however, since the minimum circular solar panel exclusion zone of 50m will be applied, the removal of some of the waterpoints will therefore not be a significant impact.	unhindered access to the nest (see sensitivity map in Figure 9.8 and Figure 9.9). • Design a facility with minimum 50m buffer zones around pans, dams and selected water troughs as delineated by the avifauna specialist.		
Avifauna: Electrocution					
Electrocution of priority species on the internal 33kV network.	Prevention of electrocution mortality	• Design the facility with underground cables as much as possible. • A raptor -friendly pole design must be used, and the pole design must	• Design the facility with underground cabling and where impractical, use a bird	Once-off during the planning phase.	Project Developer

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		be approved by the avifaunal specialist.	friendly pole design approved by the avifaunal specialist..		

Management Plan for the Construction Phase

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
Avifauna: Disturbance					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	A site-specific CEMPr must be implemented, which gives an appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: • No off-road driving; • Maximum use of existing roads, where possible and the construction of new roads should be kept to a minimum as far as practical; • Measures to control noise and dust according to latest best practice;	• Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. • Ensure that construction personnel are made aware of the impacts relating to off-road driving. • Construction access roads must be demarcated clearly. Undertake	• On a daily basis • Monthly • Monthly • Monthly • Monthly	• Contractor and ECO • Contractor and ECO • Contractor and ECO • Contractor and ECO • Contractor and ECO

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		• Restricted access to the rest of the property, the activity should as far as possible be restricted to the development footprint; • Strict application of all recommendations in the ecological and botanical specialist studies, especially pertaining to the limitation of the footprint.	site inspections to verify. • Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. • Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		

Management Plan for the Operational Phase

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
Avifauna: Displacement due to habitat transformation					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the solar PV plants and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the botanical specialist study.	• The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned. • Develop a Habitat Restoration Plan (HRP). • Monitor rehabilitation via site audits and site inspections to ensure compliance. • Record and report any non-compliance.	• Appointment of rehabilitation specialist to develop HRP. • Site inspections to monitor progress of HRP. • Adaptive management to ensure HRP goals are met.	• Once-off • Once a year • As and when required	• Project Developer • Facility Environmental Manager • Project Developer and Facility Operational Manager
Avifauna: Electrocution of priority species in the onsite substation complex					
Electrocution of priority species in the onsite substation complex.	Prevention of electrocution mortality	It is recommended that if on-going impacts are recorded as part of routine inspections once operational, site-specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List priority species are unlikely to frequent the substation and be electrocuted.	Site-specific mitigation (insulation) be applied reactively	As and when required.	Project Developer and Facility Operational Manager

Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
Avifauna: Displacement due to disturbance					
The noise and movement associated with the activities at the Study Area will be a source of disturbance which would lead to the displacement of avifauna from the area.	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Decommissioning EMPr.	A site-specific Decommissioning EMPr (DEMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the DEMPr and should apply good environmental practice during decommissioning. The DEMPr must specifically include the following: • No off-road driving; • Maximum use of existing roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical; • Measures to control noise and dust according to latest best practice; • Restricted access to the rest of the property, the activity should as far as possible be restricted to the development footprint; • Strict application of all recommendations in the ecological and botanical	• Implementation of the DEMPr. Oversee activities to ensure that the DEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. • Ensure that decommissioning personnel are made aware of the impacts relating to off-road driving. • Access roads must be demarcated clearly. Undertake site inspections to verify. • Monitor the implementation of noise control mechanisms via	• On a daily basis • Weekly • Weekly • Weekly • Weekly	• Contractor and ECO

Impact	Mitigation/Management Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		specialist studies, especially as far as limitation of the activity footprint is concerned.	site inspections and record and report non-compliance. • Ensure that the decommissioning area is demarcated clearly and that personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		

9.10 Final Specialist Statement and Authorisation Recommendation

9.10.1 Statement and Reasoned Opinion

The proposed Kudu Solar Facility 4 will have a range of potential pre-mitigation impacts on priority avifauna ranging from low to high significance, which is expected to be reduced to medium and low significance with the appropriate mitigation. No fatal flaws were discovered during the investigations. The Project is supported and it is therefore recommended that the activity is authorised, with the understanding that all mitigation measures recommended in this report will be strictly implemented.

9.10.2 EA Condition Recommendations

The proposed mitigation measures are detailed in Section 9.7 above.

9.11 References

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APPENDICES

Appendix 9.A: Specialist Expertise
Appendix 9.B: Specialist Statement of Independence
Appendix 9.C: Site Sensitivity Verification
Appendix 9.D: Impact Assessment Methodology
Appendix 9.E: Species list for the Broader Area
Appendix 9.F: Pre-Construction Monitoring Protocol and Results
Appendix 9.G: Compliance with the Animal Species Protocol (GN 1150)

Appendix 9.A: Specialist Expertise

Curriculum vitae: Chris van Rooyen

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	BA LLB
Nationality	:	South African
Years of experience	:	26 years

Key Experience

Chris van Rooyen has several years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed around 130 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He serves on the Birds and Wind Energy Specialist Group which was formed in 2011 to serve as a liaison body between the ornithological community and the wind industry.

Key Project Experience

Bird Impact Assessment Studies and avifaunal monitoring for wind-powered generation facilities:

1. Eskom Klipheuwel Experimental Wind Power Facility, Western Cape
2. Mainstream Wind Facility Jeffreys Bay, Eastern Cape (EIA and monitoring)
3. Biotherm, Swellendam, (Excelsior), Western Cape (EIA and monitoring)
4. Biotherm, Napier, (Matjieskloof), Western Cape (pre-feasibility)
5. Windcurrent SA, Jeffreys Bay, Eastern Cape (2 sites) (EIA and monitoring)
6. Caledon Wind, Caledon, Western Cape (EIA)
7. Innowind (4 sites), Western Cape (EIA)
8. Renewable Energy Systems (RES) Oyster Bay, Eastern Cape (EIA and monitoring)
9. Oelsner Group (Kerriefontein), Western Cape (EIA)
10. Oelsner Group (Langefontein), Western Cape (EIA)
11. InCa Energy, Vredendal Wind Energy Facility Western Cape (EIA)
12. Mainstream Loeriesfontein Wind Energy Facility (EIA and monitoring)
13. Mainstream Noupoort Wind Energy Facility (EIA and monitoring)

14. Biotherm Port Nolloth Wind Energy Facility (Monitoring)
15. Biotherm Laingsburg Wind Energy Facility (EIA and monitoring)
16. Langhoogte Wind Energy Facility (EIA)
17. Vleesbaai Wind Energy Facility (EIA and monitoring)
18. St. Helena Bay Wind Energy Facility (EIA and monitoring)
19. Electrawind, St Helena Bay Wind Energy Facility (EIA and monitoring)
20. Electrawind, Vredendal Wind Energy Facility (EIA)
21. SAGIT, Langhoogte and Wolseley Wind Energy facilities
22. Renosterberg Wind Energy Project – 12-month preconstruction avifaunal monitoring project
23. De Aar – North (Mulilo) Wind Energy Project – 12-month preconstruction avifaunal monitoring project
24. De Aar – South (Mulilo) Wind Energy Project – 12-month bird monitoring
25. Namies – Aggenys Wind Energy Project – 12-month bird monitoring
26. Pofadder - Wind Energy Project – 12-month bird monitoring
27. Dwarsrug Loeriesfontein - Wind Energy Project – 12-month bird monitoring
28. Waaihoek – Utrecht Wind Energy Project – 12-month bird monitoring
29. Amathole – Butterworth Utrecht Wind Energy Project – 12-month bird monitoring & EIA specialist
30. Phezukomoya and San Kraal Wind Energy Projects 12-month bird monitoring & EIA specialist study (Innowind)
31. Beaufort West Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
32. Leeuwdraai Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
33. Sutherland Wind Energy Facility 12-month bird monitoring (Mainstream)
34. Maralla Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
35. Esizayo Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
36. Humansdorp Wind Energy Facility 12-month bird monitoring & EIA specialist study (Cennergi)
37. Aletta Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
38. Eureka Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
39. Makambako Wind Energy Faclity (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
40. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
41. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
42. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
43. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
44. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
45. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
46. Dassieklip Wind Energy Facility 3 years post-construction monitoring (Biotherm)
47. Loeriesfontein 2 Wind Energy Facility 2 years post-construction monitoring (Mainstream)
48. Khobab Wind Energy Facility 2 years post-construction monitoring (Mainstream)
49. Excelsior Wind Energy Facility 18 months construction phase monitoring (Biotherm)

50. Boesmansberg Wind Energy Facility 12-months pre-construction bird monitoring (juwi)
51. Mañhica Wind Energy Facility, Mozambique, 12-months pre-construction monitoring (Windlab)
52. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
53. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO).
54. Koup 1 and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
55. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
56. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
57. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
58. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
59. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
60. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
61. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
62. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
63. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
64. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
65. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
66. Pofadder Wind Energy Facility, Northren Cape, Screening Report (Atlantic Energy)
67. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
68. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
69. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).

Bird Impact Assessment Studies for Solar Energy Plants:

1. Concentrated Solar Power Plant, Upington, Northern Cape.
2. Globeleq De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
3. JUWI Kronos PV project, Copperton, Northern Cape
4. Sand Draai CSP project, Groblershoop, Northern Cape
5. Biotherm Helena PV Project, Copperton, Northern Cape
6. Biotherm Letsiao CSP Project, Aggeneys, Northern Cape
7. Biotherm Enamandla PV Project, Aggeneys, Northern Cape
8. Biotherm Sendawo PV Project, Vryburg, North-West
9. Biotherm Tlisitseng PV Project, Lichtenburg, North-West

10. JUWI Hotazel Solar Park Project, Hotazel, Northern Cape
11. Namakwa Solar Project, Aggeneys, Northern Cape
12. Brypaal Solar Power Project, Kakamas, Northern Cape
13. ABO Vryburg 1,2,3 Solar PV Project, Vryburg, North-West
14. NamPower CSP Facility near Arandis, Namibia
15. Dayson Klip PV Facility near Upington, Northern Cape
16. Geelkop PV Facility near Upington, Northern Cape
17. Oya PV Facility, Ceres, Western Cape
18. Vrede and Rondawel PV Facilities, Free State
19. Kolkies & Sadawa PV Facilities, Western Cape
20. Leeuwbosch PV1 and 2 and Wildebeeskuil PV1 and 2 Facilities, North-West
21. Kenhardt PV 3,4 and 5, Northern Cape
22. Wittewal PV, Grootfontein PV and Hoekdoornen PV Facilities, Touws River, Western Cape

Bird Impact Assessment Studies for the following overhead line projects:

1. Chobe 33kV Distribution line
2. Athene - Umfolozi 400kV
3. Beta-Delphi 400kV
4. Cape Strengthening Scheme 765kV
5. Flurian-Louis-Trichardt 132kV
6. Ghanzi 132kV (Botswana)
7. Ikaros 400kV
8. Matimba-Witkop 400kV
9. Naboomspruit 132kV
10. Tabor-Flurian 132kV
11. Windhoek - Walvisbaai 220 kV (Namibia)
12. Witkop-Overyssel 132kV
13. Breyten 88kV
14. Adis-Phoebus 400kV
15. Dhuva-Janus 400kV
16. Perseus-Mercury 400kV
17. Gravelotte 132kV
18. Ikaros 400 kV
19. Khanye 132kV (Botswana)
20. Moropule – Thamaga 220 kV (Botswana)
21. Parys 132kV
22. Simplon –Everest 132kV
23. Tutuka-Alpha 400kV
24. Simplon-Der Brochen 132kV
25. Big Tree 132kV
26. Mercury-Ferrum-Garona 400kV
27. Zeus-Perseus 765kV
28. Matimba B Integration Project
29. Caprivi 350kV DC (Namibia)

30. Gerus-Mururani Gate 350kV DC (Namibia)
31. Mmamabula 220kV (Botswana)
32. Steenberg-Der Brochen 132kV
33. Venetia-Paradise T 132kV
34. Burgersfort 132kV
35. Majuba-Umfolozi 765kV
36. Delta 765kV Substation
37. Braamhoek 22kV
38. Steelpoort Merensky 400kV
39. Mmamabula Delta 400kV
40. Delta Epsilon 765kV
41. Gerus-Zambezi 350kV DC Interconnector: Review of proposed avian mitigation measures for the Okavango and Kwando River crossings
42. Giyani 22kV Distribution line
43. Liqhobong-Kao 132/11kV distribution power line, Lesotho
44. 132kV Leslie – Wildebeest distribution line
45. A proposed new 50 kV Spoornet feeder line between Sishen and Saldanha
46. Cairns 132kv substation extension and associated power lines
47. Pimlico 132kv substation extension and associated power lines
48. Gyani 22kV
49. Matafin 132kV
50. Nkomazi_Fig Tree 132kV
51. Pebble Rock 132kV
52. Reddersburg 132kV
53. Thaba Combine 132kV
54. Nkomati 132kV
55. Louis Trichardt – Musina 132kV
56. Endicot 44kV
57. Apollo Lepini 400kV
58. Tarlton-Spring Farms 132kV
59. Kuschke 132kV substation
60. Bendstore 66kV Substation and associated lines
61. Kuiseb 400kV (Namibia)
62. Gyani-Malamulele 132kV
63. Watershed 132kV
64. Bakone 132kV substation
65. Eerstegoud 132kV LILO lines
66. Kumba Iron Ore: SWEP - Relocation of Infrastructure
67. Kudu Gas Power Station: Associated power lines
68. Steenberg Booysendal 132kV
69. Toulon Pumps 33kV
70. Thabatshipi 132kV
71. Witkop-Silica 132kV
72. Bakubung 132kV
73. Nelsriver 132kV
74. Rethabiseng 132kV
75. Tilburg 132kV

