JUWI SOUTH AFRICA (PTY) LTD

Proposed Roos Solar Renewable Energy Facility, Battery Storage and associated Electrical Grid Infrastructure, located in the western part of Mpumalanga, in the Emakhazeni Local Municipality

Draft Basic Assessment Report

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Client:	JUWI Renewable Energies (Pty) Ltd

Confidentiality Statement

KEY PROJECT INFORMATION

TECHNICAL DETAILS

Component	Description / Dimensions
Project Location	The proposed development is located approximately 13 km south-west of Belfast, within the Emakhazeni Local Municipality in the Nkangala District Municipality of the Mpumalanga Province
Location of site (Centre point)	25°46'17.022"S 29°54'48.564"E
Generation Capacity of Substation	33/132kV
Application site area	365.14Ha (overall farm areas)
PV development area	Approximately 62ha
Affected Properties	• Portion 14 of the Farm Generaalsdraai No 423 • Portion 8 of the Farm Wintershoek nr 390
SG Codes	• T0JS00000000042300014 • T0JS00000000039000008
PV Panels	• Mounting: Fixed-tilt PV, single-axis tracking PV or double-axis tracking PV. • Module type: mono- or bi-facial • Up to approximately. 4.0m PV panels
Access roads	• Provincial and local roads, including existing farm roads will be utilised, to access the Project as far as possible. • Main site access: up to 8m, during construction and operation • Internal roads: approximately 5-6 m, during construction and operation • Existing roads will be utilised as far as reasonably possible and upgraded where necessary. Upgraded width: up to 8m
On-site Substation	• Substation will generally be stepping up from 22kV or 33kV to 88kV or 132kV. • Maximum height of on-site substations: up to 10 m • The proposed project will include one on-site substation hub incorporating the facility substation, switchyard, collector infrastructure, battery energy storage system (BESS) and associated O&M buildings • Onsite substation size: up to 4ha (for on-site substation hub)
Grid Integration	• The substation will connect to the existing 132kV overhead powerline via a double circuit 132kV loop-in, loop-out (LILO) overhead powerline configuration. • The LILO is expected to be approximately 150m long within a corridor of approximately 100m • The powerline structure will be determined at final design stage after technical consultation with Eskom Engineers and after the geotechnical and topographical surveys have been conducted. • Pylon structures may be either steel lattice, steel monopole or woodpole structures.
Construction camp	No construction camps would be developed, and labour would be sourced from nearby areas, as per relevant procurement requirements

Component	Description / Dimensions
Temporary construction laydown/ staging area	• Temporary Laydown Area: up to approximately 7 ha. • Locations: TBC
Operation and Maintenance (O&M) buildings	• All auxiliary buildings to be developed include, but are not limited to: O&M building, site office, staff lockers, bathrooms, warehouses, etc. • Footprint up to 0.5 ha (i.e., 5000 m^2) • Height (m): Up to 10 m
On-site IPP Electrical infrastructure	• The proposed project will include one on-site substation hub incorporating the facility substation, switchyard, collector infrastructure, battery energy storage system (BESS) and associated O&M buildings • Internal underground lines of up to 33 kV (22kV or 33kV) • Substation will generally be stepping up from 22kV or 33kV to 88kV or 132kV • Depth (m): Up to 1.5 m *"Cables will be laid underground wherever technically feasible, with overhead 33kV lines grouping PV areas to crossing valleys and ridges to get to the on-site substation."*
Fencing	The entire perimeter of the proposed facility will be secured. Fence height up to 3m. The type of fence could be palisade or mesh or fully electrified.
Boreholes and storage tanks (if applicable)	• If required, a 10,000l storage tank may be located on site for water storage.
Battery Energy Storage Systems	• Capacity in MWh: Up to 340MW/ 340MWh • Size in hectare - A BESS would be developed within the substation/electrical infrastructure hub footprint, if required. • Height: Up to 8 m • Technology type (i.e.: Li-Ion solid state) • Electrochemical Batteries including: o Lead Acid and Advanced Lead Acid o Lithium ion, NiCd, NiMH-based Batteries o High Temperature (NaS, Na-NiCl2, Mg/PB-Sb) o Flow Batteries (VRFB, Zn-Fe, Zn-Br) The BESS would therefore comprise the selected batteries together with chargers, inverters and related equipment.
Estimated number of employment opportunities generated by each PV project	• Construction phase: 100 (skills split would be in line with applicable procurement requirements but would be roughly 60% low-skilled, 25% semi-skilled and 15% skilled) • Operational phase: 10 (skills split would be in line with applicable procurement requirements but would be roughly 70% low skilled, 25% semi-skilled and 5% skilled • Decommissioning phase: unknown
Construction: Methodology	• The facility would be constructed in the following sequence: 1. Final design and micro-siting of the infrastructure based on topographical conditions and environmental sensitivities, and following obtaining required environmental permits. 2. Vegetation clearance and construction of access roads (where required) 3. Construction of foundations

Component	Description / Dimensions
	4. Assembly and erection of infrastructure on site 5. Stringing of inverters 6. Rehabilitation of disturbed areas 7. Continued maintenance
Construction: Duration and start date	Up to 12-18 months, start date is dependent upon award of a bid. Construction activities could take place concurrently

COORDINATES OF PREFERRED ALTERNATIVES

ROOS: SEF		
COORDINATES AT CENRE POINTS (DD MM SS.sss)		
Site	**SOUTH**	**EAST**
1	25°46'17.022"S	29°54'48.564"E
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
1	25°46'30.806"S	29°53'52.869"E
2	25°28'46.188"S	29°54'32.07"E
3	25°45'51.268"S	29°54'49.33"E
4	25°46'5.215"S	29°55'19.513"E
5	25°45'51.404"S	29°55'40.109"E
6	25°46'5.892"S	29°55'50.331"E
7	25°46'19.851"S	29°55'54.49"E
8	25°46'27.578"S	29°55'50.331"E
9	25°46'32.285"S	29°55'43.084"E
10	25°46'20.047"S	29°55'33.263"E
11	25°46'28.556"S	29°55'13.431"E
12	25°46'40.534"S	29°54'50.432"E
13	25°46'28.556"S	29°54'42.719"E

ROOS GRID: GRID CORRIDOR (PREFERRED)		
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
POINT	**SOUTH**	**EAST**
1	25° 46' 1.127" S	29° 55' 11.302" E
2	25° 46' 3.017" S	29° 55' 15.879" E
3	25° 46' 4.851" S	29° 55' 12.977" E
4	25° 46' 2.990" S	29° 55' 8.432" E
ROOS GRID: GRID CORRIDOR (ALTERNATIVE)		
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
1	25° 46' 37.125" S	29° 54' 13.300" E
2	25° 46' 35.040" S	29° 54' 16.109" E
3	25° 46' 39.001" S	29° 54' 19.379" E
4	25° 46' 40.497" S	29° 54' 16.542" E

ROOS SEF: SUBSTATION (PREFERRED)		
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
Point	**SOUTH**	**EAST**
1	25° 46' 3.162" S	29° 55' 15.796" E
2	25° 46' 4.876" S	29° 55' 19.485" E
3	25° 46' 6.634" S	29° 55' 17.047" E
4	25° 46' 4.859" S	29° 55' 13.048" E
ROOS SEF: SUBSTATION (ALTERNATIVE)		
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
1	25° 46' 39.973" S	29° 54' 16.062" E
2	25° 46' 38.300" S	29° 54' 18.718" E
3	25° 46' 41.168" S	29° 54' 21.174" E

4	25° 46' 42.828" S	29° 54' 18.713" E

ROOS SEF: LAYDOWN AREA, BESS & O&M AREA (PREFERRED)		
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
Point	**SOUTH**	**EAST**
1	25° 46' 7.840" S	29° 55' 6.471" E
2	25° 46' 4.662" S	29° 55' 12.058" E
3	25° 46' 6.783" S	29° 55' 16.821" E
4	25° 46' 14.112" S	29° 55' 5.154" E
ROOS SEF: LAYDOWN AREA, BESS & O&M AREA (ALTERNATIVE)		
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
1	25° 46' 40.441" S	29° 54' 13.216" E
2	25° 46' 39.328" S	29° 54' 15.273" E
3	25° 46' 45.939" S	29° 54' 25.488" E
4	25° 46' 44.331" S	29° 54' 23.883" E
5	25° 46' 38.004" S	29° 54' 23.851" E
6	25° 46' 34.548" S	29° 54' 22.728" E
7	25° 46' 37.309" S	29° 54' 18.348" E

The final design details of the proposed Solar Renewable Energy Facility and associated Electrical Grid Infrastructure will become available during the detailed design phase of the proposed development, before construction commences.

All maps included in the report are included in **Appendix 2.**

JUWI SOUTH AFRICA (PTY) LTD

DRAFT BASIC ASSESSMENT REPORT

EXECUTIVE SUMMARY

INTRODUCTION AND PROJECT DESCRIPTION

JUWI Renewable Energies (Pty) Ltd (hereafter referred to as 'JUWI') is proposing to construct the Roos Solar Energy Facility and Grid Infrastructure approximately 15 km south-west of the town of Belfast in the Mpumalanga Province (**DFFE Reference Number: TBA**). The overall objective of the proposed development is to generate electricity by means of renewable energy technologies capturing solar energy to feed into the national grid. The proposed development will have a maximum total generation capacity of up to 50 MW.

SiVEST Environmental Division has subsequently been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the Environmental processes for the proposed construction of the Roos Solar Energy Facility and associated Grid infrastructure. The proposed development requires an EA from the National Department Forestry, Fisheries and the Environment (DFFE). However, the provincial authority (i.e., the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) will also be consulted.

The proposed SEF, BESS and associated grid infrastructure is located within the Emalahleni Renewable Energy Development Zone (REDZ 9), as published in terms of Section 24(5) of the NEMA in GN R114 of 16 February 2018. Accordingly, a BA process as contemplated in terms of the EIA Regulations (2014, as amended) is being undertaken in respect of the proposed SEF project. All relevant legislation and guidelines will be consulted during the BA process and will be complied with at all times.

The grid connection infrastructure which is part of this application is being proposed to feed the electricity generated by the Roos SEF into the national grid. The Roos SEF will form part of the Renewable Energy Independent Power Producer Programme (REIPPP) in line with the Integrated Resource Plan (IRP). It should be noted that the proposed grid connection infrastructure will be handed over to Eskom once constructed. The on-site and/or collector substation will include an Eskom portion and an Independent Power Producer (IPP) portion. Following construction, the substation will be handed over to Eskom. The current applicant will remain in control of the low voltage components (more specifically the 33kV yard) of the substation, while the high voltage components (i.e., 132kV components) of the substation will likely be ceded to Eskom shortly after the completion of construction.

APPLICABILITY OF NEMA EIA REGULATIONS, 2014 (AS AMENDED IN 2017)

The following activities are applied for:

Activity No(s):	Relevant activities as set out in Listing Notices 1, 2 and 3 of the EIA Regulations, 2014 as amended
Relevant Basic Assessment Activities as set out in Listing Notice 1	
11 (i)	**GN R. 327 (as amended) Item 11:** The development of facilities or infrastructure for the transmission and distribution of electricity— (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.
12 (ii) (a) (c)	**GN R. 327 (as amended) Item 12:** The development of: ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.
14	**GN R. 327 (as amended) Item 14:** The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.
19	**GN R. 327 (as amended) Item 19:** The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;
24 (ii)	**GN R. 327 (as amended) Item 24:** The development of a road - ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres.
28 (ii)	**GN R. 327 (as amended) Item 28:** Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;
48 (i) (a) (c)	**GN R. 327 (as amended) Item 48: The expansion of-** (i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such expansion occurs— (a) within a watercourse; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;
56 (ii)	**GN R. 327 Item 56:** The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre - (ii) where no reserve exists, where the existing road is wider than 8 metres –
Relevant Scoping and EIA Activities as set out in Listing Notice 2 of the EIA Regulations, 2014 as amended	
1	**GN R. 325 (as amended) Item 1:** The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more.

Activity No(s):	Relevant activities as set out in Listing Notices 1, 2 and 3 of the EIA Regulations, 2014 as amended
15	**GN R. 325 (as amended) Item 15:** The clearance of an area of 20 hectares or more of indigenous vegetation.
Relevant Basic Assessment Activities as set out in Listing Notice 3 of the EIA Regulations, 2014 as amended	
4 i. (ii) (aa)	**GN R. 324 (as amended) Item 4:** The development of a road wider than 4 metres with a reserve less than 13,5 metres. **f. Mpumalanga** i. Outside urban areas; (bb) National Protected Area Expansion Strategy Focus areas; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
10.	**GN R. 324 (as amended) Item 10:** The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres. **(f) In Mpumalanga** (i) Outside urban areas; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
12 (f) (ii)	**GN R. 324 (as amended) Item 12:** The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. **(f) In Mpumalanga** (ii) Within critical biodiversity areas identified in bioregional plans;
14 ii. a.c.f.i.bb. ff	**GN R. 324 (as amended) Item 14:** The development of: ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse. **(f) In Mpumalanga** i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (ff) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans
18 f. i. (bb) (ee)	**GN R. 324 (as amended) Item 18:** The widening of a road by more than 4 meters, or the lengthening of a road by more than 1 kilometer- **f. Mpumalanga** i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
23 (ii) (a) (c); f. i. (ff	**GN R. 324 (as amended) Item 23:** The expansion of – (ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;

Activity No(s):	Relevant activities as set out in Listing Notices 1, 2 and 3 of the EIA Regulations, 2014 as amended
	where such expansion occurs – (a) within a watercourse; (c) if no development setback has been adopted adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; f. Mpumalanga i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;

DETAILS OF ALTERNATIVES CONSIDERED

Layout alternatives have been considered and assessed as part of the BA process. The alternatives which have been considered and assessed as part of the application include two (2) substations, laydown areas, BESS and O&M area alternatives. All alternatives have been comparatively assessed by the respective specialists and assessed against the 'no-go' alternative (i.e., status quo).

Powerline route

Two electrical grid infrastructure are being considered and have been comparatively assessed by the EAP and specialists. Grid Integration for both the preferred and alternative substations will be connected in the same manner. The substation will connect to the existing 132kV overhead powerline via a double circuit 132kV loop-in, loop-out (LILO) overhead powerline configuration. The LILO is expected to be approximately 150m long within a corridor of approximately 100m. Pylon structures may be either steel lattice, steel monopole or woodpole structures. The powerline structure will be determined at final design stage after technical consultation with Eskom Engineers and after the geotechnical and topographical surveys have been conducted.

SPECIALIST STUDIES

The following specialist studies have been undertaken for the project:

Specialist Study	Findings	Recommendations
Agricultural Assessment	The sensitivity analysis has identified the project area to have a Medium to Low sensitivity, with small areas of High sensitivity where existing agricultural fields are. therefore, an Agro-ecosystem impact assessment is required. The desktop results as well as the field verification and detailed soils assessment have determined that the agricultural potential is rated as Medium to High based on the	The specialist opinion is that the proposed project can be considered favourably from an agricultural and soils impact perspective based on the following: • The DFFE screening tool showed very small areas of potential High sensitivity areas. • These areas were isolated to the existing crop farming areas in the western edge of the project.

Specialist Study	Findings	Recommendations
	climatic conditions as well as the soils identified on site. The following indicates the desktop and in field findings: <u>Desktop Results;</u> • DEA screening assessment determined the agricultural sensitivity to be Medium to Low, with small areas of High; • The project has small areas of crop field boundaries; • The desktop land capability rated the project area as Low to Low-Moderate with a small portion to the east being rated as Moderate; • The climate capability was determined to be Moderate; • The desktop soil capability rated the project area as Very-Low with a small portion to the east being rated as Moderate. A very narrow edge of Moderate-High capability occurs on the northern edge of the project area; and • The desktop grazing capability rated the project area as 5ha/LSU. <u>Site Assessment Results;</u> • Land capability was determined as grazing to light cultivation; • Land potential was determined to be L2 (high potential) to L4 (moderate potential); and • Land use showed natural grasslands used for cattle grazing and small areas of maize farming.	• The land capability is marginal with limited soil depth and a light cultivation to grazing capability only. • Based on the site layout no Solar PV sites fall within the L2 land potential. The impacts are considered Moderate impact. • Additionally, the alternative substation falls within the L2 land potential. Therefor it is the specialist opinion that the preferred substation be selected. • The high potential land capability (L2; category B) must be retained for agricultural use due to the limited availability of high potential land, as per departmental guidelines. • The only mitigation measure that will reduce the impact level is by avoiding the high potential (L2) areas completely.
Aquatic Assessment	The site assessment confirmed the presence of two wetland types. The watercourses are further classified as follows: ➢ Channelled Valley Bottom Valley; ➢ 2 Hillslope Seepage Wetlands The current footprint of the Solar and associated infrastructure does not encroach into the wetland and associated buffer areas. Although the exact footprint positions of the	It is advised that the structures remain outside of the wetlands and associated buffer zones. The risk scores fall in the Low category.

Specialist Study	Findings	Recommendations
	pylons were not known during the writing of this report it is assumed that it will span the wetlands and buffer zones with no pylons located in these areas. The proposed substations are not located on any wetland or wetland buffer zone. Prior to the proposed mitigation measures most impacts rated moderate and post mitigation they ranked low in both the construction and operational phase.	
Terrestrial Biodiversity Assessment	Based on the SSV and field survey, the Terrestrial Biodiversity theme was confirmed to have Very High sensitivity, while the Sensitive Plant Species theme was confirmed to have High sensitivity owing to presence of protected species. The study areas are located within natural systems in the Endangered Eastern Highveld Grassland and Steenkampsberg Montane Grassland vegetation units. The study area is located primarily in CBA Optimal, Other Natural Areas, Heavily Modified, and a small section in CBA Irreplaceable and Moderately Modified. Areas of high biodiversity value including CBA Irreplaceable and Optimal should be avoided as far as possible concerning transformation of land cover; accordingly, all permanent infrastructure such as the BESS, substation and O&M Building must be located outside these sensitive areas. All temporary infrastructure including the site camp required during the construction phase, must also be located outside high sensitivity areas. The Primary Grassland and Watercourse is considered to have Very High SEI, especially with regards to the presence of sensitive plant species, suitable habitat for sensitive plant species and important ecosystem functions. Accordingly, transformation of these habitats is not supported (no destructive development activities should be considered) as avoidance mitigation is required wherever possible and changes to project infrastructure design must be done to limit the amount of habitat impacted. Therefore, only limited	• Rehabilitation and monitoring plan required post-construction and post-operational phase of the project which addresses ecosystem functioning, fire management, alien invasive species management and effective methods of rehabilitating natural vegetation to functional systems (not just biomass replacement). • Roads and underground cabling must avoid sensitive areas as far as possible by considering various layout alternatives. The karoo shrubland habitat will not be transformed completely (only PV related – this is not the case for roads and temporary laydown areas), accordingly with appropriate mitigation and rehabilitation measures post-construction and post-operational, the impact of the PV panels is considered medium for grassland. • It is advised that an ecological specialist is appointed during the construction, operational and decommissioning phases to monitor impacts and related mitigation measures regarding natural and sensitive habitats and the faunal and floral assemblages occurring there. • Care should be taken not to unnecessarily clear or destroy natural vegetation.

Specialist Study	Findings	Recommendations
	development activities of low impact will be acceptable. Linear infrastructure such as roads and internal powerlines can cross the watercourses, but care should be taken in the planning of this. The aquatic biodiversity assessment must also be consulted for additional mitigation measures to be considered during the design phase, as well as the construction and operational phases of the projects. A sensitive plant species, K. carolinensis was recorded in Primary Grassland which should be protected in situ and must be avoided by the proposed development. A 200m buffer has been placed around its location. The DDT Aloe verdoorniae was also recorded in Primary Grassland and could also occur within the Rocky Grassland. All suitable habitat for the species has been mapped and included as high sensitivity including suitable habitat for other sensitive plant species. For provincially listed species which are affected by the proposed development, a permit application for their removal must be applied for with the provincial authority prior to the commencement of construction activities.	• Development and planned activities should therefore be planned in such a way that totally transformed areas are chosen for major developments and natural veld and especially any highly sensitive areas are avoided as far as possible. • Provincially listed species which are affected by the proposed development require a permit application for their removal from the provincial authority prior to the commencement of construction activities.
Avifaunal Assessment	The PA is located in a region dominated by natural grassland, drainage lines, disturbed grassland, cropland and stands of alien invasive trees. Several drainage lines and small farm dams can be found scattered across the PA with most being mostly permanent with some seasonal flow/ inundation. The powerline infrastructure that traverses the PAOI is a significant habitat for Martial Eagles and other raptors. Fifteen (15) priority species were predicted during the initial surveys, including Secretarybirds, Martial Eagles, Black-chested Snake Eagle, Southern Bald Ibis and White Storks Of these, the Secretarybirds and Martial Eagle were the most concerning large bird species. At the commencement of the survey, the PAOI was characterised by an extreme rainfall event	• The addition of the proposed Roos SEF does indicate some (relatively few) potentially significant impacts (without mitigation) to the receiving environment via the risk to Priority Species (such as Secretary Bird, Martial Eagle, and Denham's Bustard and Southern Bald Ibis) and need to be considered with provision made within the EMPr for this development. • Although previous impact assessments and monitoring programs for existing local SREFs indicated that not all impacts can be mitigated to acceptable levels, medium significance post-mitigation should be interpreted that more can

Specialist Study	Findings	Recommendations
	(wet season) may have atypically transformed the PAOI where it is possible that increased densities (and perhaps diversity) of avifaunal assemblages may have been recorded due to an abundance of high forage value habitat. However, although the density and diversity of Priority Species was high, most of these species were common and widespread and largely synanthropic (water and natural grassland associates excluded) and the density and diversity of SCC was very low.	be done to avoid critically important species-specific (especially Martial Eagle and Secretary Bird impacts as is the case for the impacts discussed within this statement). This is mainly because impact assessments regarding solar energy developments have been poorly understood since their inception and the impacts (especially cumulative impacts) of solar developments may have significant consequences if mitigation and monitoring is not implemented correctly. • Overall, it is still the opinion of the consultants that the impacts associated with SEF projects are far preferable (from an environmental impact perspective) to extractive and/ or non-renewable alternatives or even Wind Energy Facilities (WEF). It must be related that this report must be considered in context with the greater EIA process which factors in economic desirability etc. • In addition, while striving to maintain the highest standards of mitigation and monitoring as well as the commissioning of a highly detailed pre-construction micro siting assessment, developments such as the Roos SEF should be encouraged within designated areas. • The roosting of Martial Eagles and the foraging of Secretarybirds is of some concern. • Avoidance mitigation must be implemented in conjunction with the aforementioned micro siting as well as technological applications such as perch diverters, flappers and possibly taping over solar panels in the case of Lake Effect impacts. Thus, the author will look to support

Specialist Study	Findings	Recommendations
		Environmental Authorisation (EA) based upon the following conditions: o All recommended No-Go buffering must be strictly adhered to; o Micro siting of panel placement must occur prior to construction and should be supervised by a specialist zoologist in order to mitigate habitat loss and collision risks for species; o All recommended mitigation measures described above must be applied; o The EMPr must be updated every three years in order to reevaluate the potential distributional population changes of species such as Martial Eagles and Southern Crowned Cranes Thus, technological mitigations such as monitoring, flapper and diverter technology may have to be re-positioned, re-calibrated and updated. • Since the immediate area comprising approved or pending SEFs are expected to cumulatively result in a Moderate impact significance to avifauna after the application of the recommended mitigation measures, and since the combined area will likely contribute moderately to the total land area in the region transformed by renewable energy projects, it is recommended that the development may proceed on condition that: • All mitigation measures stipulated above are adhered to and captured in an Environmental Management Plan (EMP); • The EMP must include the necessity for post-construction avifauna monitoring as stipulated in Jenkins et al., (2015); • All updated mitigation recommendations issued post-