76. GaKgapane 66kV
77. Knobel Gilead 132kV
78. Bochum Knobel 132kV
79. Madibeng 132kV
80. Witbank Railway Line and associated infrastructure
81. Spencer NDP phase 2 (5 lines)
82. Akanani 132kV
83. Hermes-Dominion Reefs 132kV
84. Cape Pensinsula Strengthening Project 400kV
85. Magalakwena 132kV
86. Benficosa 132kV
87. Dithabaneng 132kV
88. Taunus Diepkloof 132kV
89. Taunus Doornkop 132kV
90. Tweedracht 132kV
91. Jane Furse 132kV
92. Majeje Sub 132kV
93. Tabor Louis Trichardt 132kV
94. Riversong 88kV
95. Mamatsekele 132kV
96. Kabokweni 132kV
97. MDPP 400kV Botswana
98. Marble Hall NDP 132kV
99. Bokmakiere 132kV Substation and LILO lines
100. Styldrift 132kV
101. Taunus – Diepkloof 132kV
102. Bighorn NDP 132kV
103. Waterkloof 88kV
104. Camden – Theta 765kV
105. Dhuva – Minerva 400kV Diversion
106. Lesedi –Grootpan 132kV
107. Waterberg NDP
108. Bulgerivier – Dorset 132kV
109. Bulgerivier – Toulon 132kV
110. Nokeng-Fluorspar 132kV
111. Mantsole 132kV
112. Tshilamba 132kV
113. Thabamoopo - Tshebela – Nhlovuko 132kV
114. Arthurseat 132kV
115. Borutho 132kV MTS
116. Volspruit - Potgietersrus 132kV
117. Neotel Optic Fibre Cable Installation Project: Western Cape
118. Matla-Glockner 400kV
119. Delmas North 44kV
120. Houwhoek 11kV Refurbishment
121. Clau-Clau 132kV
122. Ngwedi-Silwerkrans 134kV

123. Nieuwehoop 400kV walk-through
124. Booysendal 132kV Switching Station
125. Tarlton 132kV
126. Medupi - Witkop 400kV walk-through
127. Germiston Industries Substation
128. Sekgame 132kV
129. Botswana – South Africa 400kV Transfrontier Interconnector
130. Syferkuil – Rampheri 132kV
131. Queens Substation and associated 132kV powerlines
132. Oranjemond 400kV Transmission line
133. Aries – Helios – Juno walk-down
134. Kuruman Phase 1 and 2 Wind Energy facilities 132kV Grid connection
135. Transnet Thaba 132kV

Bird Impact Assessment Studies for the following residential and industrial developments:

1. Lizard Point Golf Estate
2. Lever Creek Estates
3. Leloko Lifestyle Estates
4. Vaaloewers Residential Development
5. Clearwater Estates Grass Owl Impact Study
6. Somerset Ext. Grass Owl Study
7. Proposed Three Diamonds Trading Mining Project (Portion 9 and 15 of the Farm Blesbokfontein)
8. N17 Section: Springs To Leandra –"Borrow Pit 12 And Access Road On (Section 9, 6 And 28 Of The Farm Winterhoek 314 Ir)
9. South African Police Services Gauteng Radio Communication System: Portion 136 Of The Farm 528 Jq, Lindley.
10. Report for the proposed upgrade and extension of the Zeekoegat Wastewater Treatment Works, Gauteng.
11. Bird Impact Assessment for Portion 265 (a portion of Portion 163) of the farm Rietfontein 189-JR, Gauteng.
12. Bird Impact Assessment Study for Portions 54 and 55 of the Farm Zwartkop 525 JQ, Gauteng.
13. Bird Impact Assessment Study Portions 8 and 36 of the Farm Nooitgedacht 534 JQ, Gauteng.
14. Shumba's Rest Bird Impact Assessment Study
15. Randfontein Golf Estate Bird Impact Assessment Study
16. Zilkaatsnek Wildlife Estate
17. Regenstein Communications Tower (Namibia)
18. Avifaunal Input into Richards Bay Comparative Risk Assessment Study
19. Maquasa West Open Cast Coal Mine
20. Glen Erasmia Residential Development, Kempton Park, Gauteng
21. Bird Impact Assessment Study, Weltevreden Mine, Mpumalanga
22. Bird Impact Assessment Study, Olifantsvlei Cemetery, Johannesburg
23. Camden Ash Disposal Facility, Mpumalanga
24. Lindley Estate, Lanseria, Gauteng

25. Proposed open cast iron ore mine on the farm Lylyveld 545, Northern Cape
26. Avifaunal monitoring for the Sishen Mine in the Northern Cape as part of the EMPr requirements
27. Steelpoort CNC Bird Impact Assessment Study

Professional affiliations

I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.

Appendix 9.B: Specialist Statement of Independence

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

Scoping and Environmental Impact Assessment Processes for the Proposed Development of 12 Solar Photovoltaic (PV) Facilities and associated infrastructure (i.e. Kudu Solar Facility 1 - 12), near De Aar, Northern Cape

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

Details of Specialist, Declaration and Undertaking Under Oath

Page 1 of 3

1. SPECIALIST INFORMATION

Specialist Company Name:				
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 2	Percentage Procurement recognition	
Specialist name:	Chris van Rooyen			
Specialist Qualifications:	BA LLB			
Professional affiliation/registration:	I work under the supervision and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003			
Physical address:	6 Pladda Drive, Plettenberg Bay			
Postal address:	PO Box 2676, Fourways, 2122			
Postal code:	2055	Cell:	0824549570	
Telephone:	0824549570	Fax:		
E-mail:	Vanrooyen.chris@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Christiaan Stephanus van Rooyen, 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

Name of Company: Afrimage Photography t/a Chris van Rooyen Consulting

25 November 2022

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Christiaan Stephanus van Rooyen, 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

Afrimage Photography (Pty) Ltd t/a Chris van Rooyen Consulting

Name of Company

25 November 2022

Date

SOUTH AFRICAN POLICE SERVICE
PLETTENBERG BAY
2022 -11- 25
PLETTENBERGBAAI
SOUTH AFRICAN POLICE SERVICE

Signature of the Commissioner of Oaths

2022/11/25

Date

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

Scoping and Environmental Impact Assessment Processes for the Proposed Development of 12 Solar Photovoltaic (PV) Facilities and associated infrastructure (i.e. Kudu Solar Facility 1 - 12), near De Aar, Northern Cape

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:	Afrimage Photography Pty Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)		Percentage Procurement recognition	
Specialist name:	Albert Froneman			
Specialist Qualifications:	M.Sc. Conservation Biology			
Professional affiliation/registration:	SACNASP Pr.Sci.Nat Zoological Science 400177/09			
Physical address:	Unit 28 San Henrique Estate, 2 Rosewood Road, Broadacres, 2055			
Postal address:	Box 2676, Fourways			
Postal code:	2055	Cell:	082 901 4016	
Telephone:		Fax:		
E-mail:	albert.froneman@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Albert Froneman, 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

Afrimage Photography Pty Ltd

Name of Company:

2023 / 07 / 10

Date

Details of Specialist, Declaration and Undertaking Under Oath

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Albert Froneman, 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

Afrimage Photography Pty Ltd
Name of Company

2023 / 07 / 10
Date

Signature of the Commissioner of Oaths

10 July 2023
Date

KERRY AUGUST
Commissioner of Oaths
Master HR Professional (MHRP)
Member Number: 53544596
25 Bordeaux Close
Stellenbosch
7600

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Details of Specialist, Declaration and Undertaking Under Oath

Page 3 of 3

Appendix 9.C: Site Sensitivity Verification: Kudu Solar Photovoltaic (PV) cluster

Prior to commencing with the specialist assessment, a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool). The National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, Government Notice 1150, 30 October 2020) is applicable in the case of solar PV developments.

This site sensitivity verification report is applicable and relevant to all 12 Kudu Solar Facilities, based on the homogenous habitat.

The details of the site sensitivity verification (SSV) are noted below:

Date of Site Visits	28 March – 01 April
Supervising Specialist Name	Albert Froneman
Professional Registration Number	MSc Conservation Biology (SACNASP Zoological Science Registration number 400177/09)
Specialist Affiliation / Company	Chris van Rooyen Consulting

1 Methodology

The following methods were used to compile the SSV report:

- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town, as a means to ascertain which species occurs within the Broader Area i.e. within a block consisting of 9 pentad grid cells each within which the proposed projects are situated (see Figure 9.1 of the main report). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 3 full protocol lists (i.e. surveys lasting a minimum of two hours each) have been completed for this area. In addition, 4 ad hoc protocol lists (i.e. surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2022.2) International Union for Conservation of Nature (IUCN) Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the habitat in the Study Area was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2012 beta2) from the South African National Biodiversity Institute (SANBI) website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org). Study Area is the area covered by the land parcels where the PV projects will be located.

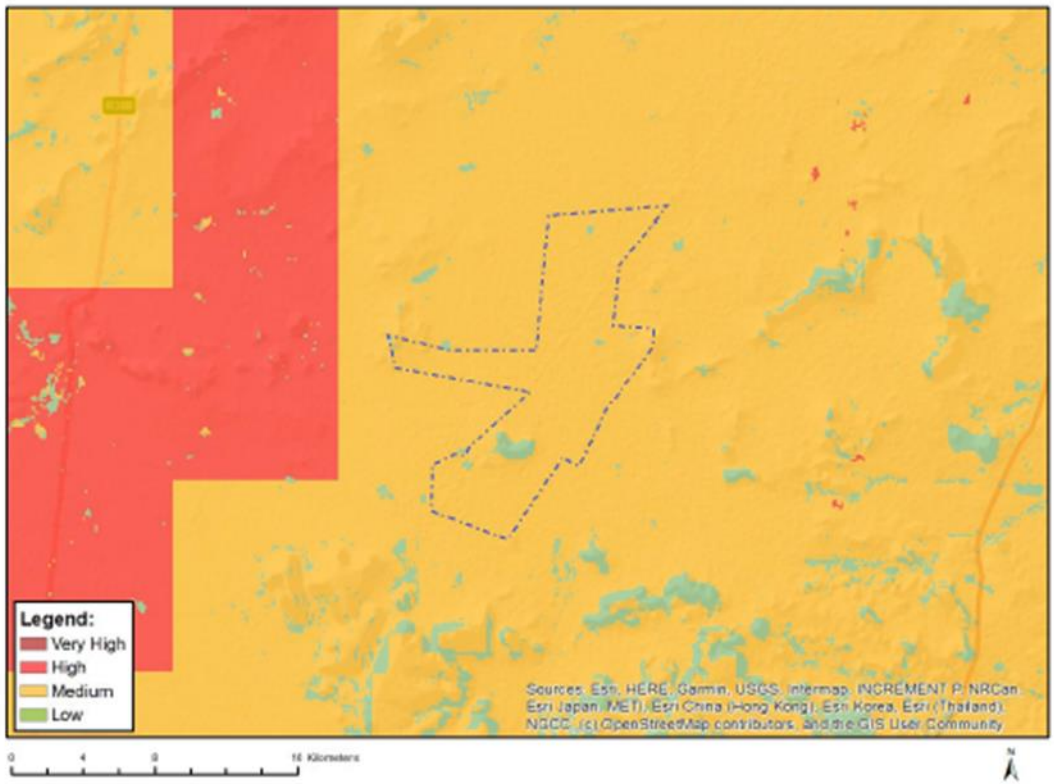
- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2022) was used in order to view the Study Area on a landscape level and to help identify sensitive bird habitat.
- Priority species were defined as follows:
    - South African Red Data species: High conservation significance
    - South African endemics and near-endemics: High conservation significance
    - Raptors: High conservation significance. Raptors are at the top of the food chain and play a key role in their ecosystems. When populations of birds of prey go down, then the numbers of their prey species go up, creating an imbalance in the ecosystem.
    - Waterbirds: Evidence indicate that waterbirds may be particularly susceptible to collisions with solar arrays due to the so-called lake effect, caused by the reflection of the sun of the smooth surface of solar panels.
- The SANBI BGIS map viewer was used to determine the locality of the Study Area relative to National Protected Areas and National Protected Areas Expansion Strategy (NPAES) focus areas.
- The Department of Forestry, Fisheries and the Environment (DFFE) National Screening Tool was used to determine the assigned avian sensitivity of the Study Area.
- Data collected during previous site visits to the Broader Area was also considered as far as habitat classes and the occurrence of priority species are concerned.
- A SSV site visit to the Study Area was conducted on 28 March – 01 April 2022 during which time the habitat was classified, and all birds were recorded.

2 Results of site assessment

The Study Area and immediate environment is classified as **Medium** and **Low** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme on the Screening Tool (Figure C.1). The 12 development footprints specifically are all classified as **Medium**. The Medium classification is linked to the potential occurrence of Ludwig's Bustard (Globally and Regionally Endangered) and Verreaux's Eagle (Regionally Vulnerable). The Study Area contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, Government Notice 1150, 30 October 2020). The occurrence of SCC was confirmed during the surveys so far i.e. Martial Eagle (Globally and Regionally Endangered), Verreaux's Eagle (Regionally Vulnerable), Blue Crane (Globally Vulnerable and Regionally Near-threatened), Cape Vulture (Globally Vulnerable and Regionally Endangered) and White-backed Vulture (Globally and Regionally Endangered) was recorded in the Study Area, as well as habitat for Secretarybird (Globally and Regionally Endangered) and Ludwig's Bustard.

Based on the SSV survey conducted on 28 March - 1 April 2022, the classification of **Medium** sensitivity for avifauna in the screening tool is therefore disputed **for all 12** development footprints, and it is suggested that a **High** rating would be more appropriate. None of the development footprints has a specific habitat feature that distinguishes it from the other development footprints which would justify a lesser rating.

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)
Low	Subject to confirmation
Medium	Aves-Aquila rapax
Medium	Aves-Aquila verreauxii
Medium	Aves-Neotis ludwigii

Figure C.1: The National Web-Based Environmental Screening Tool map of the Study Area, indicating sensitivities for the Terrestrial Animal Species theme. The Medium sensitivity classification is linked to Ludwig's Bustard (*Neotis ludwigii*), Tawny Eagle (*Aquila rapax*) and Verreaux's Eagle (*Aquila verreauxii*).

3 Avifauna

A total of 85 species could potentially occur within the Broader Area where the project is located (see Appendix 9.E). Of these, 21 are classified as priority species for solar developments. Of the 21 priority species, 17 were recorded during the monitoring, and 15 priority species have a medium to high probability of occurring regularly in the Study Area. Five SCC were recorded during the site surveys, namely Blue Crane, Martial Eagle, Verreaux's Eagle, Cape Vultures and White-backed Vulture.

The species recorded during the SSV visit is listed in Table 1.

Table 1: Priority species recorded during the SSV site visit.