Specialist Study	Findings	Recommendations
		construction (informed by monitoring) must be adhered to Ultimately, the specialist recommends that the project be given a positive authorisation based upon the avifaunal baseline and Environmental Impact Assessment.
Heritage Assessment	The broader area surrounding this proposed for this development is known for a variety of kinds of heritage resources including Stone Age and Iron Age archaeology, significant structures and living heritage sites such as significant baobab trees as well as burial grounds and graves. The survey results confirm these findings. The survey proceeded with limited constraints and limitations, and the project area was comprehensively surveyed for heritage resources. The Iron Age remains identified in the field assessment likely reflect a much more extensive past settlement and as such, CTS Heritage has mapped out the areas of high archaeological sensitivity associated with this. These areas are reflected in RED in the maps above and must be considered strict no-development areas as the likelihood of impacting significant archaeological heritage in these areas is VERY HIGH.	There is no objection to the proposed development from a heritage perspective on condition that: • A no development buffer of 100m is implemented around site 004. This is largely respected in the final layout provided. • A no development buffer of 100m is implemented around site 003 and 009. This is respected in the final layout provided. • The identified sensitive archaeology areas are not impacted by the development of any new infrastructure, including fencing. This is largely respected in the final layout provided. • A Heritage Management Plan and Heritage Agreement are drafted for the ongoing conservation of the significant Iron Age resources identified. • Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.
Social Impact Assessment	The proposed development site is next to the N4 Highway between Gauteng and Mbombela. The Emakhazeni Municipality is mainly a rural municipality The area serves as a gateway to the tourism parks and private reserves in the Lowveld areas of the	The proposed project does not present any socio-economic fatal flaws and the project should go ahead. The benefits of the proposed project exceed the negative socio-economic impacts as well as the no-go option. Given that

Specialist Study	Findings	Recommendations
	Province. There are no tourism related destinations within 15 km from the site. The proposed development is in Ward One of the Municipality which will be most affected by the direct socio-economic impacts of the project. Whereas the total population of Emakhazeni is in the order of 54 400 in 2022/3, the population of Ward One was 5 853 in 2011. The community of Ward One is poor working mainly on the farms and mines in the region with an average annual income of R29 400 per household in 2011 and with a high unemployment rate of more than 24%. Most of the formally employed persons work in the agriculture and mining sectors. Ninety-nine percent (99%) of the population in Ward One is from the Black population group with an even male and female gender split. The population is a young population with a mean age of 23 years and 46% of the people are younger than 19 years of age. About 5% of the population is older than 60 years. The 'no-go' alternative will result in no direct socio-economic impacts from the proposed project on the site or surrounding local area although, it does means that some economic employment opportunities will be lost for the local community. The socio-economic benefits and disadvantages of the proposed project relates to the broader environment outside of the site and do not relate to the specific solar site and grid infrastructure. The identification of preferred site options is not sensitive to the socio-economic impacts. There are no other renewable energy projects within 15 km of the proposed PV project. Although the broader project area is known for its mining activities within 50 km from the site, the location of the site, which on the north of the N4, share few socio-economic impacts with the mines. It is therefore assessed that the proposed project will not contribute to the	renewable energy development is highly desirable in South Africa from a social, environmental and development point of view, the positive economic and social opportunities lost under the no-go option renders it as an unattractive alternative. It is recommended that the proposed project proceed with the following actions being undertaken: • Implementation of the mitigations. • Review comments received from members of the public, key stakeholders, and any organ of state during the public review process. • Prepare a SIA Report for inclusion in the BA Report to be prepared for the project.

Specialist Study	Findings	Recommendations
	cumulative socio-economic impacts in the local area.	
Transportation Impact Assessment	The development is located along the N2 national route. It is reachable from likely points of supply through an existing road network that is in good and suitable condition, including for the transportation of abnormal loads. Two accesses to the facility already exist in the form of private farm access roads off the N2. These accesses are deemed suitable for the proposed adjusted land use but will require minor upgrades to accommodate the anticipated traffic. The construction phase of this development is estimated to generate ±18 peak hour trips, the operation and maintenance phase ± 56 peak hour trips, and the decommissioning phase ±15 peak hour trips. Overall, the traffic impacts of the proposed development are considered to be nominal. Several mitigation measures are proposed to accommodate the development and to reduce the impact to the surrounding road network.	With reference to this report, associated assessment and the findings made within, the Roos Solar Energy Facility will have a nominal impact on the existing traffic network. The project is therefore deemed acceptable from a transport perspective provided the recommendations and mitigations measures proposed herein are implemented, and hence the Environmental Authorisation (EA) should be granted.
Visual Impact Assessment	In terms of Landscape and Visual Impact Significance, the PV project is rated Medium without mitigation, and Medium to Low with mitigation or wind-blown dust, lights at night as well as soil erosion on the PV panels areas located on slope areas (less than 1 in 10m). In terms of negative cumulative effects, without mitigation the risk is rated High due to light spillage in the rural landscape from security lights at night. With mitigation and the careful management of security lighting and no overhead flood lights for the PV, BESS or substation areas, the risk can be reduced to Low. While both the Preferred and Alternative LILO/ BESS areas are suitable, there is a preference for the Preferred LILO area as the locality is less exposed to rural receptors. The following key reasons provide the motivation for the overall PV development: • The site visual resources are limited with a Medium rating for Scenic Quality and	It is recommended that the proposed PV project should be authorised WITH Mitigation. With mitigation, the benefits of the PV related landscape change are likely to outweigh the landscape status quo, where scenic resources are limited.

Specialist Study	Findings	Recommendations
	Low rating for Receptor Sensitivity to landscape change. • Regionally, the viewshed is contained to some degree from topographic screening and has no High or Medium Exposure Receptors. The nearest significant receptor area is the KNP located 12km to the north where massing effects of the combined views of the PV areas will not generate a dominating visual effect. • National energy objectives for renewable energy and job creation will be met and there is a good alignment with regional and local planning. • Medium rating for Visual Impact Significance with mitigation.	
Glint and Glare Impact Assessment	The impact of glare is assessed against ocular hazard protocols to determine whether such glare can be considered a nuisance or harmful to potential observers operating in, and around the solar PV facility. Several buildings and the natural environment surrounding the location of the proposed PV facility and several glare receptors, including route receptors such as nearby roads and railway lines, which lie within the viewshed of the proposed solar PV facility were considered in this assessment. Aviation receptors are excluded from this assessment due to none being in close proximity to the proposed solar PV facility. The potential impacts from the proposed solar PV facility from glint and glare are either none, or have a low impact (Green Glare). Green glare has a low intensity level and is similar to many materials such as concrete, steel sheeting and other building materials that have minimal visual impact. No negative impacts were observed from the site analysis. Due to low glare intensity observed during the analysis of the site, no negative impacts were identified and therefore no mitigation measures are required for the proposed solar PV modules. Using smooth glass solar PV	Using smooth glass solar PV modules without an anti-reflective coating will result in either no glare, or green glare received at the assessed receptors. Green glare will not cause any harmful effect on nearby observers due to its low intensity and has a low potential for temporary after-image. As such, the proposed solar PV facility will not cause any significant, or harmful impact on nearby surroundings from a glint and glare perspective. SOLINK supports the findings of this report, as supplementary to the intended renewable energy project's Environmental Impact Assessment applications. It must be noted that although the intended solar PV project does not trigger any requirements for an aviation-related glint and glare assessment according to South African Civil Aviation Authority regulations, it would be advisable to contact Air Traffic Navigation Services (ATNS) to confirm in writing that Obstacle Registration with ATNS is not required due to their requirements (for glint and glare assessments, and obstacle registration) not being triggered:

Specialist Study	Findings	Recommendations
	modules without protective coatings will be suitable and not cause any harmful visual impact on surroundings.	• The solar PV facility is not within 3 km of any aerodrome, airstrip, or helipad. • The solar PV facility does not lie within the extended 8 km, 9 degree diverted runway viewshed.
Risk Assessment	This report summaries the high-level Safety Health and Environmental Risk Assessment conducted by ISHECON for the proposed Battery Energy Storage Systems at the proposed Roos SEF facilities. There will be a single BESS serving all four Solar PV facilities. The BESS storage capacity will be up to 500MW with up to four hours of storage i.e. up to 2000 megawatt-hour (MWh). Two alternative technologies are being considered for the BESS, i.e. either Solid State (typically Lithium chemistry) (SSL) or Redox Flow (typically vanadium chemistry) (VRFB). The technology is advancing rapidly and the exact technology and chemistry will be chosen during the Engineering, Procurement and Construction (EPC) phase. For SSL batteries this would mean multiple xviontainerized units. For VRFB, the systems can be containerized but could, in order to achieve economies of scale, be one large utility scale plant within a conventional industrial type structural steel / brick warehousing structure. In either configuration there could be large volumes of electrolyte on site either in smaller tanks inside containers or larger tanks in a building. The VRFB facilities, either containerized or as utility buildings, will be bunded to contain 110% of the largest vessel. Supplementary infrastructure and equipment may include substations, power cables, transformers, power converters, substation buildings & offices, HV/MV switch gear, inverters and other control equipment that may be positioned within the battery containers / separate dedicated containers / the battery building.	• There are numerous different battery technologies but using one consistent battery technology system for the BESS installations associated with all the developments in the Belfast area associated with the Roos Project would allow for ease of training, maintenance, emergency response and could significantly reduce risks. • Where reasonably practicable, state-of-the-art battery technology should be used with all the necessary protective features e.g., draining of cells during shutdown and standby-mode, full BMS with deviation monitoring and trips, leak detection systems. • There are no fatal flaws associated with the proposed Solar Energy battery installation for either technology type. • The tables in Section 4 of the specialist report of this report contains technical and systems suggestions for managing and reducing risks. Ensure the items listed in these tables under preventative and mitigative measures are included in the design. • The overall design should be subject to a full Hazop prior to finalization of the design. • For the VRFB systems an end of life (and for possible periodic purging requirements) solution for the large quantities of hazardous electrolyte should be investigated, e.g., can it

Specialist Study	Findings	Recommendations
	From a safety and health point of view, there are no significant cumulative impacts from any other BESS installation in the greater area.	be returned to the supplier for re-conditioning. • Prior to bringing any solid-state battery containers into the country, the contractor should ensure that: o An Emergency Response Plan is in place that would be applicable for the full route from the ship to the site. This plan would include details of the most appropriate emergency response to fires both while the units are in transit and once they are installed and operating. o An End-of-Life plan is in place for the handling, repurposing or disposal of dysfunctional, severely damaged batteries, modules and containers. • The site layout and spacing between lithium solid-state containers should be such that it mitigates the risk of a fire or explosion event spreading from one container to another. • In order to limit the possibility of domino failures the BESS should be separated from the substation by at least 20m. • Under certain weather conditions, the noxious smoke from a fire in a lithium battery container could travel some distance from the unit. The smoke will most likely be acrid and could cause irritation, coughing, distress etc. Close to the source of the smoke, the concentration of toxic gases may be high enough to cause irreversible harmful effects. Location of the facilities needs to ensure a suitable separation distance from public facilities/residences etc. The preferred and the alternative BESS locations are over 500m from isolated farmhouses/developments, and are therefore suitable in this context.