Species	Taxonomic name	Species of Conservation Concern
Blue Crane	*Grus paradisea*	Yes
Cloud Cisticola	*Cisticola textrix*	
Egyptian Goose	*Alopochen aegyptiaca*	
Fairy Flycatcher	*Stenostira scita*	
Greater Kestrel	*Falco rupicoloides*	
Jackal Buzzard	*Buteo rufofuscus*	
Karoo Prinia	*Prinia maculosa*	
Large-billed Lark	*Galerida magnirostris*	
Martial Eagle	*Polemaetus bellicosus*	Yes
Pale Chanting Goshawk	*Melierax canorus*	
Pied Starling	*Lamprotornis bicolor*	
Rock Kestrel	*Falco rupicolus*	
South African Cliff Swallow	*Petrochelidon spilodera*	
Three-banded Plover	*Charadrius tricollaris*	
Verreaux's Eagle	*Aquila verreauxii*	Yes
Cape Vulture	*Gyps coprotheres*	Yes
White-backed Vulture	*Gyps africanus*	Yes

4 Bird Habitat

The following bird habitat features were recorded at and near the Study Area:

5 Biomes and Vegetation Types

The Study Area is situated on a wide flat plain, with its centre approximately 32km southwest of the small town of Petrusville, and 23km from Potfontein railway stop in the Northern Cape Province, in the Nama Karoo biome, in the Upper Karoo Bioregion (Mucina & Rutherford 2006). The habitat in the Study Area is highly homogenous and consists of extensive plains with low shrub and a very prominent grass component (see Figures C.2 and C.3). Mucina & Rutherford (2006) classify the vegetation in the Study Area as a mixture of Northern and Eastern Upper Karoo on the plains, with Besemkaree Koppies Shrubland on the ridges. Northern and Eastern Upper Karoo consist of shrubland dominated by dwarf microphyllous shrubs, with 'white' grasses of the genera Aristida and Eragrostis (these become prominent especially in the early autumn months after good summer rains,

as is the case currently in the Study Area). Besemkaree Koppies Shrubland consist of two-layered karroid shrubland. The lower (closed-canopy) layer is dominated by dwarf small-leaved shrubs and, especially in precipitation-rich years, also by abundant grasses, while the upper (loose canopy) layer is dominated by tall shrubs (Mucina & Rutherford). There are no prominent rivers or drainage lines in the Study Area, however additional information is provided in the separate Aquatic Biodiversity Assessment (Chapter 8 of the EIA Report).

SABAP1 recognises six primary vegetation divisions (biomes) within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison *et al.* 1997). The criteria used by the authors to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. Using this classification system, the natural vegetation in the Study Area is classified as Grassy Karoo, a sub-category of the Nama Karoo biome. Grassy Karoo can be viewed as a transitional zone between the Nama Karoo and grassland biomes, although also primarily a dwarf shrub habitat, it shows a higher proportion of grass cover (Harrison et al. 1997).

The Potfontein area is semi – arid with extreme temperature variation. Mean annual precipitation averages around 204mm. The least amount of rainfall occurs in July with an average of 7mm. In February, the precipitation reaches its peak, with an average of 30mm. The temperatures are highest on average in January, with a mean daily maximum of 32 °C. With a mean daily maximum of 16 °C, July is the coldest month of the year, with temperatures dropping at night to - 4°C on cold nights (meteoblue.com 2022).

- **Grassy Karoo**

This habitat feature is described above under Section 5.

See Figures C.2 and C.3 for examples of the Grassy Karoo habitat.

Figure C.2: Typical Grassy Karoo on the plains in the Study Area.

Figure C.3: A patch of dwarf shrubs in the Study Area

- **Surface water**

Surface water is of specific importance to avifauna in this semi-arid Study Area. The Study Area contains many boreholes with water reservoirs and a few small ground dams (Figure C.4). Boreholes with open water troughs are important sources of surface water for priority avifauna for drinking and bathing.

Figure C.4: A typical borehole and water trough in the Study Area

- **Trees**

The Study Area is generally devoid of trees, except for isolated clumps of trees at homesteads and boreholes, where a mixture of alien and indigenous trees is growing (Figure C.5). The trees could attract a variety of bird species for purposes of nesting and roosting.

Figure C.5: Trees are typically found at localities in the Study Area with surface water.

- **High voltage lines**

High voltage lines are an important potential roosting and breeding substrate for large raptors in the Karoo (Jenkins *et al*. 2013). The Hydra – Perseus 1 765kV high voltage line bisects the Study Area from south to north, the Gamma – Perseus 1 765kV high voltage line runs just west of the Study Area, and the Hydra – Perseus 400kV high voltage line runs approximately 4km east of the closest border of the Study Area. A suspected Verreaux's Eagle nest is present at -30.227660° 24.329773° on the Hydra – Perseus 1 765kV high voltage line. Five White-backed Vultures and a Cape Vulture were also observed perching on the high voltage lines in the Study Area during the first survey. There is increasing evidence that vultures are using high voltage lines in the Karoo (personal observation), mostly in the non-breeding season (January to March), and that they could be encountered anywhere in the Broader Area.

See Figure C.6 for an image of the suspected Verreaux's Eagle nest in the Study Area.

Figure C.6: Suspected Verreaux's Eagle nest in the Study Area.

- **Ridges (koppies)**

The Study Area contains one prominent ridge (koppie) known as Basberg in the south of the Study Area, which rises to a height of 1 465m/asl. There are also a cluster of lower ridges on the extreme western side of the Study Area, just north of PV 6. There are a number of ridges in the Broader Area, starting approximately 4km to the south of the Study Area and continuing further south, with names like Perdekop and Tierberg, rising to a height of 1 615m/asl.

6 Conclusion

Based on the SSV site visit, the classification of **High** sensitivity for avifauna is suggested for the **Study Area**. The presence of SCC in the Study Area was confirmed i.e. Martial Eagle (Globally and Regionally Endangered), Verreaux's Eagle (Regionally Vulnerable), Blue Crane (Globally Vulnerable and Regionally Near-threatened), Cape Vulture (Globally Vulnerable and Regionally Endangered) and White-backed Vulture (Globally and Regionally Endangered). The Study Area also contain habitat for Secretarybird (Globally and Regionally Endangered) and Ludwig's Bustard (Globally and Regionally Endangered). None of the development footprints has a specific habitat feature that distinguishes it from the other development footprints which would justify a lesser rating.

Appendix 9.D: Impact Assessment Methodology

The impact assessment includes:

- *the nature, status, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

Terminology used in impact assessment can overlap. To avoid ambiguity, please note the following clarifications (that are based on NEMA and the EIA Regulations):

- *The term environment is understood to have a broad interpretation that includes both the natural (biophysical) environment and the socio-economic environment. The term socio-ecological system is also used to describe the natural and socio-economic environment and the interactions amongst these components.*
- *Significance = Consequence x Probability, which means that significance is equivalent to risk.*
- *The impact can have a positive or negative status. The significance of a negative impact may be called a risk, and the significance of a positive impact may be called an opportunity.*

The following principles are to underpin the application of this methodology:

- *Transparent and repeatable process - specialists are to describe the thresholds and limits they apply in their assessment, wherever possible.*
- *Adapt parameters to context (where justified) – the methodology proposes some thresholds (e.g. for spatial extent, in Step 3 below), however, if the nature of the impact requires a different definition of the categories of spatial extent, then this can be provided and described.*
- *Combination of a quantitative and qualitative assessment – where possible, specialists are to provide quantitative assessments (e.g. areas of habitat affected, decibels of noise, number of jobs), however, it is recognised that not all impacts can be quantified, and then qualitative assessments are to be provided.*

As per the DFFE Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *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. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *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. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the aspects described below.

- ***Step 1**: **Nature** of impact/risk - The type of effect that a proposed activity will have on the environment.*

- ***Step 2**: **Status** - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- ***Step 3**: **Qualitatively** determine the **consequence** of the impact/risk by identifying the **a) SPATIAL EXTENT; b) DURATION; c) REVERSIBILITY; AND d) IRREPLACEABILITY**.*

    - ***A) Spatial extent** – The size of the area that will be affected by the impact/risk:*
        - *Site specific;*
        - *Local (<10 km from site);*
        - *Regional (<100 km of site);*
        - *National; or*
        - *International (e.g. Greenhouse Gas emissions or migrant birds).*

    - ***B) Duration** – The timeframe during which the impact/risk will be experienced:*
        - *Very short term (instantaneous);*
        - *Short term (less than 1 year);*
        - *Medium term (1 to 10 years);*
        - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
        - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

    - ***C) Reversibility** of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
        - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
        - *Moderate reversibility of impacts;*
        - *Low reversibility of impacts; or*
        - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

    - ***D) Irreplaceability** of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
        - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
        - *Moderate irreplaceability of resources;*
        - *Low irreplaceability of resources; or*

- *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Some of the criteria are quantitative (e.g. spatial extent and duration) and some may be described in a quantitative or qualitative manner (e.g. reversibility and irreplaceability). The specialist then combines these criteria in a qualitative manner to determine the ***consequence****.*

The consequence terms ranging from slight to extreme must be calibrated per Specialist Study so that there is transparency and consistency in the way a risk/impact is measured. For example, from a biodiversity and ecology perspective, the consequence ratings could be defined according to a reduction in population or occupied area in relation to Species of Conservation Concern (SCC) status, ranging from slight consequence for defined areas of Least Concern, to extreme consequence for defined areas that are Critically Endangered. For example, from a social perspective, a slight consequence could refer to small and manageable impacts, or impacts on small sections of the community; a moderate consequence could refer to impacts which affect the bulk of the local population negatively or may produce a net negative impact on the community; and an extreme consequence could refer to impacts which could result in social or political violence or institutional collapse.

- ***Consequence*** *– The anticipated consequence of the risk/impact is generally defined as follows:*
  - *Extreme (extreme alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they permanently cease);*
  - *Severe (severe alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they temporarily or permanently cease);*
  - *Substantial (substantial alteration of natural or socio-economic systems, patterns or processes, i.e. where environmental or socio-economic functions and processes are altered such that they temporarily or permanently cease;*
  - *Moderate (notable alteration of natural or socio-economic systems, patterns or processes, i.e. where the natural or socio-economic environment continues to function but in a modified manner; or*
  - *Slight (negligible and transient alteration of natural or socio-economic systems, patterns or processes, i.e. where natural systems/environmental or socio-economic functions, patterns, or processes are not affected in a measurable manner, or if affected, that effect is transient and the system recovers).*

- ***Step 4****: Rate the* ***probability*** *of the impact/risk using the criteria below:*

  - ***Probability*** *– The probability of the impact/risk occurring:*
    - *Extremely unlikely (little to no chance of occurring);*
    - *Very unlikely (<30% chance of occurring);*
    - *Unlikely (30-50% chance of occurring)*
    - *Likely (51 – 90% chance of occurring); or*
    - *Very Likely (>90% chance of occurring regardless of prevention measures).*

- ***Step 5**: Use both the **consequence** and **probability** to determine the **significance** of the identified impact/risk (qualitatively as shown in Figure 1). Significance definitions and rankings are provided below:*

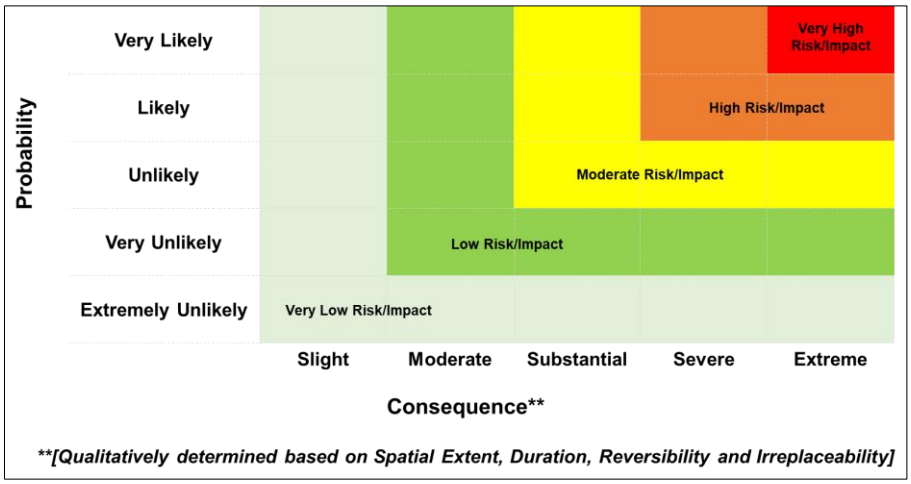


Figure 1. Guide to assessing risk/impact significance as a result of consequence and probability.

- ***Significance** – Will the impact cause a notable alteration of the environment?*
  - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
  - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
  - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
  - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
  - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

The specialists must provide a written supporting motivation of the assessment ratings provided.

- ***Step 6****: Determine the* ***Confidence Level*** *– The degree of confidence in predictions based on available information and specialist knowledge:*
    - *Low;*
    - *Medium; or*
    - *High.*

Appendix 9.E: Species List for the Broader Area

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate
Acacia Pied Barbet	*Tricholaema leucomelas*	0.00	16.67
African Hoopoe	*Upupa africana*	0.00	0.00
African Pipit	*Anthus cinnamomeus*	100.00	33.33
African Red-eyed Bulbul	*Pycnonotus nigricans*	0.00	0.00
Ant-eating Chat	*Myrmecocichla formicivora*	100.00	50.00
Barn Swallow	*Hirundo rustica*	66.67	0.00
Black-chested Prinia	*Prinia flavicans*	0.00	8.33
Black-headed Canary	*Serinus alario*	0.00	33.33
Black-throated Canary	*Crithagra atrogularis*	33.33	8.33
Blue Crane	*Grus paradisea*	33.33	16.67
Blue Korhaan	*Eupodotis caerulescens*	0.00	8.33
Bokmakierie	*Telophorus zeylonus*	33.33	8.33
Cape Bunting	*Emberiza capensis*	0.00	0.00
Cape Sparrow	*Passer melanurus*	33.33	33.33
Cape Turtle Dove	*Streptopelia capicola*	33.33	16.67
Cape Vulture	*Gyps coprotheres*	0.00	0.00
Cape Wagtail	*Motacilla capensis*	0.00	16.67
Capped Wheatear	*Oenanthe pileata*	0.00	16.67
Chat Flycatcher	*Melaenornis infuscatus*	33.33	41.67
Cinnamon-breasted Bunting	*Emberiza tahapisi*	0.00	0.00
Cloud Cisticola	*Cisticola textrix*	0.00	0.00
Common Ostrich	*Struthio camelus*	0.00	8.33
Common Quail	*Coturnix coturnix*	0.00	0.00
Crowned Lapwing	*Vanellus coronatus*	0.00	8.33
Desert Cisticola	*Cisticola aridulus*	66.67	16.67
Eastern Clapper Lark	*Mirafra fasciolata*	100.00	16.67
Egyptian Goose	*Alopochen aegyptiaca*	33.33	16.67
European Bee-eater	*Merops apiaster*	0.00	0.00
Fairy Flycatcher	*Stenostira scita*	0.00	0.00
Familiar Chat	*Oenanthe familiaris*	33.33	8.33
Fawn-colored Lark	*Calendulauda africanoides*	0.00	16.67
Greater Kestrel	*Falco rupicoloides*	33.33	16.67
Greater Striped Swallow	*Cecropis cucullata*	33.33	0.00
Grey-backed Cisticola	*Cisticola subruficapilla*	0.00	0.00
Hadada Ibis	*Bostrychia hagedash*	0.00	0.00
Helmeted Guineafowl	*Numida meleagris*	33.33	16.67
House Sparrow	*Passer domesticus*	0.00	0.00
Jackal Buzzard	*Buteo rufofuscus*	0.00	8.33
Karoo Prinia	*Prinia maculosa*	0.00	0.00
Karoo Scrub Robin	*Cercotrichas coryphoeus*	33.33	41.67
Large-billed Lark	*Galerida magnirostris*	33.33	8.33
Lark-like Bunting	*Emberiza impetuani*	0.00	41.67

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate
Laughing Dove	*Spilopelia senegalensis*	0.00	8.33
Levaillant's Cisticola	*Cisticola tinniens*	0.00	0.00
Little Swift	*Apus affinis*	0.00	0.00
Long-billed Pipit	*Anthus similis*	0.00	0.00
Ludwig's Bustard	*Neotis ludwigii*	0.00	0
Martial Eagle	*Polemaetus bellicosus*	0.00	0.00
Mountain Wheatear	*Myrmecocichla monticola*	33.33	0.00
Namaqua Dove	*Oena capensis*	66.67	0.00
Neddicky	*Cisticola fulvicapilla*	0.00	0.00
Northern Black Korhaan	*Afrotis afraoides*	66.67	41.67
Pale Chanting Goshawk	*Melierax canorus*	100.00	41.67
Pied Crow	*Corvus albus*	100.00	58.33
Pied Starling	*Lamprotornis bicolor*	33.33	8.33
Plain-backed Pipit	*Anthus leucophrys*	0.00	0.00
Quailfinch	*Ortygospiza atricollis*	0.00	0.00
Red-billed Quelea	*Quelea quelea*	0.00	0.00
Red-capped Lark	*Calandrella cinerea*	33.33	8.33
Red-headed Finch	*Amadina erythrocephala*	0.00	16.67
Rock Kestrel	*Falco rupicolus*	0.00	0.00
Rock Martin	*Ptyonoprogne fuligula*	0.00	8.33
Rufous-eared Warbler	*Malcorus pectoralis*	100.00	75.00
Sabota Lark	*Calendulauda sabota*	33.33	8.33
Scaly-feathered Weaver	*Sporopipes squamifrons*	0.00	8.33
Secretarybird	*Sagittarius serpentarius*	0.00	0
South African Cliff Swallow	*Petrochelidon spilodera*	33.33	0.00
Southern Fiscal	*Lanius collaris*	33.33	25.00
Southern Grey-headed Sparrow	*Passer diffusus*	0.00	0.00
Southern Masked Weaver	*Ploceus velatus*	0.00	0.00
Southern Red Bishop	*Euplectes orix*	33.33	0.00
Speckled Pigeon	*Columba guinea*	33.33	16.67
Spike-heeled Lark	*Chersomanes albofasciata*	100.00	50.00
Spotted Thick-knee	*Burhinus capensis*	0.00	0.00
Three-banded Plover	*Charadrius tricollaris*	0.00	0.00
Verreaux's Eagle	*Aquila verreauxii*	66.67	0.00
Wattled Starling	*Creatophora cinerea*	33.33	0.00
White-backed Mousebird	*Colius colius*	33.33	0.00
White-backed Vulture	*Gyps africanus*	0.00	0.00
White-browed Sparrow-Weaver	*Plocepasser mahali*	33.33	0.00
White-necked Raven	*Corvus albicollis*	33.33	16.67
White-rumped Swift	*Apus caffer*	0.00	0.00
White-throated Canary	*Crithagra albogularis*	0.00	0.00
Yellow Canary	*Crithagra flaviventris*	0.00	0.00
Yellow-bellied Eremomela	*Eremomela icteropygialis*	0	25

Appendix 9.F: Pre-Construction Monitoring Protocol and Results

1 Methodology

Pre-construction avifaunal surveys were undertaken at the project site during the following time envelopes:

- 28 March to 01 April 2022 (Survey 1); and
- 10 to 13 May 2022 (Survey 2).

Surveys were conducted according to an adapted Regime 2 site as defined in the Solar Guidelines (Jenkins *et al.* 2017) i.e., a minimum of two surveys conducted over 6 months. Monitoring for the 12 Kudu Solar PV Project Sites were conducted in the following manner:

- Five (5) drive transects of 17.3 km, 2.8 km, 2.7 km, 5.9 km, and 1.9 km, respectively, were identified within the Study Area.
- Two monitors travelling slowly (± 10km/h) in a vehicle recorded all birds on both sides of the transects. The observers stopped at regular intervals (every 500m) to scan the environment with binoculars. Drive transects were counted three times per sampling session. All birds were recorded during the surveys.
- Three (3) walk transects of roughly 1km each were also used during the surveys. Walk transects were counted four times per sampling session.
- The following variables were recorded:
    - Species;
    - Number of birds;
    - Date;
    - Start time and end time;
    - Estimated distance from transect;
    - Wind direction;
    - Wind strength (estimated Beaufort scale);
    - Weather (sunny; cloudy; partly cloudy; rain; mist);
    - Temperature (cold; mild; warm; hot); and
    - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground).

Figure 1 below indicates the location of the transects where monitoring was conducted.

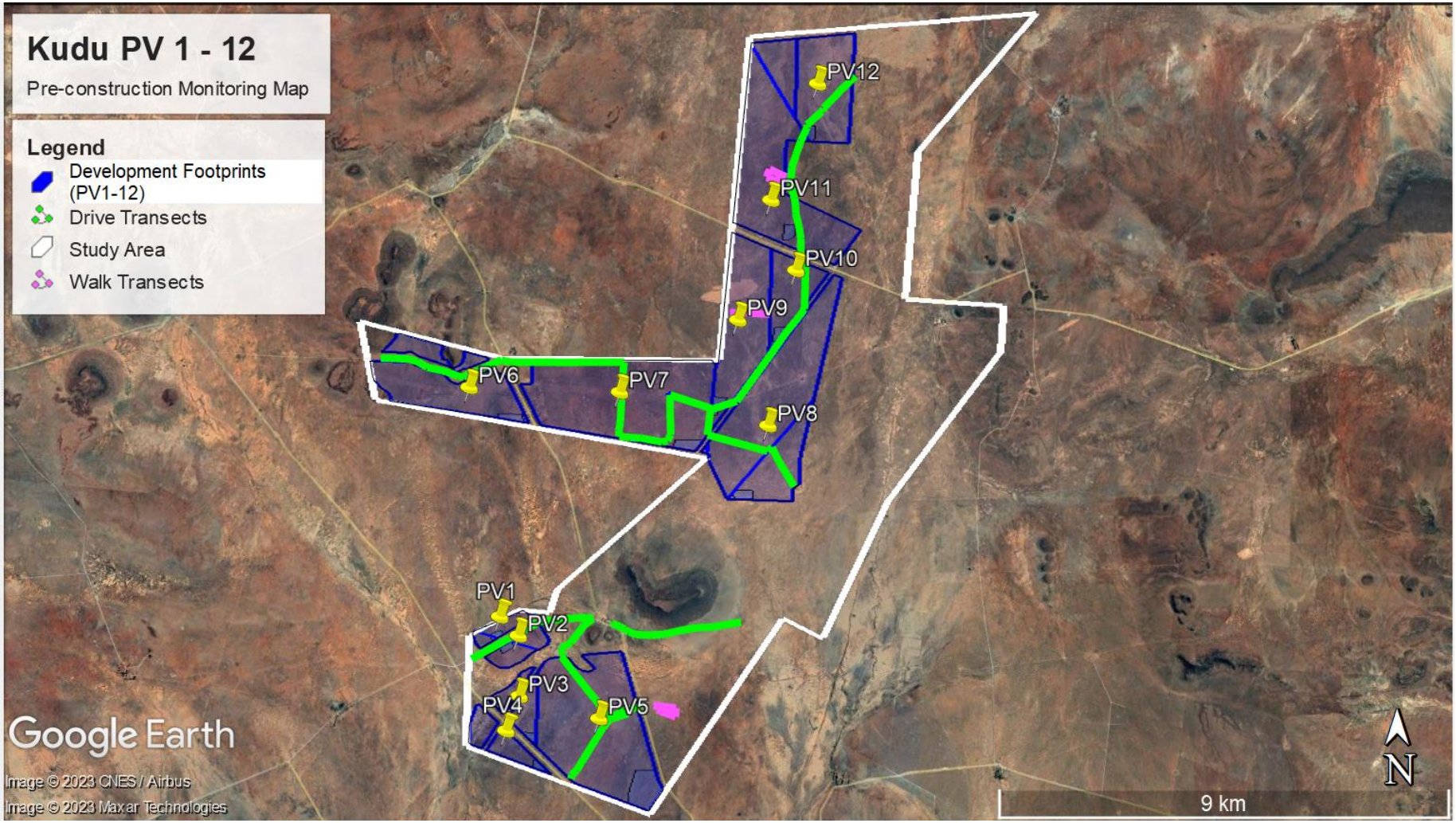


Figure 1: Map of Transect Locations of the Pre-construction Monitoring Surveys (Kudu Solar PV Study Area = white polygon).

2 Results of Pre-Construction Bird Monitoring

Table 1 and **2** and **Figures 2** and **3** below present the results of the pre-construction monitoring conducted at the Kudu PV Study Area during the two surveys. The results of the transect counts are presented in Table 1.

Table 1: Results of the transect counts

Total number of species	
All Species	76
Priority Species	18 (24%)
Non-Priority Species	58

Total number of records	
Transects	4097

An Index of Kilometric Abundance (IKA = birds/km) was calculated for each priority species recorded during transect counts for the two surveys (**Figure 2**). And **Figure 3** below shows the spatial distribution of the priority species recorded during transect counts and incidental sightings during the pre-construction monitoring surveys conducted at the Kudu Solar PV Cluster.

The results of the incidental counts are presented in Table 2.

Species names	Sci name	**Survey 1**	**Survey 2**	**Grand total**
Pale Chanting Goshawk	*Melierax canorus*	2		**2**
Large-billed Lark	*Galerida magnirostris*	1		**1**
Jackal Buzzard	*Buteo rufofuscus*		2	**2**
Greater Kestrel	*Falco rupicoloides*		1	**1**

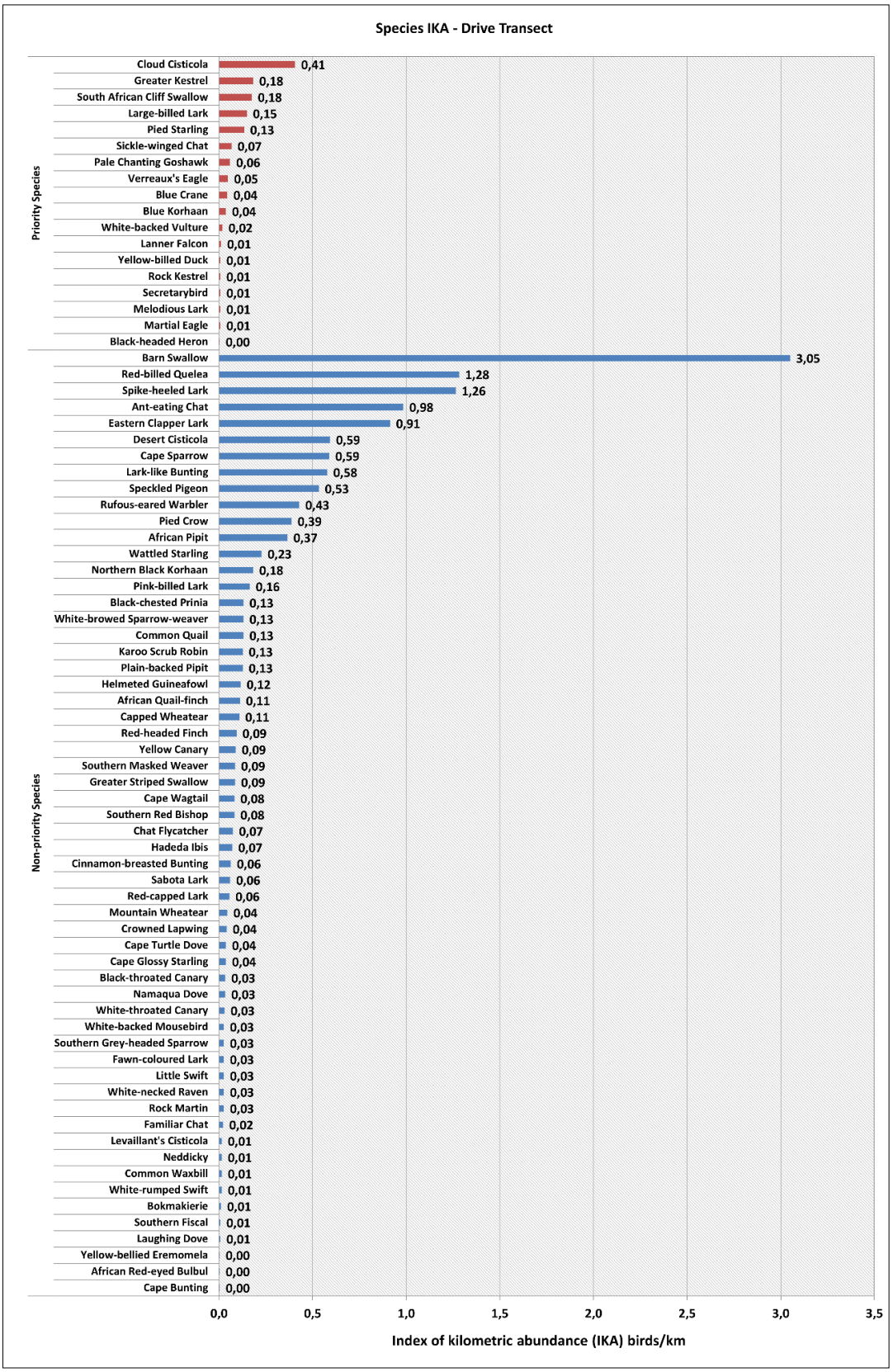


Figure 2: IKA for transect solar priority & non-priority species at the proposed Kudu Solar PV Project Cluster recorded during the two surveys.