Specialist Study	Findings	Recommendations
		• VRFB hazards are mostly related to possible loss of containment of electrolyte and solid-state systems may experience fires that may result in loss of containment of liquids or the use of large amounts of fire water which could be contaminated. One would not want these run-offs to enter water courses directly and a BESS Location that is far from water courses would be preferred. The buffer distance between water bodies and the facilities containing chemicals should be set in consultation with a water specialist and is therefore not specified in this SHE RA. It is noted that there are no tributaries of the main water courses in the area within 100m of the proposed BESS Location. • Finally, it is suggested once the BESS technology has been chosen and more details of the final design are available, the necessary updated Risk Assessments should be in place (prior to commencement, after environmental authorisation and other necessary approvals are granted (should such be granted)).

PUBLIC PARTICIPATION PROCESS UNDERTAKEN

WAY FORWARD

Please note that the commenting period on the advert placed in Lowveld Newspaper refers to **04 August 2023** until **04 September 2023**.

Since the DBAR was not made available on the said date, the notification that was sent to interested and affected parties regarding the availability of the DBAR Report have given interested and affected parties 30 days commenting period, which commenced from **07 August 2023** until **06 September 2023** to ensure that the regulated 30 days commenting period is adhered to.

All comments received will be responded to in a C&RR, which will be included prior to submission of the FBAR to the decision-making authority, namely the DFFE. Comments received on the report will be taken into consideration, incorporated into the report (where applicable) and will be used when compiling the FBAR.

Once the FBAR has been submitted and the DFFE has acknowledged receipt thereof, a decision to either grant or refuse the EA for the proposed development will be made by the DFFE. In addition, once a decision regarding the EA has been received from the DFFE, it will be made available to the public and all registered I&APs, stakeholders and OoS / authorities will be notified accordingly and provided details regarding the appeal process. The BA process will thus come to an end once appeals (if any) have been dealt with adequately and the appeal process closes.

All I&APs and key stakeholders are invited to register as I&APs in order to be kept informed throughout the process. To register as an I&AP / stakeholder and/or to obtain additional information, please submit your name, contact details (telephone number, postal address and email address) and the interest which you have in the application to SiVEST Environmental Division, as per the details below:

Contact: Hlengiwe Ntuli
 PO Box 2921, RIVONIA, 2128
 Phone: (011) 798 0600
 E-mail: sivest_ppp@sivest.com
 Fax: (011) 803 7272
Website: www.sivest.com

Please reference '*Roos PV Facility'* in your correspondence, should your comments be project specific. SiVEST shall keep all registered I&APs / key stakeholders informed of the BA process.

JUWI SOUTH AFRICA (PTY) LTD

ROOS SOLAR ENERGY FACILITY

DRAFT BASIC ASSESSMENT REPORT

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ACRONYMS

AAA	Astronomy Advantage Area
AIA	Archaeological Impact Assessment
BAR	Basic Assessment Report
BESS	Battery Energy Storage System
CBA	Critical Biodiversity Area
DARDLEA	Mpumalanga Department of Agriculture, Rural Development, Land and Environmental
DFFE	Department Forestry, Fisheries and the Environment
DMP	Disaster Management Plan
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioners Association of South Africa
ECO	Environmental Control Officer
EGI	Electrical Grid Infrastructure
EMPR	Environmental Management Programme
ERA	Electricity Regulation Act
HGM	Hydrogeomorphic
IPP	Independent Power Producer
IRP	Integrated Resource Plan
IWMP	Integrated Waste Management Plan
LED	Local Economic Development Strategy
MBSP	Mpumalanga Biodiversity Sector Plan
NEMA	National Environmental Management: Act (No. 107 of 1998)
MHRA	Mpumalanga Heritage Resources Authority
MTPA	Mpumalanga Tourism & Parks Agency
NFA	National Forests Act (No. 84 of 1998)
NHRA	National Heritage Resources Act (No. 25 of 1999)
NWA	National Water Act (No. 36 of 1998)
PAOI	Project Area of Impact
PIA	Paleontological Impact Assessment
PPA	Power Purchase Agreement
RDP	Rural Development Plan
RE	Renewable Energy
REDZ	Renewable Energy Development Zones
REIPPP	Renewable Energy Independent Power Producer Programme
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SALT	South African Large Telescope
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SEF	Solar Energy Facility
SKA	Square Kilometre Array
WSDP	Water Services Development Plan
ZoR	Zone of Regulation

JUWI SOUTH AFRICA (PTY) LTD

ROOS SOLAR ENERGY FACILITY

DRAFT BASIC ASSESSMENT REPORT

1. INTRODUCTION

1.1 Background

JUWI Renewable Energies (Pty) Ltd (hereafter referred to as 'JUWI') is proposing to construct the Roos Solar Energy Facility and Grid Infrastructure approximately 15 km south-west of the town of Belfast in the Mpumalanga Province (**Figure 1**) (**DFFE Reference Number: TBA**). The overall objective of the proposed development is to generate electricity by means of renewable energy technologies capturing solar energy to feed into the national grid. The proposed development will have a maximum total generation capacity of up to 50 MW.

SiVEST Environmental Division has subsequently been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the Environmental processes for the proposed construction of the Roos Solar Energy Facility and associated Grid infrastructure. The proposed development requires an EA from the National Department Forestry, Fisheries and the Environment (DFFE). However, the provincial authority (i.e., the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) will also be consulted.

The proposed SEF, BESS and associated grid infrastructure is located within the Emalahleni Renewable Energy Development Zone (REDZ 9), as published in terms of Section 24(5) of the NEMA in GN R114 of 16 February 2018. Accordingly, a BA process as contemplated in terms of the EIA Regulations (2014, as amended) is being undertaken in respect of the proposed SEF project. All relevant legislation and guidelines will be consulted during the BA process and will be complied with at all times.

The grid connection infrastructure which is part of this application is being proposed to feed the electricity generated by the Roos SEF into the national grid. The Roos SEF will form part of the Renewable Energy Independent Power Producer Programme (REIPPP) in line with the Integrated Resource Plan (IRP). It should be noted that the proposed grid connection infrastructure will be handed over to Eskom once constructed. The on-site and/or collector substation will include an Eskom portion and an Independent Power Producer (IPP) portion. Following construction, the substation will be handed over to Eskom. The current applicant will remain in control of the low voltage components (more specifically the 33kV yard) of the substation, while the high voltage components (i.e., 132kV components) of the substation will likely be ceded to Eskom shortly after the completion of construction.

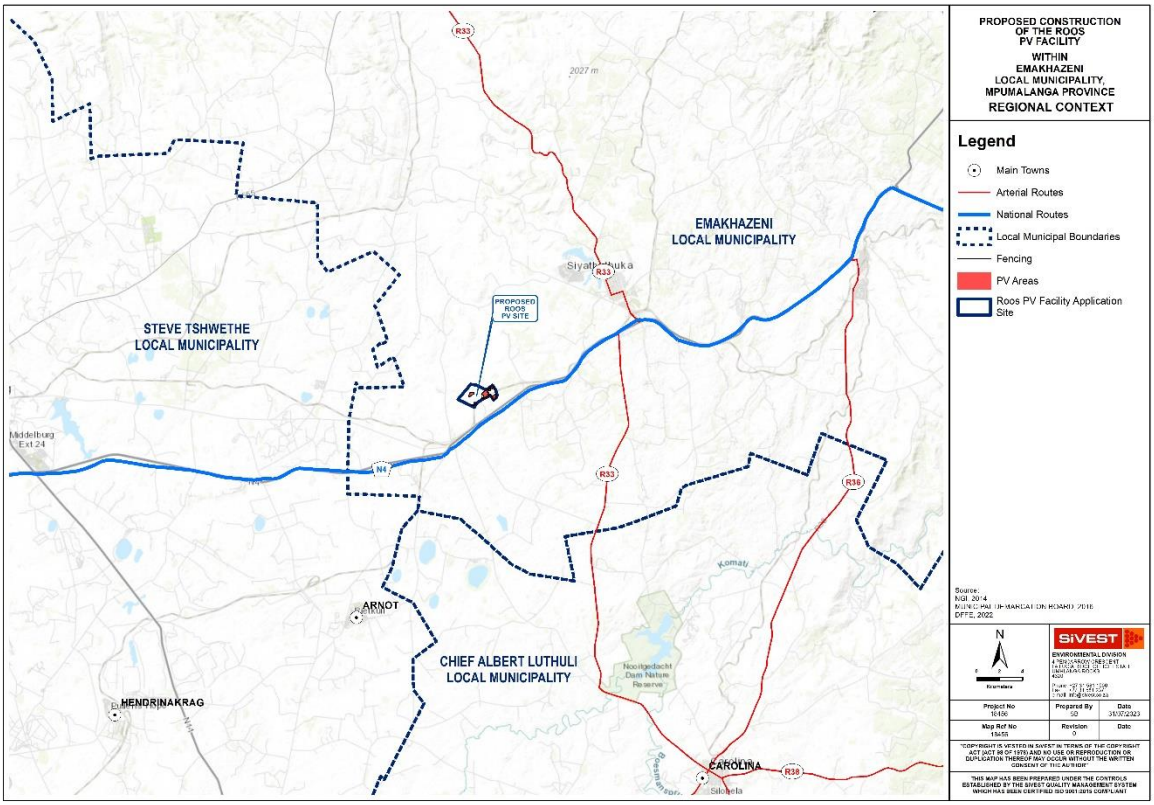

Figure 1: Roos Regional Context

1.2 Content Requirements for a Basic Assessment Report

A BAR must contain the information that is necessary for the competent authority to consider and come to a decision on the application and must include a proper understanding of the process, informing all preferred alternatives, the scope of the assessment, an assessment of the significant impacts, findings of the specialists and proposed mitigation measures, and the consultation process followed through the BA process. The content requirements for a BAR (as provided in Appendix 1 of the EIA Regulations 2014, as amended), as well as details of which section of the report fulfils these requirements, are shown in **Table 1** below.

Table 1: Content requirements for a Basic Assessment Report

2014 EIA Regulations, as amended.	Requirements for Basic Assessment Reports	Location in this BAR
Appendix 1, Section 3 (1)	A basic assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include—	Refer to relevant reference sections below:
Appendix 1, Section 3 (a)	Details of – (i) The EAP who prepared the report; and (ii) The expertise of the EAP, including a curriculum vitae.	Section 4

2014 EIA Regulations, as amended.	Requirements for Basic Assessment Reports	Location in this BAR
Appendix 1, Section 3 (b)	The location of the activity, including – (i) The 21-digit Surveyor General code of each cadastral land parcel; (ii) Where available, the physical address and farm name; (iii) Where the required information in items (i) and (ii) is not available, coordinates of the boundary of the property or properties	Section 5
Appendix 1, Section 3 (c)	A plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale, or, if it is – (i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) On land where the property has not been defined, the coordinates within which the activity is to be undertaken.	Section 5
Appendix 1, Section 3 (d)	A description of the scope of the proposed activity, including – (i) All listed and specified activities triggered and being applied for; and (ii) A description of the activities to be undertaken, including associated structures and infrastructure.	Section 7
Appendix 1, Section 3 (e)	A description of the policy and legislative context within which the development is proposed including- (i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and have been considered in the preparation of the report; and (ii) How the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	Section 11 and 12
Appendix 1, Section 3 (f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section 13
Appendix 1, Section 3 (g)	a motivation for the preferred site, activity and technology alternative;	Section 14
Appendix 1, Section 3 (h)	A full description of the process followed to reach the proposed preferred activity, site and location within the site, including-	Section 14
	(i) Details of all alternatives considered;	Section 14
	(ii) Details of the Public Participation Process undertaken in terms of Regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 14
	(iii) A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	TBC in Final BAR
	(iv) The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 9 and 10
	(v) The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which the impacts- (aa) Can be reversed; (bb) May cause irreplaceable loss of resources; and (cc) Can be avoided, managed, or mitigated.	Section 15