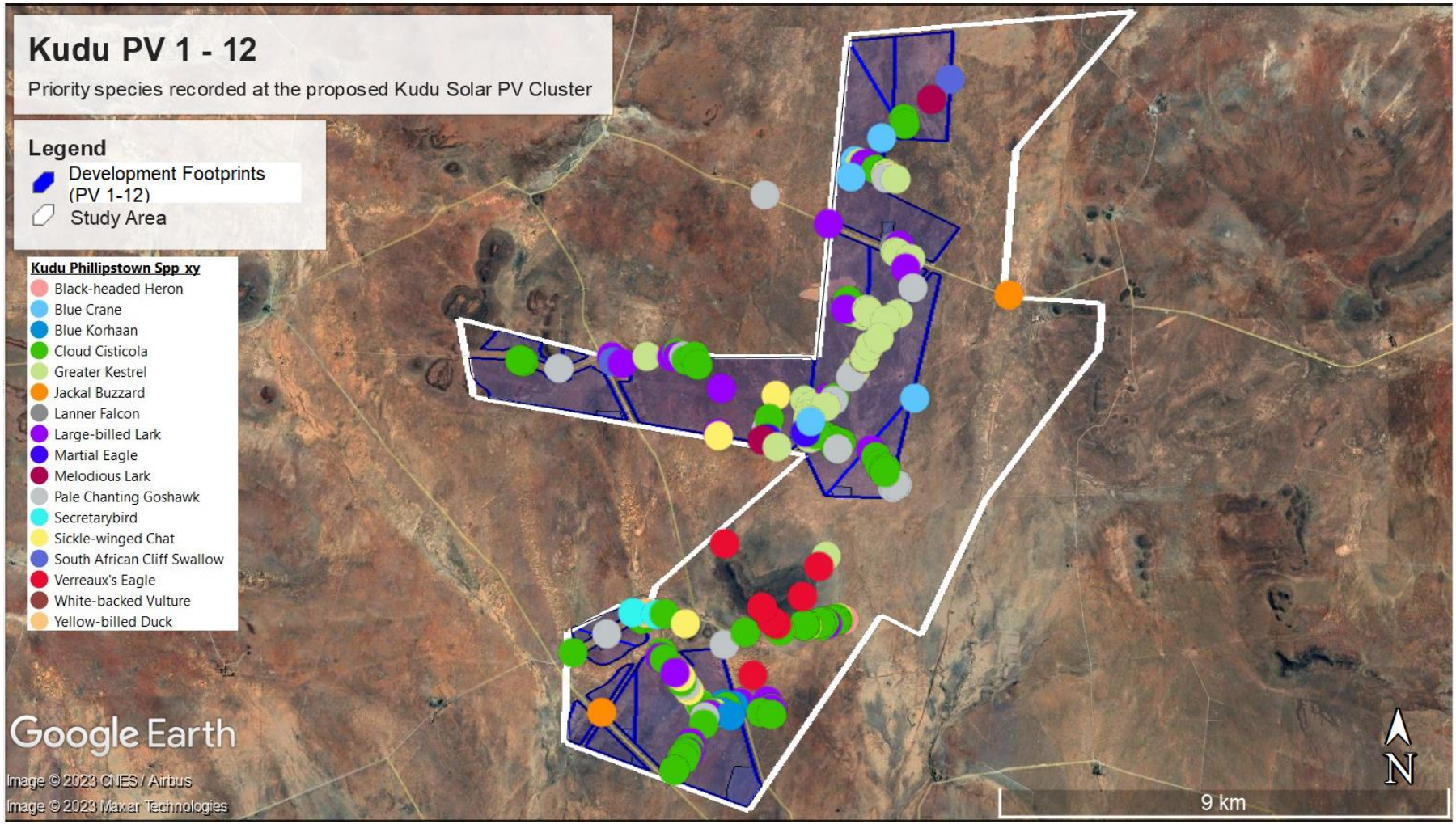


Figure 3: The location of priority species recorded at the proposed SEF study area during transect and incidental counts.

3 List of species recorded during the pre-construction monitoring

The species that were recorded during the pre-construction monitoring are listed below.

Priority Species		**Transect counts**	**Incidental counts**
Black-headed Heron	*Ardea melanocephala*	*	
Blue Crane	*Grus paradisea*	*	
Blue Korhaan	*Eupodotis caerulescens*	*	
Cloud Cisticola	*Cisticola textrix*	*	
Greater Kestrel	*Falco rupicoloides*	*	*
Jackal Buzzard	*Buteo rufofuscus*		*
Lanner Falcon	*Falco biarmicus*	*	
Large-billed Lark	*Galerida magnirostris*	*	*
Martial Eagle	*Polemaetus bellicosus*	*	
Melodious Lark	*Mirafra cheniana*	*	
Pale Chanting Goshawk	*Melierax canorus*	*	*
Pied Starling	*Lamprotornis bicolor*	*	
Rock Kestrel	*Falco rupicolus*	*	
Secretarybird	*Sagittarius serpentarius*	*	
Sickle-winged Chat	*Emarginata sinuata*	*	
South African Cliff Swallow	*Petrochelidon spilodera*	*	
Verreaux's Eagle	*Aquila verreauxii*	*	
White-backed Vulture	*Gyps africanus*	*	
Yellow-billed Duck	*Anas undulata*	*	
		18	**4**
Non-Priority Species		**Transect counts**	**Incidental counts**
African Pipit	*Anthus cinnamomeus*	*	
African Quail-finch	*Ortygospiza atricollis*	*	
African Red-eyed Bulbul	*Pycnonotus nigricans*	*	
Ant-eating Chat	*Myrmecocichla formicivora*	*	
Barn Swallow	*Hirundo rustica*	*	
Black-chested Prinia	*Prinia flavicans*	*	
Black-throated Canary	*Crithagra atrogularis*	*	
Bokmakierie	*Telophorus zeylonus*	*	
Cape Bunting	*Emberiza capensis*	*	
Cape Glossy Starling	*Lamprotornis nitens*	*	
Cape Sparrow	*Passer melanurus*	*	
Cape Turtle Dove	*Streptopelia capicola*	*	
Cape Wagtail	*Motacilla capensis*	*	
Capped Wheatear	*Oenanthe pileata*	*	
Chat Flycatcher	*Melaenornis infuscatus*	*	
Cinnamon-breasted Bunting	*Emberiza tahapisi*	*	
Common Quail	*Coturnix coturnix*	*	
Common Waxbill	*Estrilda astrild*	*	
Crowned Lapwing	*Vanellus coronatus*	*	
Desert Cisticola	*Cisticola aridulus*	*	

Eastern Clapper Lark	*Mirafra fasciolata*	*	
Familiar Chat	*Oenanthe familiaris*	*	
Fawn-coloured Lark	*Calendulauda africanoides*	*	
Greater Striped Swallow	*Cecropis cucullata*	*	
Hadeda Ibis	*Bostrychia hagedash*	*	
Helmeted Guineafowl	*Numida meleagris*	*	
Karoo Scrub Robin	*Cercotrichas coryphoeus*	*	
Lark-like Bunting	*Emberiza impetuani*	*	
Laughing Dove	*Spilopelia senegalensis*	*	
Levaillant's Cisticola	*Cisticola tinniens*	*	
Little Swift	*Apus affinis*	*	
Mountain Wheatear	*Myrmecocichla monticola*	*	
Namaqua Dove	*Oena capensis*	*	
Neddicky	*Cisticola fulvicapilla*	*	
Northern Black Korhaan	*Afrotis afraoides*	*	*
Pied Crow	*Corvus albus*	*	
Pink-billed Lark	*Spizocorys conirostris*	*	
Plain-backed Pipit	*Anthus leucophrys*	*	
Red-billed Quelea	*Quelea quelea*	*	
Red-capped Lark	*Calandrella cinerea*	*	
Red-headed Finch	*Amadina erythrocephala*	*	
Rock Martin	*Ptyonoprogne fuligula*	*	
Rufous-eared Warbler	*Malcorus pectoralis*	*	
Sabota Lark	*Calendulauda sabota*	*	
Southern Fiscal	*Lanius collaris*	*	
Southern Grey-headed Sparrow	*Passer diffusus*	*	
Southern Masked Weaver	*Ploceus velatus*	*	
Southern Red Bishop	*Euplectes orix*	*	
Speckled Pigeon	*Columba guinea*	*	
Spike-heeled Lark	*Chersomanes albofasciata*	*	
Wattled Starling	*Creatophora cinerea*	*	
White-backed Mousebird	*Colius colius*	*	
White-browed Sparrow-weaver	*Plocepasser mahali*	*	
White-necked Raven	*Corvus albicollis*	*	
White-rumped Swift	*Apus caffer*	*	
White-throated Canary	*Crithagra albogularis*	*	
Yellow Canary	*Crithagra flaviventris*	*	
Yellow-bellied Eremomela	*Eremomela icteropygialis*	*	
	Subtotal	**58**	**1**
	Grand total	**76**	**5**

Appendix 9.G: Compliance with the Animal Species Protocol (GN 1150, October 2020)

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species	***Section where this has been addressed in the Specialist Report***
2. Terrestrial Animal Species Specialist Assessment *The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:* *2.1. The assessment must be undertaken by a specialist registered with the South African Council for Natural Scientific Professions (SACNASP), within a field of practice relevant to the taxonomic groups ("taxa") for which the assessment is being undertaken.*	*Appendix 9.A*
2.2. The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline and must:	-
2.2.1. Identify the SCC which were found, observed or are likely to occur within the study area;	*Section 9.4, Appendix 9.C*
2.2.2. provide evidence (photographs or sound recordings) of each SCC found or observed within the study area, which must be disseminated by the specialist to a recognized online database facility immediately after the site inspection has been performed (prior to preparing the report contemplated in paragraph 3);	*Section 9.4, Appendix 9.C*
2.2.3. identify the distribution, location, viability and provide a detailed description of population size of the SCC identified within the study area;	*Section 9.4, Appendix 9.C, & Appendix 9.F*
2.2.4. identify the nature and the extent of the potential impact of the proposed development to the population of the SCC located within the study area;	*Sections 9.6 & 9.7*
2.2.5. determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases including the IUCN Red List of Threatened Species, South African Red List of Species, and/or other relevant databases;	*Sections 9.2 & 9.4, Appendix 9.C*
2.2.6. determine the potential impact of the proposed development on the habitat of the SCC located within the study area;	*Sections 9.6 & 9.7*
2.2.7. include a review of relevant literature on the population size of the SCC, the conservation interventions as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, a motivation for the deviation;	*Section 9.2*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species	***Section where this has been addressed in the Specialist Report***
2.2.8. identify any dynamic ecological processes occurring within the broader landscape, that might be disrupted by the development and result in negative impact on the identified SCC, for example, fires in fire-prone systems;	*Section 9.7*
2.2.9. identify any potential impact on ecological connectivity within the broader landscape, and resulting impacts on the identified SCC and its long term viability	*Section 9.7*
2.2.10. determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC;	*Section 9.4.4*
2.2.11. discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species, or roosting and breeding or foraging areas used by migratory species where these species show significant congregations, occurring in the vicinity;	*Section 9.4.2, Appendix 9.C & Appendix 9.F*
2.2.12. Identify any alternative development footprints within the preferred development site which would be of "low" sensitivity" or "medium" sensitivity as identified by the screening tool and verified through the site sensitivity verification.	*Section 9.5*
2.3. The findings of the assessment must be written up in a Terrestrial Animal Species Specialist Assessment Report.	-
3. Terrestrial Animal Species Specialist Assessment Report: *3.1. This report must include as a minimum the following information:*	-
3.1.1. contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae;	*Appendix 9.A*
3.1.2. a signed statement of independence by the specialist;	*Appendix 9.B*
3.1.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	*Section 9.4.4, Appendix 9.F*
3.1.4. a description of the methodology used to undertake the site sensitivity verification and impact assessment and site inspection, including equipment and modelling used where relevant;	*Section 9.2, Appendix 9.C*
3.1.5. a description of the mean density of observations/number of sample sites per unit area and the site inspection observations;	*Appendix 9.F*
3.1.6. a description of the assumptions made and any uncertainties or gaps in knowledge or data;	*Section 9.2.2*
3.1.7. details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;	*Section 9.4.4*
3.1.8. the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area;	*Section 9.2*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species	***Section where this has been addressed in the Specialist Report***
3.1.9. the location of areas not suitable for development and to be avoided during construction where relevant;	*Section 9.4.4*
3.1.10. a discussion on the cumulative impacts;	*Section 9.7.4*
3.1.11. impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	*Sections 9.7, 9.9 & 9.10*
3.1.12. a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant;	*Section 9.10*
3.1.13. a motivation must be provided if there were any development footprints identified as per paragraph 2.2.12 above that were identified as having "low" or "medium" terrestrial animal species sensitivity and were not considered appropriate.	*Section 9.5*
3.2. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	*This Avifauna Report serves this purpose i.e. Chapter 9 of the EIA Report.*

CHAPTER 10:

Visual Impact Assessment

CSIR
Touching lives through innovation

VISUAL SPECIALIST ASSESSMENT:

Scoping and Environmental Impact Assessment (EIA) Processes for the Proposed Development of a Solar Photovoltaic Facility (Kudu Solar Facility 4) and associated infrastructure, near De Aar, Northern Cape Province

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services P O Box 320 Stellenbosch 7599 South Africa	Bernard Oberholzer (bola) and Quinton Lawson (qarc) PO Box 471, Stanford, 7210

V1: 20 May 2023
V2: July 2023

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Photomontage: Kudu PV4

List of Abbreviations

BA	Basic Assessment
BESS	Battery Energy Storage System
DEM	Digital Elevation Model
DFFE	Department of Forestry, Fisheries and the Environment
EAP	Environmental assessment practitioner
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GN	Government Notice
GPS	Global Positioning System
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
PV	Photovoltaic
REEA	Renewable Energy EIA Application Database
SAPAD	South African Protected Areas Database
SEA	Strategic Environmental Assessment
VIA	Visual Impact Assessment

Glossary

Definitions	
Receptor	Individuals, groups or communities who are subject to the visual influence of a particular project.
Viewpoint	A selected point in the landscape from which views of the project are ascertained.
Viewshed	The outer boundary defining a view catchment area, used to determine the zone of visual influence.
View shadow	An area within the view catchment visually obscured from the project, usually by topography.
Visual absorption capacity	The ability of an area to visually absorb development by means of screening topography, vegetation or buildings.

VISUAL IMPACT ASSESSMENT

1. Introduction

1.1. Scope, Purpose and Objectives of this Specialist Input to the EIA Report

This report serves as the Visual Impact Assessment (VIA) as part of the Environmental Impact Assessment (EIA) Process for the proposed development of a Solar Photovoltaic (PV) Facility (Kudu Solar Facility 4) and associated infrastructure, near De-Aar, Northern Cape Province (**Map 1**).

The purpose of the VIA is to provide inputs to the Scoping and EIA Reports for the Kudu Solar PV project as required by the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) EIA Regulations (2014, as amended). The intention is that the VIA used to determine layouts for the Solar PV site based on the visual sensitivities identified, as well as those by other specialists.

During the scoping phase, the specialists considered the entire study area, which included the Original Scoping Buildable Areas that included the development of up to 14 Solar PV Facilities. However, following the identification of sensitivities, discussions with landowners and other considerations such as the capacities of the upcoming Bidding Windows, the proposed projects were re-clustered and a total of up to 12 Solar PV Facilities are now being proposed.

Separate reports have been compiled for each PV facility. This report covers the Kudu Solar Facility 4 and associated infrastructure.

1.2. Details of Specialist

The visual specialist assessment has been undertaken by Bernard Oberholzer (BOLA) and Quinton Lawson (QARC). BOLA is registered with the South African Council for the Landscape Architectural Profession (SACLAP), with Registration Number 87018, and QARC with the South African Council for the Architectural Profession (SACAP), with Registration Number 3686. A curriculum vitae is included in Appendix A of this specialist input report and a signed specialist statement of independence is included in Appendix B.

1.3. Terms of Reference

The Terms of Reference for the visual scoping and EIA specialist studies include the following:

- Undertake a site inspection to identify existing scenic resources/visual characteristics on and around the proposed project sites.
- Determine visual constraints and sensitivity levels in terms of solar PV development. Verify these in terms of the National Screening Tool to confirm or dispute identified environmental sensitivities.
- Determine viewsheds, view corridors and important viewpoints in order to assess the visual influence of the proposed project.
- Review the legal framework that may have implications for visual/scenic resources.
- Identify and assess possible visual impacts that could result from the proposed project.
- Determine possible cumulative visual impacts in relation to other renewable energy projects in the region.
- Identify possible mitigation measures to reduce the significance of negative visual impacts for inclusion into the project design.

2. Approach and Methodology

The approach and methodology for the VIA specialist study includes the following:

- A 3D digital terrain model of the study area is used to determine the viewshed of the proposed project.
- Potential sensitive receptors, such as farmsteads and settlements in the surrounding area, are identified using the viewshed map and Google Earth.
- Landscape features and sensitive receptors are mapped together with recommended buffers.
- Field work is used to verify the existence and significance of landscape features and receptors.
- A photographic record is made with the emphasis on views from potential sensitive receptors of the proposed project at varying distances.
- The panoramic photographs, which include GPS positions, are then used to create the post-mitigation photomontages.

A Site visit was carried out on 15 and 16 March 2022. The track used during the fieldwork is indicated on **Map 3**. The season was not a consideration for the visual survey, but clear visibility was required.

The methodology is based on the 'Guideline for Involving Visual and Aesthetic Specialists in EIA Processes' (Oberholzer, 2005).

Potential visual impacts identified in this specialist study have been assessed based on the criteria and methodology outlined in Appendix D. Refer to Appendix E for table of compliance with Appendix 6 of the 2014 NEMA EIA Regulations (as amended).

2.1. Information Sources

A List of the main databases and information sources is given in Table 1 below. The quality of base data was considered adequate for the visual assessment.

Table 1: Sources of information

Data / Information	Source	Date	Type	Description
Project Data	ABO Wind Renewable Energies (PTY) LTD	2023	Vector Digital Spatial Data	Project Component Layout provided by proponent
South African National Protected Areas Database (SAPAD)	Department of Forestry, Fisheries and the Environment (DFFE)	2022, Q1	Vector Digital Spatial Data	Spatial delineation of protected areas in South Africa, updated quarterly
South African Renewable Energy EIA Application Database (REEA)	Department of Forestry, Fisheries and the Environment (DFFE)	2022, Q2	Vector Digital Spatial Data	Spatial delineation of Renewable Energy EIA Applications in South Africa, updated quarterly
ESKOM EGI Power Corridors	Department of Forestry, Fisheries and the Environment (DFFE)	2015	Vector Digital Spatial Data	Spatial delineation of EGI Power Corridors in South Africa
ESKOM Infrastructure Spatial Data	ESKOM: Electricity Grid Infrastructure (EGI) Database	2008	Vector Digital Spatial Data	Spatial delineation of ESKOM EGI Transmission, Distribution and Substation Data
Geological Data	Council for Geoscience	2011	Vector Digital Spatial Data	Geological Map of South Africa: Spatial Dataset

Data / Information	Source	Date	Type	Description
1:50 000 Topographic Series GIS Data	Chief Directorate National Geo-spatial Information (CDNGI)	2008	Vector Digital Spatial Data	Spatial Data of the 1:50 000 Topographic Series including elevational data (20m contours)
1:50 000 Topographic Series Maps	Chief Directorate National Geo-spatial Information (CDNGI)	2005	Georeferenced Raster Data	3024AA Potfontein, 3024AB Jakkalskuil 3024AC Houtkraal, 3024AD Philipstown
South Africa Road and Terrain Data	Google Maps (maps.google.com)	2022	Online Data	South Africa Road and Terrain Data
South Africa Satellite Imagery	Google Earth Pro	2022	Online Data	South Africa Satellite Imagery

2.1.1. Assumptions, Knowledge Gaps and Limitations

The detailed design of the solar arrays that may be used have not been determined at this stage, but a height of 3,5m was used to prepare the viewshed map.

Assumptions were made regarding the configuration and finishes of the proposed substation and battery energy storage system (BESS), as well as lighting related to the proposed project.

3. Description of Project Aspects relevant to the Visual Assessment

The Kudu project will entail the proposed development of up to 12 Solar PV Facilities ranging from up to 50 MWac to 350 MWac, as well as associated infrastructure, near De Aar, Northern Cape. This report focuses on Kudu Solar PV Facility 4.

The proposed project will make use of PV solar technology with the solar PV facility having associated infrastructure, including, but not limited to, an on-site substation complex and BESS (+-1 ha and max. height 10m). Each On-Site Substation Complex (extending up to 8 ha) could include an on-site Independent Power Producer (IPP) or Facility Substation (+-1 ha), and O&M buildings (up to 0,5 ha), as well as other infrastructure that would be subjected to the separate assessment processes. **Maps 2 and 3** indicate the affected farm portions, as well as the proposed PV areas for all 12 projects.

Various Electrical Grid Infrastructure (EGI) are being proposed to enable and facilitate connection of the proposed projects to the national grid, and that these EGI will be assessed as part of separate Basic Assessment processes or similar[1].

4. Baseline Environmental Description

4.1. Study Area Definition

The study area for all the proposed Kudu Solar Facilities is the full extent of the eight affected farm properties on which the proposed PV Facilities will be constructed. The full extent of these properties has been assessed in this study in order to identify environmental sensitivities and no-go areas. The total **study area** for all the Kudu Solar Facilities is approximately 8 150 hectares (ha).

At the commencement of this Scoping and EIA Process, the **Original Scoping Buildable Areas** were identified by the Project Developer, following the completion of high-level environmental screening based on the Screening Tool.

[1] However, for completeness, the external EGI corridor and power lines (Projects 13 to 26) are shown on some of the maps in this report. Note these are not part of this current assessment, and are still to be finalised.

Following the identification of sensitivities during the Scoping Phase, the Project Developer has considered such sensitivities and formulated the **Revised Buildable Areas**. The Revised Scoping Buildable Areas were used to inform the design of the layout, and further assessed during this EIA Phase of the project in order to identify the preferred development footprint of the proposed project on the approved site as contemplated in the accepted Scoping Report. The development footprint is where the actual development will be located, i.e. the footprint containing the PV solar arrays and associated infrastructure.

4.2. General Description

A brief description of scenic features and receptors in the surrounding area that can potentially be affected by visual impacts arising from the proposed project are described below. These are indicated on **Map 9** together with the proposed development, and in the photographs below.

The study area lies within an expansive flattish landscape, composed of Ecca Group shales, interspersed with dolerite-capped koppies, providing topographic relief, these being the main scenic features of the area (**Map 5** and Figure 1). The elevation ranges from 1000 to 1500m in the region.

The vegetation is Northern Upper Karoo type (Mucina and Rutherford, 2006), consisting of dwarf shrubland and grassland. The grassland was unusually lush after the good summer rains experienced this year in the region, (Figure 2), and the local district roads were very muddy. The dolerite koppies are covered with open shrubland along with grasses.

The main agricultural activity is open-range sheep farming with both merino and dorper sheep occurring, along with cattle farming and some horses. A main Eskom powerline (i.e. Hydra/Perseus 1 765kV) traverses several of the proposed Kudu Solar PV sites, constituting an existing visual impact.

Farmsteads nestled among tree copses in the surrounding area tend to be 2 km or more apart (Figures 4 and 5). Three of the farmsteads, Louwsvilla, Zionsheuwel and Rooidam, were derelict and not occupied (Figure 3). Two farmsteads, Wolwekuil farmstead (situated on Farm 42/RE), and Basberg, are located within the overall project area, and it was therefore assumed that these are not sensitive receptors. Furthermore, the area around the Basberg Mountain, being a scenic feature, has been excluded from the proposed PV development area.

Figure 1: Grass-covered dolerite koppies provide the main landscape relief in the area

Figure 2: The grassland plains near Louwsvilla are used for sheep grazing

Figure 3: Louwsvilla farmstead to the south of the proposed Kudu Solar PV facilities is derelict

Figure 4: Karee Kloof farmstead, surrounded by tall cypresses, would be 2,8km from the proposed Kudu project

Figure 5: View towards Middelplaas-Noord farmstead and the flat-topped Basberg in the middle distance

The only known guest farm / game farm in the area, which provides visitor facilities, is Jakkalskuil, and the nearest nature reserves are in the vicinity of the Van Der Kloof Dam more than 30km to the north-east (**Map 1**). According to the Social Impact Assessment (SIA), game occurs on most of the study area properties, several of which offer annual (winter) hunting opportunities. There are no known airfields in the local area.

The viewshed, or zone of visual influence of the proposed solar PV site potentially extends for some 5km, but is partly restricted by the Basberg to the north-east, creating a view shadow. Given the height of the solar arrays (about 3,5m), the viewshed of the proposed solar facility would be fairly localised (see **Map 6**). Estimated degrees of visibility, based on the scale and height of all the PV facilities and related infrastructure, and on the distance from various viewpoints, are indicated in Tables 2 and 3 below.

Table 2: Degrees of Visibility of Proposed PV Facilities

Very high visibility	0-500m	Prominent feature within the observer's view frame
High visibility	500m-1km	Relatively prominent within observer's view frame
Moderate visibility	1-2km	Only prominent as part of the wider landscape
Low visibility	2-4km	Visible as a minor element in the landscape
Very low visibility	>4km	Hardly visible with the naked eye in the distance

Table 3: Viewing Distances and Potential Visibility from Receptors

View-point	Receptor	Latitude	Longitude	Distance to PV arrays	Potential Visibility/ Closest PV Project
VP1	Bokkraal	30.318559 S	24.354662 E	6.79 km	Not Visible
VP2	Zionsheuwel (derelict)	30.267535 S	24.374876 E	5.81 km	Very Low visibility. Beyond 5km
VP3	Rooidam (derelict)	30.281976 S	24.362026 E	4.82 km	Very Low visibility.
VP4	Louwsvilla (derelict)	30.294538 S	24.308752 E	2.97 km	Low visibility.
VP5	Karee Kloof (Swartkoppies)	30.281137 S	24.276414 E	2.87 km	Low visibility
VP6	Vrede	30.256084 S	24.270718 E	2.59 km	Low visibility
VP7	Tafelkop	30.185034 S	24.234760 E	9.98 km	Very Low visibility. Beyond 5km
VP8	Middelplaas-Noord	30.187386 S	24.300348 E	7.56 km	Very Low visibility. Beyond 5km
VP9	Jakobsrus	30.161906 S	24.328036 E	10.74 km	Very Low visibility. Beyond 5km
VP10	Wolwekuil (Farm 42/1)	30.167089 S	24.410270 E	14.48 km	Not Visible
VP11	Grasbult	30.149474 S	24.418840 E	16.46 km	Not Visible

4.3. Project Specific Description

The description of the baseline environment for Kudu Solar Facility 4 is similar to the general description given above. Landscape and scenic features have generally been avoided in the proposed solar PV layout and features of 'very high' visual sensitivity have been avoided.

4.4. Identification of Environmental Sensitivities

4.4.1. Sensitivities identified by the National Web-Based Environmental Screening Tool

The proposed project study area has been overlaid on the landscape sensitivity map generated by the Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool, and on a more detailed project-scale sensitivity map, that has been verified by the specialists, (see Appendix C).

The Screening Tool 'Landscape' Sensitivity Map indicates areas of ridges and steep slopes in the northern and southern parts of the study area (**Map 8**). These were, however, mapped at the regional scale linked to the Phase 1 Wind and Solar 2015 Strategic Environmental Assessment (SEA), and a more accurate map of landscape features with recommended buffers has been prepared at the local project scale by the specialists, (see **Map 10** and Tables 4 and 5).