2014 EIA Regulations, as amended.	Requirements for Basic Assessment Reports	Location in this BAR
	(vi) The methodology used in deterring and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	Appendix 7
	(vii) Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographic, physical, biological, social, economic, heritage and cultural aspects;	Section 16
	(viii) The possible mitigation measures that could be applied and level of residual risk;	Section 15
	(ix) The outcome of the site selection matrix;	Section 14
	(x) If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such and;	Not Applicable
	(xi) A concluding statement indicating the preferred alternatives, including preferred location of the activity.	Section 14
Appendix 1, Section 3 (i)	A full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including- (i) A description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	Appendix 7 and Section 15
Appendix 1, Section 3 (j)	An assessment of each identified potentially significant impact and risk, including- (i) Cumulative impacts; (ii) The nature, significance and consequences of the impact and risk; (iii) The extent and duration of the impact and risk; (iv) The probability of the impact and risk occurring; (v) The degree to which the impact and risk can be reversed; (vi) The degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) The degree to which the impact and risk can be avoided, managed or mitigated.	Section 15
Appendix 1, Section 3 (k)	Where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report.	Section 17
Appendix 1, Section 3 (l)	An environmental impact statement which contains- (i) A summary of the key findings of the environmental impact assessment; (ii) A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	Section 18
Appendix 1, Section 3 (m)	Based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr.	Refer attached in Appendix 8

2014 EIA Regulations, as amended.	Requirements for Basic Assessment Reports	Location in this BAR
Appendix 1, Section 3 (n)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	Section 20
Appendix 1, Section 3 (o)	A description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 21
Appendix 1, Section 3 (p)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Section 18 and Section 22
Appendix 1, Section 3 (q)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised.	Section 22
Appendix 1, Section 3 (r)	An undertaking under oath or affirmation by the EAP in relation to- (i) The correctness of the information provided in the report; (ii) The inclusion of the comments and inputs from stakeholders and interested and affected parties; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties.	Section 23
Appendix 1, Section 3 (s)	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.	Not Applicable at this stage
Appendix 1, Section 3 (t)	any specific information required by the Competent Authority.	Section 24
Appendix 1, Section 3 (u)	Any other matter required in terms of section 24(4) (a) and (b) of the Act.	None
Appendix 1 Section 3 (2)	Where a government notice gazetted by the Minister provides for the basic assessment process to be followed, the requirements as indicated in such a notice will apply.	Noted and applied with

2. PROJECT TITLE

Proposed Development of the Roos Solar Renewable Energy Facility and associated Electrical Grid Infrastructure near Belfast in Mpumalanga Province.

3. DETAILS OF APPLICANT

3.1 Name and contact details of the Applicant

Name and contact details of Applicant:

Table 2: Name and contact details of the applicant

Business Name of Applicant	JUWI Renewable Energies (Pty) Ltd
Physical Address	20th Floor, The Halyard, 4 Christiaan Barnard Street, Foreshore, Cape Town, 8001
Postal Address	20th Floor, The Halyard, 4 Christiaan Barnard Street, Foreshore, Cape Town, 8001
Postal Code	8001
Telephone	+27 (0) 21 831 6130
Fax	N/A
Email	pdza@juwi.co.za (Attn: Justine Wyngaardt)

4. DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER AND SPECIALISTS

4.1 Name and contact details of the Environmental Consultant

The table below provides the name and contact details of the Environmental Consultants who prepared this report:

Table 3: Name and contact details of the Environmental Consultant who prepared the report

Business Name of EAP	SiVEST SA (PTY) Ltd
Physical Address	2 Autumn Street, Rivonia, Sandton
Postal Address	PO Box 2921, Rivonia
Postal Code	2128
Telephone	011 798 0633
Fax	N/A
Email	nataliep@sivest.com

4.2 Names and expertise of the Environmental Assessment Practitioner

The table below provides the names of the EAP's who prepared this report:

Table 4: Names and details of the expertise of the EAP's involved in the preparation of this report.

Name of representative of the EAP	Educational Qualifications	Professional Affiliations	Experience (years)
Natalie Pullen	MSc (Environmental Biotechnology)	EAPASA Registration No. 2018/132 IAIAsa	19

Name of representative of the EAP	Educational Qualifications	Professional Affiliations	Experience (years)
Phumela Madubela *(Cand.Sci.Nat)*	BSc (Hons) Environmental Monitoring & Modelling	Cand.Sci.Nat Registration No. 137670 IAIAsa	7

CV's of SiVEST personnel and EAP declaration are attached in **Appendix 1.**

4.3 Names and expertise of the specialists

Specialist studies have been conducted in terms of the Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) And 44 of the NEMA when applying for EA, as well as the EIA Regulations, 2014 (as amended). The table below provides the names of the specialists involved in the project:

Table 5: Names of specialists involved in the project.

Company	Name of representative of the specialist	Specialist	Educational Qualifications	Experience (years)
Visual Resource Management Africa cc	Stephen Stead	Visual Impact Assessment	BA (Hons) Human Geography and Geographic Information Management Systems	28
CTS Heritage	Jenna Lavin	Heritage Impact Assessment	MSc. Archaeology (UCT), CPD in Conservation of the Built Environment (UCT)	12
	Elize Butler	Paleontological Impact Assessment	MSc Zoology	28
Limosella Consulting	Rudi Bezuidenhoudt	Aquatic Biodiversity Assessment	Professional registered SACNASP, Pr. Nat. Sci (008867), BSc. (Hons) Botany	12
ECO-Assist	Wayne Jackson	Agriculture and Soils Impact Assessment	B.Sc. Soil Science and Hydrology	14
Enviro Insight	Corné Niemandt	Terrestrial Biodiversity Assessment	MSc Plant Science Pr. Sci. Nat.	8
	Sam Laurence	Avifaunal Impact Assessment	BSc, BSC Hons, M.Sc. candidate. Pr. Sci. Nat. Zoological Science	15
Social Risk Research	Eugene de Beer	Social Economic Impact Assessment	Master of Business Leadership BSc Town and Regional Planning	35

Company	Name of representative of the specialist	Specialist	Educational Qualifications	Experience (years)
SiVEST SA	Ntuthuko Hlanguza	Transportation Study	Pr. Eng	7
iSHECON	Debra Mitchell	Quantitative Risk Assessment	MSc (Chem Eng) and Pr. Eng	25

5. LOCATION OF THE ACTIVITY

The proposed development is located approximately 13 km south-west of Belfast, within the Emakhazeni Local Municipality in the Nkangala District Municipality of the Mpumalanga Province (**Figure 2**).

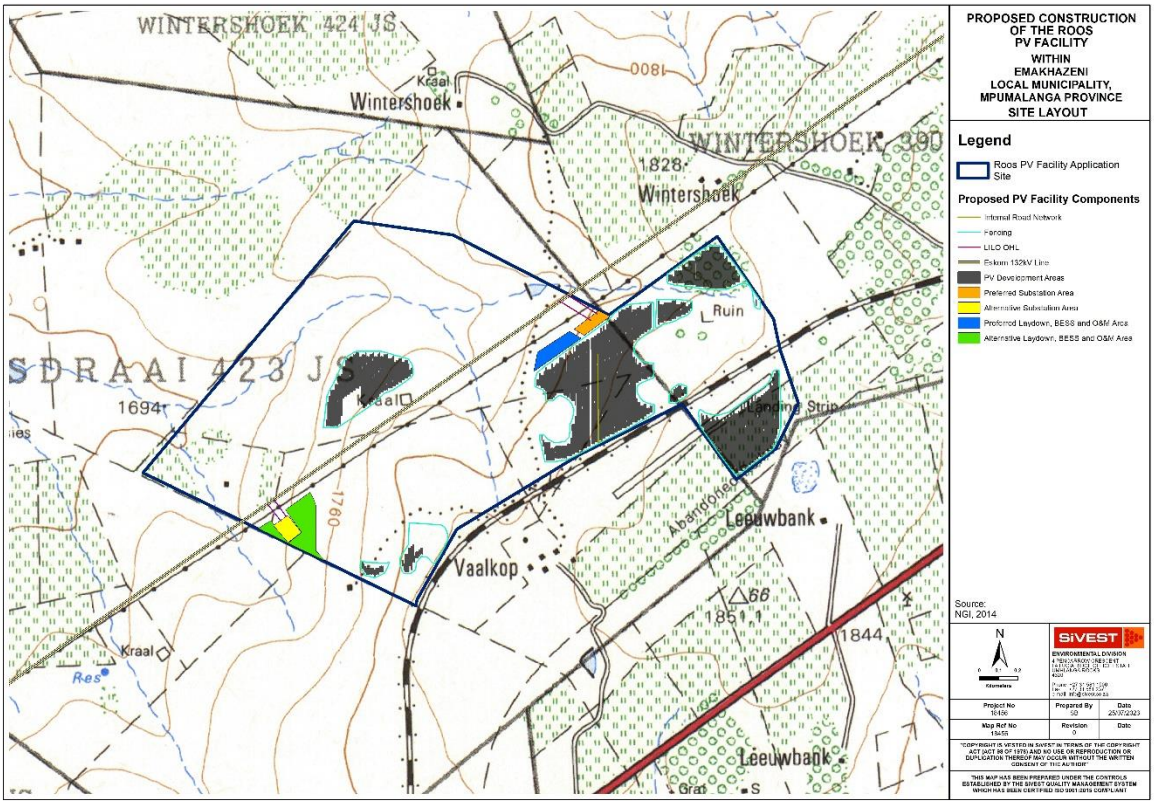

Figure 2: Site layout

5.1 21 Digit Surveyor General Codes of the site and Property Description

The SEF's and associated infrastructure will be located on the following properties:

Table 6: Summary of affected properties (including SG Codes and Farm Names) for all alternatives

21 Digit Surveyor General Code	Description	Portion No.	Farm No.	Farm Name
T0JS00000000042300014	Portion 14 of the Farm Generaalsdraai No 423	14	423	Generaalsdraai
T0JS00000000039000008	Portion 8 of the Farm Wintershoek nr 390, JS	8	390	Wintershoek

5.2 Coordinates of the site

The coordinates for the SEF and associated infrastructure are as follows:

Table 7: SEF site boundary coordinates

ROOS: SEF		
COORDINATES AT CENRE POINTS (DD MM SS.sss)		
Site	SOUTH	EAST
1	25°46'17.022"S	29°54'48.564"E
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
1	25°46'30.806"S	29°53'52.869"E
2	25°28'46.188"S	29°54'32.07"E
3	25°45'51.268"S	29°54'49.33"E
4	25°46'5.215"S	29°55'19.513"E
5	25°45'51.404"S	29°55'40.109"E
6	25°46'5.892"S	29°55'50.331"E
7	25°46'19.851"S	29°55'54.49"E
8	25°46'27.578"S	29°55'50.331"E
9	25°46'32.285"S	29°55'43.084"E
10	25°46'20.047"S	29°55'33.263"E
11	25°46'28.556"S	29°55'13.431"E
12	25°46'40.534"S	29°54'50.432"E
13	25°46'28.556"S	29°54'42.719"E

Table 8: Grid connection coordinates

ROOS GRID: GRID CORRIDOR (PREFERRED)		
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
POINT	SOUTH	EAST
1	25° 46' 1.127" S	29° 55' 11.302" E
2	25° 46' 3.017" S	29° 55' 15.879" E
3	25° 46' 4.851" S	29° 55' 12.977" E
4	25° 46' 2.990" S	29° 55' 8.432" E
ROOS GRID: GRID CORRIDOR (ALTERNATIVE)		

COORDINATES AT CORNER POINTS (DD MM SS.sss)		
1	25° 46' 37.125" S	29° 54' 13.300" E
2	25° 46' 35.040" S	29° 54' 16.109" E
3	25° 46' 39.001" S	29° 54' 19.379" E
4	25° 46' 40.497" S	29° 54' 16.542" E

Table 9: On-site Substation Coordinate

ROOS SEF: SUBSTATION (PREFERRED)		
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
Point	**SOUTH**	**EAST**
1	25° 46' 3.162" S	29° 55' 15.796" E
2	25° 46' 4.876" S	29° 55' 19.485" E
3	25° 46' 6.634" S	29° 55' 17.047" E
4	25° 46' 4.859" S	29° 55' 13.048" E
ROOS SEF: SUBSTATION (ALTERNATIVE)		
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
1	25° 46' 39.973" S	29° 54' 16.062" E
2	25° 46' 38.300" S	29° 54' 18.718" E
3	25° 46' 41.168" S	29° 54' 21.174" E
4	25° 46' 42.828" S	29° 54' 18.713" E

Table 10: Laydown area, BESS & O&M Area Coordinates

ROOS SEF: LAYDOWN AREA, BESS & O&M AREA (PREFERRED)		
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
Point	**SOUTH**	**EAST**
1	25° 46' 7.840" S	29° 55' 6.471" E
2	25° 46' 4.662" S	29° 55' 12.058" E
3	25° 46' 6.783" S	29° 55' 16.821" E
4	25° 46' 14.112" S	29° 55' 5.154" E
ROOS SEF: LAYDOWN AREA, BESS & O&M AREA (ALTERNATIVE)		
COORDINATES AT CORNER POINTS (DD MM SS.sss)		
1	25° 46' 40.441" S	29° 54' 13.216" E
2	25° 46' 39.328" S	29° 54' 15.273" E
3	25° 46' 45.939" S	29° 54' 25.488" E
4	25° 46' 44.331" S	29° 54' 23.883" E
5	25° 46' 38.004" S	29° 54' 23.851" E
6	25° 46' 34.548" S	29° 54' 22.728" E
7	25° 46' 37.309" S	29° 54' 18.348" E

6. SITE LAYOUT/ ROUTE ALIGNMENT PLAN

The Site Layout is attached in **Appendix 3**.

Photographs of the site are included in **Appendix 4**.

7. ACTIVITY INFORMATION

7.1 Project Description

7.1.1 SEF and Associated Infrastructure

The application site assessed is approximately 365.14 ha in extent. It is anticipated that the proposed Solar PV energy facility will include PV fields (arrays) comprising of multiple PV panels. In summary, the proposed SEF development will include the following components:

PV panels

- Mounting: Fixed-tilt PV, single-axis tracking PV or double-axis tracking PV
- Module type: mono- or bi-facial
- up to approx. 4.0m PV panels

Access roads

- Main site access: Up to 8m, during construction and operation
- Internal roads: Approx. 4 - 5m, during construction and operation
- Existing roads will be utilised as far as reasonably possible and upgraded where necessary. Upgraded width: Up to 8m

Onsite Substation

- Substation will generally be stepping up from 22kV or 33kV to 88kV or 132kV.
- Maximum height of on-site substations: up to 10 m
- The proposed project will include one on-site substation hub incorporating the facility substation, switchyard, collector infrastructure, battery energy storage system (BESS) and associated O&M buildings
- Onsite substation size: Up to 2ha (for on-site substation hub)

Grid Integration

- The substation will connect to the existing 132kV overhead powerline via a double circuit 132kV loop-in, loop-out (LILO) overhead powerline configuration
- The LILO is expected to be approximately 150m long within a corridor of approximately 100m
- Pylon structures may be either steel lattice, steel monopole or woodpole structures
- The powerline structure will be determined at final design stage after technical consultation with Eskom Engineers and after the geotechnical and topographical surveys have been conducted

Construction Camp

- No construction camps would be developed, and labour would be sourced from nearby areas, as per relevant procurement requirements

Temporary Infrastructure

- Temporary Laydown Area: up to approximately 5.96 ha

O&M Buildings

- O&M building will be utilized for plant supervision and storing of spare parts
- All auxiliary buildings to be developed include, but are not limited to: O&M building, site office, staff lockers, bathrooms, warehouses, etc (with septic tanks and all infrastructure) as follows:

- Office (~250m²).
- Storeroom (~200m²).
- Staff lockers and changing room (~100m²).
- Security control (~40m²).
- Sanitation facilities with septic tank outside.
- Conservancy Tank.
- Borehole (if possible, somewhere on site).

On-site IPP Electrical Infrastructure

- The proposed project will include one on-site substation hub incorporating the facility substation, switchyard, collector infrastructure, battery energy storage system (BESS) and associated O&M buildings.)
- Internal underground lines of up to 33 kV (22kV or 33kV)
- Substation will generally be stepping up from 22kV or 33kV to 88kV or 132kV
- Depth (m): Up to 1.5 m
- Cables will be laid underground wherever technically feasible, with overhead 33kV lines grouping PV areas to crossing valleys and ridges to get to the on-site substation

Fencing

- The entire perimeter of the proposed facility will be secured
- Type: proposed palisade or mesh or fully electrified
- Length: TBC
- Height: Up to 3m

Boreholes and storage tanks

- If required, a 10,000l storage tank may be located on site for water storage

A Battery Energy Storage System (BESS)

- Capacity in MWh: Up to 340MW/ 340MWh
- Size in hectare - A BESS would be developed within the substation/electrical infrastructure hub footprint, if required
- Height: Up to 8 m
- Technology type will be either solid state or flow batteries, depending on the client's specification (i.e.: Li-Ion solid state/Redox flow)
- Electrochemical Batteries including:
  - Lead Acid and Advanced Lead Acid
  - Lithium ion, NiCd, NiMH-based Batteries
  - High Temperature (NaS, Na-NiCl2, Mg/PB-Sb)
  - Flow Batteries (VRFB, Zn-Fe, Zn-Br)
- The BESS would therefore comprise the selected batteries together with chargers, inverters and related equipment

The preliminary layout is reflected in **Figure 3** below:

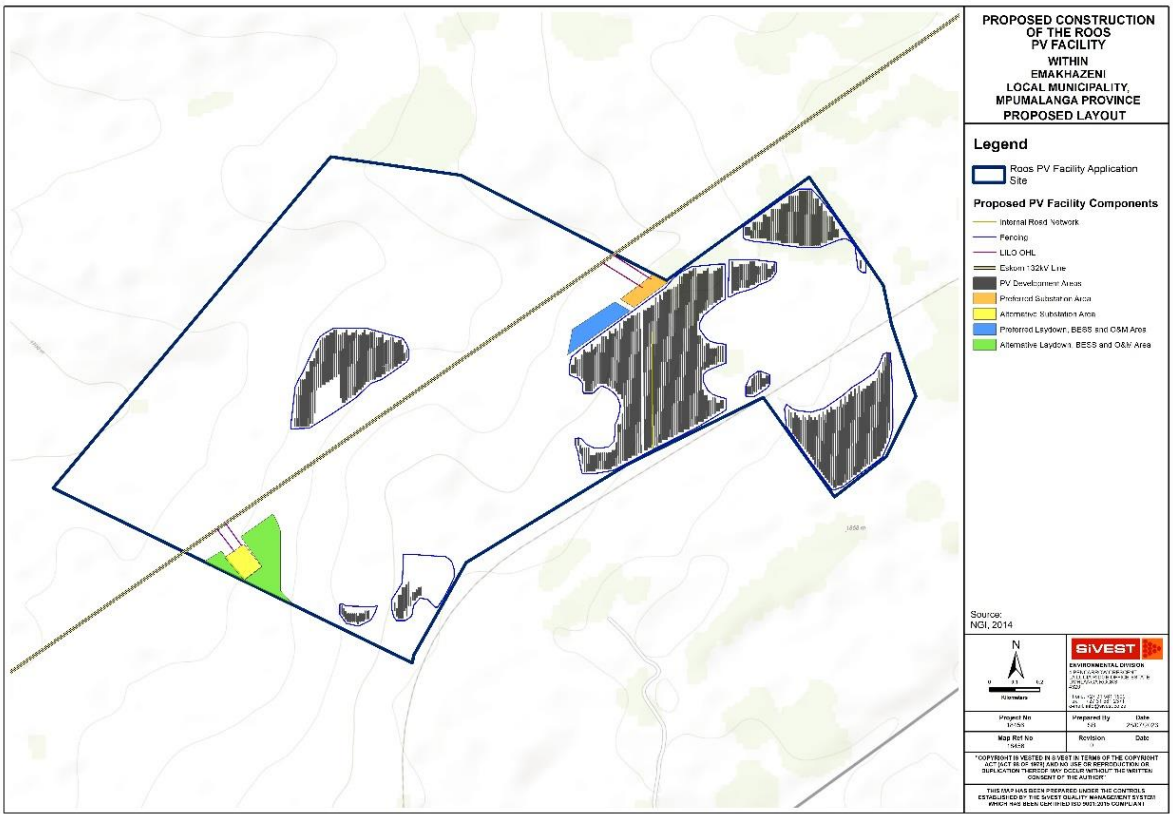

Figure 3: Proposed Layout

The solar PV panels and all other project infrastructure have been placed strategically within the development area based on environmental constraints.

7.1.2 Main components of a Solar PV Facility

It is anticipated that the proposed Solar PV energy facility will include PV fields (arrays) comprising multiple PV panels. Solar PV panels are usually arranged in rows consisting of a number of PV modules.

Please refer to **Figure 4** below for the typical components of a solar panel.

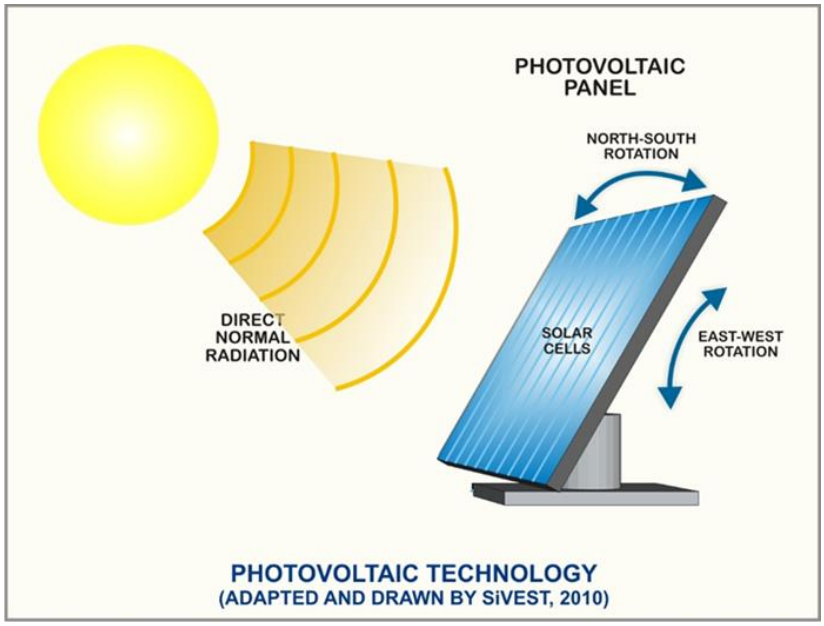

Figure 4: Typical components of a solar PV Panel

The solar arrays are usually connected in strings, which are in turn connected to inverters. DC power from the panels will be converted into AC power in the inverters and the voltage will be typically stepped up to a medium voltage in the transformers. As mentioned, medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure (132kV overhead power line and 33/132kV on-site substation). The medium voltage cables will be run underground (wherever technically feasible) in the facility before being fed to the on-site and/or collector substation, where the voltage will typically be stepped up.

The solar PV electricity generation process is illustrated in **Figure 5** below.

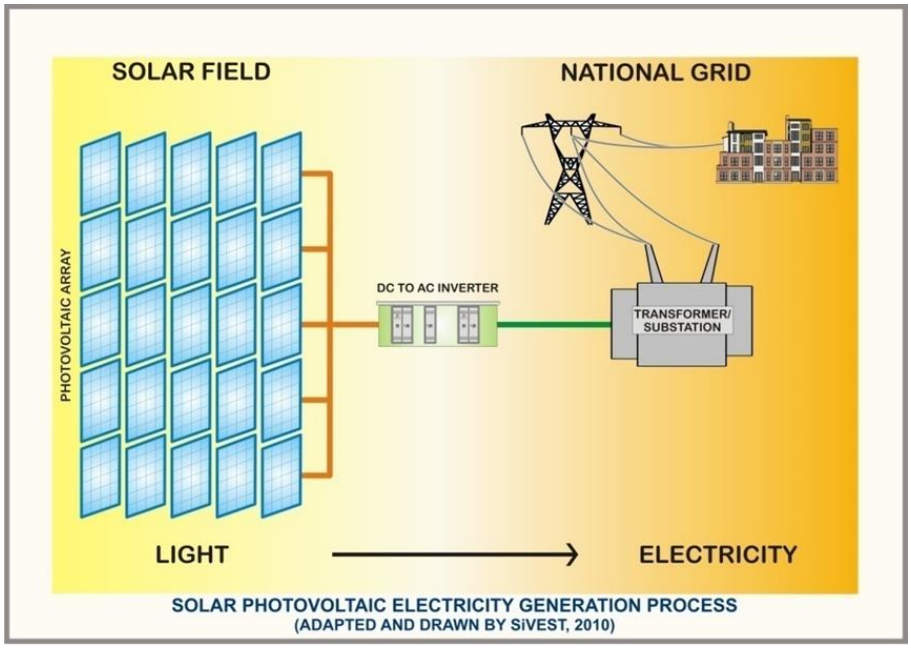

Figure 5: Solar PV electricity generation process

7.1.3 Battery Energy Storage System

Two BESS technology alternatives are being considered, such as Solid-state battery electrolytes and Redox-flow technology. Solid-state battery electrolytes, such as lithium-ion (Li-ion), zinc hybrid cathode, sodium ion, flow (e.g., zinc iron or zinc bromine), sodium sulphur (NaS), zinc air and lead acid batteries, can be used. Compared to other battery options, Li-ion batteries are highly efficient, have a high energy density and are lightweight. As a result of the declining costs, Li-ion technology now accounts for more than 90% of battery storage additions globally (IRENA, 2019) and has now been applied more widely in the industry and at grid-scale in South Africa. Flow batteries use solid electrodes and liquid electrolytes. The most used flow battery is the Vanadium Redox Flow Battery (VRFB), which is a type of rechargeable flow battery that employs vanadium ions in different oxidative states to store chemical potential energy. The specific technology will only be determined following Engineering, Procurement, and Construction (EPC) procurement. The main components of the BESS include the batteries, power conversion system, and transformer which will all be stored in various rows of containers. The BESS components will arrive on site pre-assembled. The approximate footprint for the BESS is 2 ha.

The storage capacity and type of technology would be confirmed at a later stage during the development phase, but most likely comprise an array of containers.

7.1.4 Roads

Existing internal gravel site roads will be used wherever possible. However, where required, new internal gravel roads may be constructed as per the following:

- Access and internal roads with a width of 5-6 m and up to 8 m at bends, and a road reserve width of 20 m to accommodate cable trenches, stormwater channels (as required), and turning circle/bypass areas. (Note: the layout and design of internal roads is yet to be finalized.)
- Internal roads of approximately 16 ha total footprint, consisting of existing gravel roads wherever possible and new roads where required.

7.1.5 Technical Detail Summary

A summary of the project technical details is provided in **Table 11** below.

Table 11: Technical Detail Summary

Component	Description / Dimensions
Project Location	The proposed development is located approximately 13 km south-west of Belfast, within the Emakhazeni Local Municipality in the Nkangala District Municipality of the Mpumalanga Province
Location of site (Centre point)	25°46'17.022"S 29°54'48.564"E
Generation Capacity of Substation	33/132kV
Application site area	365.14Ha (overall farm areas)
PV development area	Approximately 62ha
Affected Properties	• Portion 14 of the Farm Generaalsdraai No 423 • Portion 8 of the Farm Wintershoek nr 390
SG Codes	• T0JS00000000042300014

Component	Description / Dimensions
	• T0JS00000000039000008
PV Panels	• Mounting: Fixed-tilt PV, single-axis tracking PV or double-axis tracking PV. • Module type: mono- or bi-facial • Up to approx. 4.0m PV panels
Access roads	• Provincial and local roads, including existing farm roads will be utilised, to access the Project as far as possible. • Main site access: up to 8m, during construction and operation • Internal roads: approximately 5-6 m, during construction and operation • Existing roads will be utilised as far as reasonably possible and upgraded where necessary. Upgraded width: up to 8m
On-site Substation	• Substation will generally be stepping up from 22kV or 33kV to 88kV or 132kV. • Maximum height of on-site substations: up to 10 m • The proposed project will include one on-site substation hub incorporating the facility substation, switchyard, collector infrastructure, battery energy storage system (BESS) and associated O&M buildings • Onsite substation size: up to 4ha (for on-site substation hub)
Grid Integration	• The substation will connect to the existing 132kV overhead powerline via a double circuit 132kV loop-in, loop-out (LILO) overhead powerline configuration. • The LILO is expected to be approximately 150m long within a corridor of approximately 100m • The powerline structure will be determined at final design stage after technical consultation with Eskom Engineers and after the geotechnical and topographical surveys have been conducted. • Pylon structures may be either steel lattice, steel monopole or woodpole structures.
Construction camp	No construction camps would be developed, and labour would be sourced from nearby areas, as per relevant procurement requirements
Temporary construction laydown/ staging area	• Temporary Laydown Area: up to approximately 7 ha. • Locations: TBC
Operation and Maintenance (O&M) buildings	• All auxiliary buildings to be developed include, but are not limited to: O&M building, site office, staff lockers, bathrooms, warehouses, etc. • Footprint up to 0.5 ha (i.e., 5000 m^2) • Height (m): Up to 10 m
On-site IPP Electrical infrastructure	• The proposed project will include one on-site substation hub incorporating the facility substation, switchyard, collector infrastructure, battery energy storage system (BESS) and associated O&M buildings

Component	Description / Dimensions
	• Internal underground lines of up to 33 kV (22kV or 33kV) • Substation will generally be stepping up from 22kV or 33kV to 88kV or 132kV • Depth (m): Up to 1.5 m *"Cables will be laid underground wherever technically feasible, with overhead 33kV lines grouping PV areas to crossing valleys and ridges to get to the on-site substation."*
Fencing	The entire perimeter of the proposed facility will be secured. Fence height up to 3m. The type of fence could be palisade or mesh or fully electrified.
Boreholes and storage tanks (if applicable)	• If required, a 10,000l storage tank may be located on site for water storage.
Battery Energy Storage Systems	• Capacity in MWh: Up to 340MW/ 340MWh • Size in hectare - A BESS would be developed within the substation/electrical infrastructure hub footprint, if required. • Height: Up to 8 m • Technology type (i.e.: Li-Ion solid state/Redox flow) • Electrochemical Batteries including: ○ Lead Acid and Advanced Lead Acid ○ Lithium ion, NiCd, NiMH-based Batteries ○ High Temperature (NaS, Na-NiCl2, Mg/PB-Sb) ○ Flow Batteries (VRFB, Zn-Fe, Zn-Br) The BESS would therefore comprise the selected batteries together with chargers, inverters and related equipment.
Estimated number of employment opportunities generated by each PV project	• Construction phase: 100 (skills split would be in line with applicable procurement requirements but would be roughly 60% low-skilled, 25% semi-skilled and 15% skilled) • Operational phase: 10 (skills split would be in line with applicable procurement requirements but would be roughly 70% low skilled, 25% semi-skilled and 5% skilled • Decommissioning phase: unknown
Construction: Methodology	• The facility would be constructed in the following sequence: 8. Final design and micro-siting of the infrastructure based on topographical conditions and environmental sensitivities, and following obtaining required environmental permits. 9. Vegetation clearance and construction of access roads (where required) 10. Construction of foundations 11. Assembly and erection of infrastructure on site 12. Stringing of inverters 13. Rehabilitation of disturbed areas 14. Continued maintenance
Construction: Duration and start date	Up to 12-18 months, start date is dependent upon award of a bid. Construction activities could take place concurrently

7.2 NEMA Listed Activities

The amended EIA Regulations promulgated under Section 24(5) of the National Environmental Management Act, Act 107 of 1998 and published in Government Notice No. R. 326 list activities which may not commence without environmental authorization from the Competent Authority. The proposed activity is identified in terms of Government Notice No. R. 327, and 324 for activities which must follow a Basic Assessment Process. The project will trigger the following listed activities:

Table 12: Listed activities in terms of NEMA: EIA Regulations 2014 (as amended in 2017), applicable to the proposed project

Activity No(s):	Relevant activities as set out in Listing Notices 1, 2 and 3 of the EIA Regulations, 2014 as amended	Describe the portion of the proposed project to which the applicable listed activity relates.
Relevant Basic Assessment Activities as set out in Listing Notice 1		
11 (i)	**GN R. 327 (as amended) Item 11:** The development of facilities or infrastructure for the transmission and distribution of electricity— (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.	New on-site substations/ collector switching stations will be constructed as part of the proposed development. The proposed substation / collector switching stations will be located outside urban areas and will have capacities of 33/132kV respectively.
12 (ii) (a) (c)	**GN R. 327 (as amended) Item 12:** The development of: ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	The proposed developments will therefore entail the construction of infrastructure with physical footprints of approximately 100m^2 or more within a surface water feature / watercourse or within 32m of a surface water feature / watercourse.
14	**GN R. 327 (as amended) Item 14:** The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.	"Dangerous goods" that are likely to be associated with the project include fuel stored during the construction phase and/or hazardous chemical substances at the substation during the operational phase. Threshold of 80 m^3 expected to be exceeded. The proposed development will include the construction of an on-site Battery Energy Storage System (BESS) using solid state / liquid flow or redox flow batteries with hazardous material of more than 80m^3.
19	**GN R. 327 (as amended) Item 19:** The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;	The proposed development will involve the excavation, removal, infilling, depositing and moving of more than 10 cubic metres (m^3) of soil, sand, pebbles or rock from some of the identified surface water features / watercourses. Although the layout of the proposed development will be designed to avoid the identified surface water features / watercourses as far as possible, some of the internal and/or access roads may need to traverse the identified

Activity No(s):	Relevant activities as set out in Listing Notices 1, 2 and 3 of the EIA Regulations, 2014 as amended	Describe the portion of the proposed project to which the applicable listed activity relates.
		surface water features / watercourses. In addition, during construction of these roads, soil may need to be removed from some of the identified surface water features / watercourses.
24 (ii)	**GN R. 327 (as amended) Item 24:** The development of a road - ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres.	Internal roads will be required to access the PV panels and substations. Existing roads will be used wherever possible, although new roads will be constructed where necessary.
28 (ii)	**GN R. 327 (as amended) Item 28:** Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;	The total area to be developed for the proposed renewable energy facilities is greater than 1ha and occurs outside an urban area in an area currently zoned as agriculture land.
48 (i) (a) (c)	**GN R. 327 (as amended) Item 48: The expansion of-** (i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such expansion occurs— (a) within a watercourse; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	The proposed project will most likely entail the expansion (upgrading) of roads and other infrastructure by 100m^2 or more within a surface water feature / watercourse or within 32 m from the edge of a surface water feature / watercourse. Although the layout of the proposed development will be designed to avoid the identified surface water features / watercourses as far as possible, some of the infrastructure (e.g. internal and access roads, etc) to be upgraded will likely need to traverse the identified surface water features / watercourses and construction will likely occur within some of the surface water features / watercourses and/or be within 32m of some of the surface water features / watercourses.
56 (ii)	**GN R. 327 Item 56:** The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre - (ii) where no reserve exists, where the existing road is wider than 8 metres –	Internal access roads will be required to access the PV panels and the substation. Existing roads will be used wherever possible, although new roads will be constructed where necessary. The existing access roads might thus need to be upgraded by widening them more than 6m, or by lengthening them by more than 1km.
Relevant Scoping and EIA Activities as set out in Listing Notice 2 of the EIA Regulations, 2014 as amended		
1	**GN R. 325 (as amended) Item 1:** The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more.	The proposed development will entail the construction of a PV where the electricity output will be approximately 50MW. In addition, the proposed PV development will be located outside urban area.
15	**GN R. 325 (as amended) Item 15:** The clearance of an area of 20 hectares or more of indigenous vegetation.	The proposed SEF development will involve the clearance of more than 20ha of indigenous vegetation. Clearance will also be required for the proposed on-site

Activity No(s):	Relevant activities as set out in Listing Notices 1, 2 and 3 of the EIA Regulations, 2014 as amended	Describe the portion of the proposed project to which the applicable listed activity relates.
		substation, BESS, internal roads and other associated infrastructure.
Relevant Basic Assessment Activities as set out in Listing Notice 3 of the EIA Regulations, 2014 as amended		
4 i. (ii) (aa)	**GN R. 324 (as amended) Item 4:** The development of a road wider than 4 metres with a reserve less than 13,5 metres. **f. Mpumalanga** i. Outside urban areas; (bb) National Protected Area Expansion Strategy Focus areas; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	The development of the SEF facilities and associated infrastructure is likely to require the development of roads wider than 4m with a reserve of less than 13.5m within CBA and NPAES areas. These roads will occur within the Mpumalanga Province, outside urban areas.
10.	**GN R. 324 (as amended) Item 10:** The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres. **(f) In Mpumalanga** (ii) Outside urban areas; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	The development of the onsite substation will require the construction and operation of facilities and infrastructure for the storage and handling of dangerous goods (combustible and flammable liquids, such as oils, lubricants, solvents) such storage will occur inside containers with a combined capacity exceeding 80 cubic meters but not exceeding 500 cubic meters within areas classified as CBAs.
12 (f) (ii)	**GN R. 324 (as amended) Item 12:** The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. **(f) In Mpumalanga** (ii) Within critical biodiversity areas identified in bioregional plans;	The proposed SEF development will involve the clearance of more than 300m^2 or more of indigenous vegetation within CBA. Clearance will also be required for the proposed on-site substation, BESS, internal roads and other associated infrastructure.
14 ii. a.c.f.i.bb. ff	**GN R. 324 (as amended) Item 14:** The development of: ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse;	The proposed development will likely entail the development of infrastructure with physical footprints of 10m^2 or more within a watercourse / surface water feature or within 32m from the edge of a watercourse / surface water feature. Although the layouts of the respective proposed developments will be designed to avoid the identified

Activity No(s):	Relevant activities as set out in Listing Notices 1, 2 and 3 of the EIA Regulations, 2014 as amended	Describe the portion of the proposed project to which the applicable listed activity relates.
	(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse. **(f) In Mpumalanga** i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (ff) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	surface water features / watercourse as far as possible, some of the infrastructure / structures will likely need to traverse the identified surface water features / watercourses. The construction of the infrastructure for the development will occur within CBA and NPAES areas. These infrastructures will occur within the Mpumalanga Province, outside urban areas.
18 f. i. (bb) (ee)	**GN R. 324 (as amended) Item 18:** The widening of a road by more than 4 meters, or the lengthening of a road by more than 1 kilometer- **f. Mpumalanga** i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	Access roads will be required to access the PV panels as well as the substation. Existing roads will be used wherever possible. Internal access roads will thus likely be widened by more than 4m or lengthened by more than 1km. These roads will occur within CBA and NPAES areas, within the Mpumalanga province and outside urban areas
23 (ii) (a) (c); f. i. (ff	**GN R. 324 (as amended) Item 23:** The expansion of – (ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; where such expansion occurs – (a) within a watercourse; (c) if no development setback has been adopted adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; f. Mpumalanga i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	The proposed development will entail the development and expansion of roads by 10m^2 or more within a watercourses or within 32m from the edge of a watercourses. The proposed development will be located outside an urban area and within CBA and NPAES areas, within the Mpumalanga province and outside urban areas.

8. NATIONAL WEB-BASED ENVIRONMENTAL SCREENING TOOL

The National Web based Environmental Screening Tool is a geographically based web-enabled application which allows a proponent intending to submit an application for EA in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended to screen their proposed site for any environmental sensitivity.

According to the DFFE Screening Tool Report (attached in **Appendix 9**), the following themes described in **Table 13** below are applicable to the proposed grid and substation development:

Table 13: DEA Screening tool themes

Theme	Sensitivity	Comment
Agriculture Theme	High	The Agricultural Compliance Statement is included in **Appendix 6** of the Draft BAR. The result of the DFFE Screening Tool is regarded as Medium to Low is correct for the majority of the project area. The area to the west does however have areas that are currently being utilised for agriculture and therefore these areas dispute the DFFE rating of Medium to Low. Therefore, the project area does have the potential to be of a high sensitivity in these areas. The assessment would require an Agro-ecosystem impact assessment.
Animal Species Theme	High	The Terrestrial Ecological Report is included in **Appendix 6** of the Draft BAR. The result of the DFFE Screening Tool analysis for Animal Species Sensitivity is confirmed as Very High.
Aquatic Biodiversity Theme	Very High	The Aquatic Biodiversity Report is included in **Appendix 6** of the Draft BAR. The result of the DFFE Screening Tool is regarded as Very high for the proposed project. The watercourses associated with the study site are classified as highly sensitive, with the reminder of the study site classified as having low sensitivity. The area south of the N4 is classified as having high sensitivity.
Archaeological and Cultural Heritage Theme	Low	The Heritage Report is included in **Appendix 6** of the Draft BAR. The development area has Low levels of sensitivity for impacts to archaeological and cultural heritage resources. As per the findings of this assessment, and its supporting documentation, the outcome of the sensitivity verification disputes the results of the DFFE Screening Tool for Palaeontology - this should

Theme	Sensitivity	Comment
		be considered to be Moderate - and disputes the results of the screening tool for archaeology and cultural heritage - this should be considered to be Very High and Moderate.
Avian Theme	Low	The entire site has a low sensitivity in terms of the avian theme. No further specialist study required.
Civil Aviation (Solar PV) Theme	Low	The entire site has a low sensitivity in terms of the civil aviation theme. No further specialist study required
Defence Theme	Low	The entire site has a low sensitivity in terms of the defence theme. No further specialist study required.
Landscape (Solar) Theme	Very High	The Visual Report is included in **Appendix 6** of the Draft BAR. The proposed PV is located approximately 3km to the northwest of the Cecilia Private Nature Reserve as is located 4,1km to the southwest and is outside of the project ZVI. This NR is part of a coal mine and has low levels of scenic quality that do not add to local tourism planning. Slopes of 1 in 4m and 1 in 10m were found within the project development area. These areas do add value to local scenic resources and should be excluded from development. Based on the findings of the SSVR, these areas were excluded from the development footprint. Slopes less than 1 in 10m were found within the project development area. These areas are topographically contained and could be utilized for PV development without significant loss of regional landscape and visual resources. The site is located in close proximity to an elevated plateau, with prominence over the lower lying western areas. The development areas are located off prominent ridgelines. Minor ridgelines have been identified and excluded from the development area. The site visual resources are limited with a Medium rating for Scenic Quality and Low rating for Receptor Sensitivity to landscape change and disputes the results of DFFE Screening Tool for the Landscape theme.
Palaeontology Theme	Very High	The Heritage Report is included in **Appendix 6** of the Draft BAR.

Theme	Sensitivity	Comment
		The development area has Very High levels of sensitivity for impacts to palaeontological heritage and Low levels of sensitivity for impacts to archaeological and cultural heritage resources. As per the findings of this assessment, and its supporting documentation, the outcome of the sensitivity verification disputes the results of the DFFE Screening Tool for Palaeontology - this should be considered to be Moderate - and disputes the results of the screening tool for archaeology and cultural heritage - this should be considered to be Very High and Moderate.
Plant Species Theme	Medium	The Terrestrial Ecological Report is included **Appendix 6** of the Draft BAR. The result of the DFFE Screening Tool analysis for Plant Species Sensitivity for the development site is shown as High for more natural areas. The vegetation survey results indicate High sensitivity for one Sensitive Plant Species, however this is disputed the results of the DFFE Screening Tool.
RFI Theme	Low	The entire site has a low sensitivity in terms of the RFI theme. No further specialist study required.
Terrestrial Biodiversity Theme	Very High	The Terrestrial Ecological Report is included **Appendix 6** of the Draft BAR. The result of the DFFE Screening Tool analysis for Terrestrial Biodiversity Sensitivity is regarded as Very High. In terms of the Terrestrial Assessment, the site visit and desktop assessment confirmed Very High environmental sensitivity of the Terrestrial Biodiversity Theme and High sensitivity for one Sensitive Plant Species. Accordingly full assessments were carried out for both themes.

9. DESCRIPTION OF THE RECEIVING ENVIRONMENT

This chapter summarises the environmental attributes associated with the proposed project study area focusing on the geographical, physical and biological environment.

9.1 Geographical

The proposed Roos SEF and infrastructure is located approximately 14km north east of Belfast in the Mpumalanga Province and is within the Emakhazeni Local Municipality, in the Nkangala District Municipality. The regional context of the proposed application area is shown in **Figure 1**.

9.2 Land Use

The area surrounding the site is predominantly characterised by agricultural activity (mainly maize cultivation and livestock).

Surrounding land use includes:

- Western Rural Farmsteads;
- Agri-village;
- Railway line;
- Mining;
- N4 Westbound;
- Power lines;
- Wonderfontein Town;
- Agriculture:
    - Agricultural silo;
    - Maize cultivation; and
    - Cattle and sheep pastures.

Figure 6: Afgri grain silo

Figure 7: Agri-village

Figure 8: Farm dams

Figure 9: Railway line infrastructure

Figure 10: Degraded mining landscape

9.3 Climate

This region is characterised by a strongly seasonal summer rainfall, with very dry winters. Mean annual precipitation (MAP) 650–900 mm (overall average: 726 mm), MAP relatively uniform across most of this unit, but increases significantly in the extreme southeast. The coefficient of variation in MAP is 25% across most of the unit but drops to 21% in the east and southeast. Incidence of frost from 13–42 days, but higher at higher elevations. The regional climate capability was classified as Moderate (Mucina, et al., 2006).

9.4 Geology and Soils

The geology broadly forms part of the Pretoria Group, with the Dullstroom, Steenkampsberg, Lakenvlei, Vermont, Magaliesberg, Silverton, Strubenkop, Daspoort, Hekpoort, and Timeball Hill Formations running from the west through to the east. The Pretoria Group is commonly intersected by the intrusive Transvaal Diabase in the form of dykes and sills. The resulting rocks are predominantly comprised of quartzite, shale, dolerite, diabase and basalt.

Soils are shallow to deep, well-drained; either dystrophic and/or mesotrophic, depending on geology. Soil derived from quartzite results in sandy, white dystrophic soils with high humus content.

9.5 Surface Water

An Aquatic Biodiversity Impact Assessment was undertaken by Limosella Consulting (Pty) Ltd (May 2023).

The site assessment confirmed the wetlands that will be potentially impacted by the proposed project are classified as follows:

- Channelled valley bottom wetland;
- 2 Hillslope seepage wetlands.

The proposed Solar layout sections does partially encroach on the wetland and their associated buffer zones. The proposed powerline traverses 3 wetland sections of two different wetland types. Although the exact footprint positions of the pylons were not known during the writing of this report it is assumed that it will span the wetlands and buffer zones with no pylons located in these areas. The proposed substations are not located on any wetland or wetland buffer zone. It is recommended that the layout of the proposed development be refined to exclude the wetlands as well as their respective buffer zones. This will be one of the major mitigation measures proposed and will have a significant influence on the impact of the SEF. Prior to the proposed mitigation measures most impacts rated moderate and post mitigation they ranked low in both the construction and operational phase