4.4.2. Visual Sensitivity Analysis and Verification

Landscape features of visual or scenic value, along with potential sensitive receptors in the surroundings, are listed in Table 4 below. Visual features are indicated on **Map 9**.

Table 4: Scenic Features and Sensitive Receptors

Landscape features within or adjacent to the study area.	
Topographic features	Characteristic landforms include the dolerite *koppies* contributing to the scenic value of the area, and providing visual interest or contrast to the flat grassy plains.
Water Features	In the dry landscape, drainage features and larger dams provide scenic and amenity value.
Cultural landscapes	The area contains modest farmsteads with tree copses, grazing pasture and minimal cultivation.
Receptors adjacent to the PV project or in the local surroundings.	
Protected Areas	There are no known proclaimed nature reserves or private reserves in close proximity to the study area, the nearest being Van der Kloof Nature reserve some 30km away.
Human settlements	The nearest settlements are Philipstown and Petrusville, over 20 km away, and De Aar about 50 km away.
Scenic and arterial routes	There are no major arterial or scenic routes within the vicinity of the solar PV site.

Scenic resources and sensitive receptors within the study area have been categorised into no-go (very high), high, medium and low visual sensitivity zones, for the proposed solar PV facility, as indicated in Tables 5 and 6 below. The visual sensitivity mapping categories are spatially indicated on **Map 10**.

Substations, BESS, internal power lines and access roads would have minor buffers. The buffers in Table 5 are based on those for landscape resources in the National Wind and Solar SEA (Lawson and Oberholzer, 2014).

Table 5: Visual Sensitivity Mapping Categories for the Proposed Kudu Solar Facility 4

Scenic Resources	Very high sensitivity	High visual sensitivity	Medium visual sensitivity	Low visual sensitivity
Topographic features	Feature	Within 250m	-	-
Steep slopes	Slopes > 1:4	Slopes > 1:10	-	-
Drainage courses	Feature	Within 50m	-	-
Cultural landscapes	within 250m	within 500m	-	
Protected Landscapes / Sensitive Receptors				
Nature reserves / game farms	within 500m	within 1 km	within 2 km	-
Farmsteads outside site	within 500m	within 1 km	within 2 km	-
Farmsteads inside site	within 250m	within 500m	-	
Arterial routes n/a	within 250m	within 500m	within 1km	-
District roads	within 50m	within 100m	within 250km	-

Table 6: Visual Sensitivity Categories

Very high	Areas or features considered of such sensitivity or importance that any adverse effects upon them may be regarded as a fatal flaw.
High	Development to be limited and remain within acceptable limits of change determined by the specialist, and comply with restrictions or mitigation measures identified by the specialist.
Medium	Areas considered to be developable, but to remain within acceptable limits of change as determined by the specialist, and comply with restrictions or mitigation measures identified by the specialist.
Low	Low sensitivity areas that are considered to be developable. However, specialists may still wish to define acceptable limits of change where necessary.

4.4.3. Sensitivity Analysis Summary Statement

More accurate mapping of landscape features has been provided at the detailed project scale, being a refinement of the DFFE's Screening Tool Landscape Sensitivity Map. No significant landscape or scenic features would be affected by the currently proposed Kudu Solar facility. The sensitivities noted below are based on the identified 'Buildable Areas', (i.e. development footprints).

Table 7: Visual Sensitivity Analysis of the Proposed Solar Facility

Kudu Solar Facility	Scenic Resources / Receptors	Sensitivity
Kudu Solar Facility 4 related infrastructure	The proposed solar PV borders on a drainage feature and local road but outside the no-go buffer areas. The nearest surrounding farmstead, Vrede, is 2,59 km away, and well outside the buffer area.	Low visual sensitivity

As indicated above, following the identification of sensitivities during the Scoping Phase, the Project Developer considered such sensitivities and formulated the Revised Buildable Areas. The Revised Scoping Buildable Areas led to the identification of the development footprints and detailed layouts in the EIA Phase which are considered suitable from a visual perspective, as the sensitivities identified above have been taken into consideration as shown on **Map 10**.

Changes to the detailed layouts are deemed acceptable if the changes remain within the approved buildable areas / development footprints assessed during the Scoping and EIA Process with no-go sensitive areas avoided.

5. Issues, Risks and Impacts

5.1. Identification of Potential Impacts/Risks

Potential visual impacts arising from the proposed Kudu Solar PV Facility and associated infrastructure on landscape features and receptors identified above are listed below for each of the project phases, including cumulative impacts. No indirect impacts have been identified.

Construction Phase

- Impact 1: Potential effect of dust and noise from trucks and construction machinery during the construction period, and the effect of this on nearby farmsteads and visitors to the area.
- Impact 2: Potential visual effect of haul roads, access roads, stockpiles and construction camps in the visually exposed landscape.

Operational Phase

- Impact 1: Potential visual intrusion of solar arrays and related infrastructure on receptors including glint and glare.
- Impact 2: Potential visual impact of an industrial type activity on the pastoral / rural character and sense of place of the area.

Decommissioning Phase

- Impact 1: Potential visual effect of any remaining structures, platforms and disused roads on the landscape.

Cumulative Impacts

- Impact 1: Potential combined visual effect of the proposed 12 solar PV facilities in the study area, seen together with other existing and proposed renewable energy facilities in the area, are indicated on **Map 11** and could potentially increase the overall cumulative visual impact.

5.2. Summary of Issues identified during the Public Consultation Phase

Visual related issues were raised by Interested and Affected Parties (I&APs) and Stakeholders during the 30-day review period on the Draft Scoping Report. A summary of these issues is listed below, together with responses from the Visual Specialists.

KEY ISSUE	RESPONSE
Requests for information on the visual impact of the development on neighbouring farm portions as relating to farming and tourism activities. Specifically: • Please provide information and sketches about the visual impact that this development will have on farm Vanwyngaardspan and farming. • Please provide information and sketches about the visual impact that this development will have on farm Jakkalskuil and farming activities like the offering of hunting- and photographic safaris to clients from all over the world.	• The location of farm Vanwyngaardspan was confirmed with the landowner during the EIA Phase. Farm Vanwyngaardspan is more than 25 km away from the northern-most corner of Kudu Solar Facility 11 (and even further from the Kudu Solar Facility 4). The proposed Kudu Solar Facilities would not be visible from this area. There are also two koppies - Aasvoëlkop and Ongelukskop, which are 85m higher than the Kudu Solar Facility 11, which would block the line of sight of the proposed Kudu Solar Facilities. Refer to the VIA for Kudu Solar Facility 11 for additional information. • The Jakkalskuil farmstead is 5,84 km from the proposed project area and the Kudu Solar Facility would therefore not be visible. Refer to the VIA for Kudu Solar Facility 12 for additional information. However, the farm boundary is directly adjacent to the Kudu Solar Facility 12 and the visibility would be very high at 360m distance. The viewshed, or zone of visual influence, potentially extends for some 5 km, hence the Jakkalskuil farmstead was not included in the Visual Scoping Level Assessment. Impacts on adjacent farmsteads have therefore been identified and considered in the VIA specialist study.
Request to ensure that the visual impact on the nearest farmstead, Vrede, is adequately assessed.	Various impacts are identified and assessed in the VIA, such as the potential effect of dust and noise from trucks and construction machinery during the construction period, and the effect of this on nearby farmsteads and visitors to the area, as well as the potential visual impact of a solar energy facility on the pastoral / rural character and sense of place of the area. The Vrede farmstead is located some 2,59 km away from the proposed Kudu PV 4 project, assessed as 'low' visibility and is also outside the visual buffer area as shown on Map 10.

Minor comments related to visual impacts associated with the proposed project were raised by Interested and Affected Parties during the review period of the Draft EIA Report. These comments mainly related to clarification of high sensitivity areas being slightly encroached for Kudu Solar Facility 1, 2, 3 and 4 (which do not need to be avoided) and dust generation. Responses have been provided in Appendix H.7 of the Final EIA Report.

6. Visual Impact Assessment

This section provides an assessment of the potential visual impacts of the proposed project. Comment on the no-go alternative is also provided.

Criteria for determining visual impact included the following:

Visual Exposure: (Map 6)
The viewshed, or zone of visual influence, potentially extends for some 5km, but is partly restricted by the Basberg to the north-east where parts of the surrounding area are in a view shadow.

Visibility:
Possible degrees of visibility from a number of viewpoints are indicated in Table 3. (See also photo-montages). Visibility of lights at night would not be significant because of the localised need for lighting and the distance of receptors. Visibility for Kudu PV 4 varies from not visible to low visibility.

Landscape Integrity:
The natural landscape intactness of the area, and its pastoral sense of place, has been altered to some extent by the main Eskom powerline (i.e. Hydra/Perseus 1 765kV) that runs through the study area. The character and sense of place of the rural landscape would potentially be affected by the proposed solar PV development.

Visual Absorption Capacity:
The area around the proposed site is generally flat to gently undulating with scattered koppies, and low grass vegetation cover. It is therefore relatively visually exposed, with low to moderate visual absorption capacity, i.e. little potential to screen any proposed structures.

Visually Sensitive Resources:
Natural and cultural landscapes, or scenic resources, form part of the 'National Estate' and may have local or regional significance. The study area has few significant features, most of these being minor dolerite koppies, which have been avoided in the layout**.**

Visual Impact Intensity:
The overall potential visual impact intensity (magnitude) is determined in Table 8 below by combining the above criteria. Visual impact intensity is in turn used to assess impact consequence.

No-go Alternative

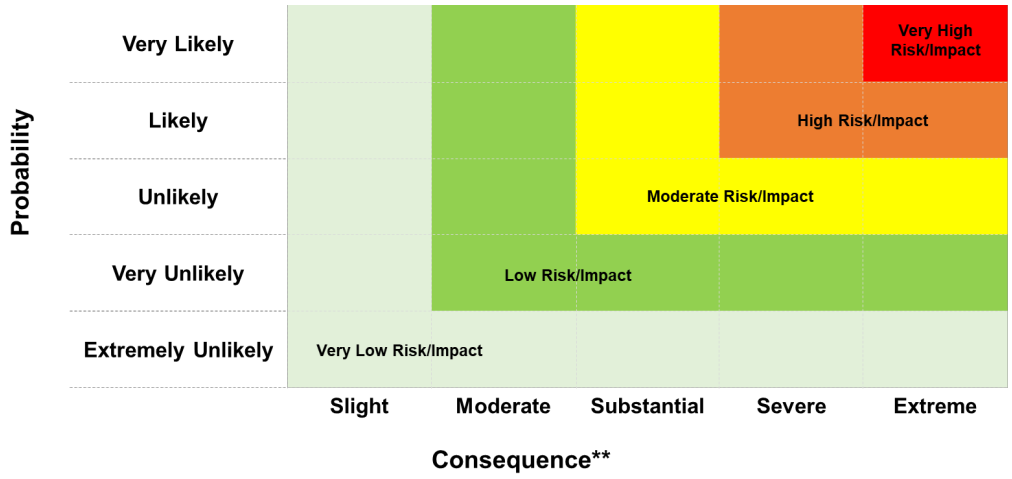
The 'no-go' alternative is the option of not constructing the Project in which case the *status quo* of the current landscape character would prevail, the disadvantage being that no solar energy would be produced for export to the national grid. The potential visual impact would be neutral where the *status quo* is maintained, with neither impacts or benefits occurring.

Table 8: Visual Impact Intensity for Kudu Solar Facility 4

Visual Criteria	Comments	Intensity
Visual exposure	Viewshed is related to the height of the solar arrays. Some areas are in a view shadow.	Medium-low
Visibility	Visible mainly from nearby farmsteads and local district roads. Distance is a mitigatory factor in most cases.	Low
Visual absorption capacity (VAC)	Visually exposed landscape with some undulations. Generally low VAC.	Medium
Landscape integrity / intactness	Effect on landscape character / sense of place.	Medium-high

Visual Criteria	Comments	Intensity
Landscape / scenic sensitivity	Landscape features generally avoided.	Low
Impact intensity	Summary	**Medium**

The quantification of overall visual impact significance for the proposed Kudu Solar Facility is based on the methodology provided by the CSIR (2022), as used in Tables 9 to 12 below. The assessment criteria are included in Appendix D of this report, and the significance rating is based on Figure 6 below.



[Qualitatively determined based on Spatial Extent, Duration, Reversibility and Irreplaceability]

Figure 6: Visual impact risk chart

6.1. Potential Visual Impacts during the Construction Phase

This section includes a description of the potential visual impacts during the Construction Phase.

- ***Impact 1: Potential effect of dust and noise from trucks and construction machinery during the construction period, and the effect of this on nearby farmsteads and visitors to the area.***

The above impact is rated as a negative, direct impact that extends locally and is of a short-term duration. The consequence is rated as moderate, and the probability identified as very likely, resulting in an impact significance of low, without the implementation of mitigation measures. With mitigation, the significance would remain low significance. Mitigation measures include ensuring that the Environmental Management Programme (EMPr) is implemented during the construction phase via the appointment of an Environmental Control Officer (ECO); and ensuring that construction camp and other facilities are located in visually unobtrusive areas, away from public roads. The impact summary is given in Table 9.

- ***Impact 2: Potential visual effect of haul roads, access roads, stockpiles and construction camps in the visually exposed landscape.***

This impact is rated as a negative, direct impact with a short-term duration and local spatial extent. The consequence and probability are respectively rated as moderate and very likely, rendering a low impact significance, without the implementation of mitigation measures. With mitigation, the significance of this

impact would remain low significance. The same mitigation measures identified for Impact 1 above apply to Impact 2.

Table 9: Construction Phase: Visual Impact Assessment

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Potential visual effect of construction activities, haul roads, construction camps (Impacts 1 and 2)	*Status*	**Negative**	**Low risk (Level 4)**	Locate construction camps, batching plants and stockpiles in visually unobtrusive areas, away from public roads. Implement EMPr with ECO during construction.	**Low risk (Level 4)**	**High**
	Spatial Extent	**Local**				
	Duration	**Short Term**				
	Consequence	**Moderate**				
	Probability	**Very Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				

6.2. Potential Impacts during the Operational Phase

This section includes a description of the potential visual impacts during the Operational Phase.

- ***Impact 1 for the above facility: Potential visual intrusion of solar arrays and related infrastructure on receptors including glint and glare***

This impact is rated as a negative, direct impact that extends locally and is of a long term duration. The consequence is rated as moderate, and the probability identified as very likely, resulting in an impact significance of low risk, without the implementation of mitigation measures. With mitigation, the significance of this impact remains low risk significance. Mitigation measures include:

- Locate the substations and BESS in unobtrusive low-lying areas, away from public roads.
- Use muted natural colours and non-reflective finishes for structures generally.
- Keep internal access roads as narrow as possible, and use existing roads or tracks as far as possible.
- Fit outdoor/ security lighting with reflectors to obscure the light source, and minimise light spillage.
- Locate internal powerlines (i.e. 22 kV or 33 kV) underground where possible. (In some cases, such as stream crossings, internal powerlines may need to be above ground).
- Use discrete outdoor signage and avoid commercial / billboard signage.

- ***Impact 2 for the above solar facility: Potential visual impact of an industrial type activity on the pastoral / rural character and sense of place of the area***

This impact is rated as a negative, direct impact with a long-term duration and local spatial extent. The consequence and probability are respectively rated as moderate and very likely, rendering a low risk impact significance, without the implementation of mitigation measures. With mitigation, the significance of this impact remains low risk significance. The same mitigation measures identified for Impact 1 above apply to Impact 2. The impact summary is given in Table 10.

Table 10: Operational Phase: Visual Impact Assessment

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Impact 1: Potential visual intrusion of solar arrays and related infrastructure on receptors, including glint and glare. Impact 2: Effect of an industrial type activity on the pastoral/rural character and sense of place.	*Status*	**Negative**	**Low risk (Level 4)**	Substation and BESS to be located in an unobtrusive low-lying area, away from public roads. Muted natural colours and non-reflective finishes to be used for structures generally. Internal access roads to be as narrow as possible, and existing roads or tracks used as far as possible. Outdoor/ security lighting to be fitted with reflectors to obscure the light source, and to minimise light spillage. Internal powerlines (i.e. 22 kV or 33 kV) to be located underground where possible. (In some cases, such as stream crossings, internal powerlines may need to be above ground). Outdoor signage to be discrete and commercial / billboard signage avoided.	**Low risk (Level 4)**	**High**
	Spatial Extent	**Local**				
	Duration	**Long Term**				
	Consequence	**Moderate**				
	Probability	**Very Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				

6.3. Potential Impacts during the Decommissioning Phase

This section includes a description of the potential visual impacts during the Decommissioning Phase.

- ***Impact 1: Potential visual effect of any remaining structures, platforms and disused roads on the landscape.***

This impact is rated as a negative, direct impact that extends locally and is of a short-term duration. The consequence is rated as moderate, and the probability identified as very likely, resulting in an impact significance of low, without the implementation of mitigation measures. With mitigation, the significance of this impact is rated as very low significance. Mitigation measures include ensuring that the solar arrays and infrastructure are removed and recycled; and access roads that are no longer required are ripped and regraded, and that exposed or disturbed areas are revegetated to blend with the surroundings. The impact summary is given in Table 11.

Table 11: Decommissioning Phase: Visual Impact Assessment

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING PHASE						
Potential visual effect of any remaining structures, platforms and disused roads on the landscape.	*Status*	**Negative**	**Low risk (Level 4)**	Solar arrays and infra-structure to be removed and recycled. Access roads no longer required to be ripped and regraded. Exposed or disturbed areas to be revegetated to blend with the surroundings.	**Very low risk (Level 5)**	**High**
	Spatial Extent	**Local**				
	Duration	**Short Term**				
	Consequence	**Moderate**				
	Probability	**Very Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				

6.4. Cumulative Impacts

This section includes a description of the potential cumulative visual impacts during the Construction, Operational and Decommissioning Phases.

There are a number of other renewable energy and EGI projects within 30km of the site, (see **Map 11**), not all of which will be within the same viewshed as the proposed Kudu Solar PV 4 facility. The projects numbered on Map 11 are as follows:

- Project 1: Kalkbult Solar PV (Operational)
- Project 2: Longyuan Mulilo De Aar 2 North Wind Energy Facility (WEF) (Operational)
- Project 3: Longyuan Mulilo De Aar Maanhaarberg WEF (Operational)
- Project 4: EGI for the Longyuan Mulilo De Aar 2 North WEF
- Project 5: EGI for the De Aar 2 WEF
- Project 6: Proposed Castle WEF
- Project 7: Proposed Swartwater PV
- Project 8: Proposed Solar Power Plant in Phillipstown area
- Project 9: Proposed PV facility on farm Jakhalsfontein near De Aar
- Project 10: Proposed Solar Power Plant in Petrusville
- Project 11: Proposed Keren Energy Odyssey Solar PV Facilities (Eight PV Facilities)
- Project 12: Proposed Crossroads Green Energy Cluster of Renewable Energy Facilities and Grid Connection Infrastructure. The Cluster entails the development of up to 21 solar energy facilities, with the Scoping and EIA Processes consisting of three phases. Phases 1, 2 and 3 consist of 9, 6 and 6 solar facilities, respectively. The Phase 1 Scoping and EIA Processes were launched in January 2023.

Cumulative visual impacts would mainly be the combined visual effect of the 12 Kudu Solar PV facilities, as well as those solar projects within about 5 km of the Kudu PV 4 site, as well as the existing and proposed Eskom powerlines shown on **Map 11**.

The potential combined visual effect of the proposed 12 solar PV facilities and adjacent proposed solar facilities, seen together, is rated as a negative, cumulative impact for the construction, operational and decommissioning phases. The duration for the impact is rated as short term for the construction and decommissioning phases; and long term for the operational phase. The impacts have been rated with a local spatial extent. The consequence of the impact has been rated as substantial for the operational phase; and moderate for the construction and decommissioning phases; and the probability has been rated as very likely for the three phases. Without the implementation of mitigation measures, the impact

is rated as low significance for the construction and decommissioning phases, and moderate significance for the operational phase. With mitigation, the significance of this impact is rated as low, moderate and very low significance for the construction, operational, and decommissioning phases, respectively.

Table 12: Cumulative Visual Impact Assessment

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Potential combined visual effect of proposed 12 solar PV facilities seen together during construction phase.	*Status*	**Negative**	**Low risk (Level 4)**	Mitigation measures as for construction phase, Table 9.	**Low risk (Level 4)**	**High**
	Spatial Extent	**Local**				
	Duration	**Short Term**				
	Consequence	**Moderate**				
	Probability	**Very Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				
OPERATIONAL PHASE						
Potential combined visual effect of proposed 12 solar PV facilities seen together during operational phase.	*Status*	**Negative**	**Moderate risk (Level 3)**	Mitigation measures as for operational phase, Table 10.	**Moderate risk (Level 3)**	**High**
	Spatial Extent	**Local**				
	Duration	**Long Term**				
	Consequence	**Substantial**				
	Probability	**Very Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				
DECOMMISSIONING PHASE						
Potential combined visual effect of proposed 12 solar PV facilities seen together during decommissioning phase.	*Status*	**Negative**	**Low risk (Level 4)**	Mitigation measures as for decommissioning phase, Table 11.	**Very low risk (Level 5)**	**High**
	Spatial Extent	**Local**				
	Duration	**Short Term**				
	Consequence	**Moderate**				
	Probability	**Very Likely**				
	Reversibility	**High**				
	Irreplaceability	**Low**				

6.5. Substation and BESS

Lithium-Ion BESS and Redox Flow BESS were both considered for the proposed project. For Redox Flow BESS, various chemical compositions are likely, such as Vanadium. Refer to Chapter 15 of this EIA Report for a High-Level Safety, Health and Environment Risk Assessment, which provides high level information on the safety, health and environmental risks of the BESS technologies.

The substation and BESS have been considered as an integral part of the solar facility and mitigations for these have been included in the assessment tables above. Both BESS technologies are considered viable from a visual perspective.

7. Impact Assessment Summary

The overall visual impact significance findings, post-mitigation, are indicated in the Table 13 below:

Table 13: Overall Visual Impact Significance (Post Mitigation)

Phase	**Overall Impact Significance**
Construction	**Low risk (level 4)**
Operational:	**Low risk (level 4)**
Decommissioning	**Very low risk (level 5)**
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	**Low risk (level 4)**
Cumulative - Operational	**Moderate risk (level 3)**
Cumulative - Decommissioning	**Very low risk (level 5)**

8. Legislative and Permit Requirements

No permits, licenses or other authorizations are specifically required in terms of landscape or visual issues. Visual assessments are sometimes required in terms of the National Heritage Act, being part of the 'national estate', and would be included with the heritage assessment in those cases.

Although the proposed Kudu Solar PV project is located in the Northern Cape, the Western Cape guideline for involving visual and aesthetic specialists in EIA processes has been used.

National Heritage Resources Act (Act 25 of 1999 NHRA)	The Act includes protection of national and provincial heritage sites, as well as areas of environmental or cultural value, and proclaimed scenic routes. Natural heritage, including scenic resources, form part of the 'national estate'.
Provincial Government of the Western Cape 2005: Guideline for Involving Visual and Aesthetic Specialists in EIA Processes. B. Oberholzer.	A guideline document for specialist visual input with respect to determining potential visual impacts, along with criteria for rating the significance of impacts.

9. Environmental Management Programme Inputs

Mitigation measures have been recommended for the solar facility and related infrastructure in the tables above, in order to minimise visual impacts on scenic resources and sensitive receptors.

Visual input into the Environmental Management Programme (EMPr) is discussed below. This should be included in the Environmental Authorisation for the project.

Design Phase Monitoring:

Review signed off designs to ensure that the substation and BESS are located in an unobtrusive low-lying area, away from public roads; muted natural colours and non-reflective finishes are used for structures; internal access roads are designed to be as narrow as possible, and existing roads or tracks used as far as possible; outdoor/security lighting to be fitted with reflectors; internal powerlines (i.e. 22 kV or 33 kV) to be located underground where possible (in certain cases, such as stream crossings, internal powerlines may need to be aboveground); and outdoor signage to be discrete and commercial / billboard signage avoided.

Responsibility: Project Developer and ECO.

Timeframe: During the planning and design phase.

Construction Phase Monitoring:

Ensure that visual management measures are included as part of the EMPr, monitored by an Environmental Control Officer (ECO), including siting of any construction camps, stockpiles, temporary laydown areas and batching plants outside of identified no-go areas unless otherwise approved by the visual specialists, as well as the implementation of dust suppression and litter control measures. Rehabilitation efforts to commence immediately after construction activities are completed.

Responsibility: ECO / Contractor.

Timeframe: Preparation of EMPr during the planning phase. Monitoring during the construction phase.

Operation Phase Monitoring:

Ensure that visual mitigation measures are monitored by management on an on-going basis, including the maintenance of rehabilitated areas, as well as control of any signage, lighting and waste at the proposed solar project, with interim inspections by the responsible environmental officer.

Responsibility: Solar Farm Operator.

Timeframe: During the operational life of the project.

Decommissioning Phase Monitoring:

Ensure that procedures for the removal of structures and stockpiles during decommissioning are implemented, including recycling of materials and rehabilitation of the site to a visually acceptable standard, and signed off by the delegated authority.

It is assumed that some access roads and concrete pads would remain. Those that are not required should be ripped and regraded, and vegetation or cropland reinstated to match the surroundings.

Exposed or disturbed areas to be revegetated to blend with the surroundings. The revegetation measures are not described here as they would fall under the auspices of the vegetation/ biodiversity specialist.

Responsibility: ECO / Contractor / qualified rehabilitation ecologist or horticulturist.

Timeframe: During the decommissioning contract phase, as well as a prescribed maintenance period thereafter (usually one year).

10. Visual Specialist Statement and Authorisation Recommendation

The VIA is based on the currently provided layout for the proposed Kudu PV 4 facility. Mitigation measures have been recommended in Tables 9 to 12 above. These have been included where possible in the project layout. A photomontage has been attached to depict the current layout.

The visual assessment findings are the following:

- The viewshed is fairly localised given the modest height of the solar facilities.
- There are a number of visual receptors in the surroundings these being mainly small farmsteads. However, these are fairly distant, the Vrede farmstead being the closest at 2,59 km.
- The overall visual impact significance for the Kudu PV 4 facility has been rated as low during the operational and construction phases, both before and after mitigation. The main visual impact is that there would be some change in character to the rural area.

- The cumulative visual impact significance of the proposed 12 Kudu solar energy facilities, seen in combination with other renewable energy projects in the adjacent area, as well as existing and proposed Eskom powerlines, could be substantial and has been rated as moderate using the rating methodology provided by the CSIR.

The fact that there will be similar proposed solar facilities adjacent to the site tends to reduce the visual sensitivity of the Kudu PV 4 site as the area would be seen as a node for solar energy.

Conclusion, Reasoned Opinion, and Impact Statement

The layout of the Kudu PV 4 facility has been subject to revisions, based on the various specialist findings, including the mapping of scenic resources and sensitive receptors. The currently proposed layout succeeds in avoiding visually sensitive areas as indicated on the visual sensitivity map (**Map 10**).

The cumulative visual impact of the solar facilities and related infrastructure, such as the substations, battery facilities and grid connection powerlines, together with other existing and proposed renewable energy facilities in the area, could affect the rural quality of the area (**Map 11**).

Specialist Recommendations for Inclusion in the EA

It is the opinion of the Visual Specialists that provided the recommended mitigation measures and EMPr are implemented, the Kudu PV 4 project would not present a potential fatal flaw in visual terms and could be authorised.

11. References

CSIR, April 2022. Terms of Reference for Specialist Studies for the Environmental Impact Assessments and Basic Assessments for the proposed development of 15 Solar PV Facilities and Associated Infrastructure, near De Aar, Northern Cape.

DFFE, 2022. Screening Report for an Environmental Authorisation as Required by the 2014 EIA Regulations – Proposed Site Environmental Sensitivity: Kudu PV Project.

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Mucina, L. and Rutherford, M.C. (eds) 2006.The Vegetation of South Africa, Lesotho and Swaziland. *Strelizia* 19. SANBI, Pretoria.

Oberholzer, B. 2005. Guideline for Involving Visual and Aesthetic Specialists in EIA Processes: Edition 1 CSIR Report No. ENV-S-C 2005 053 F. Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning.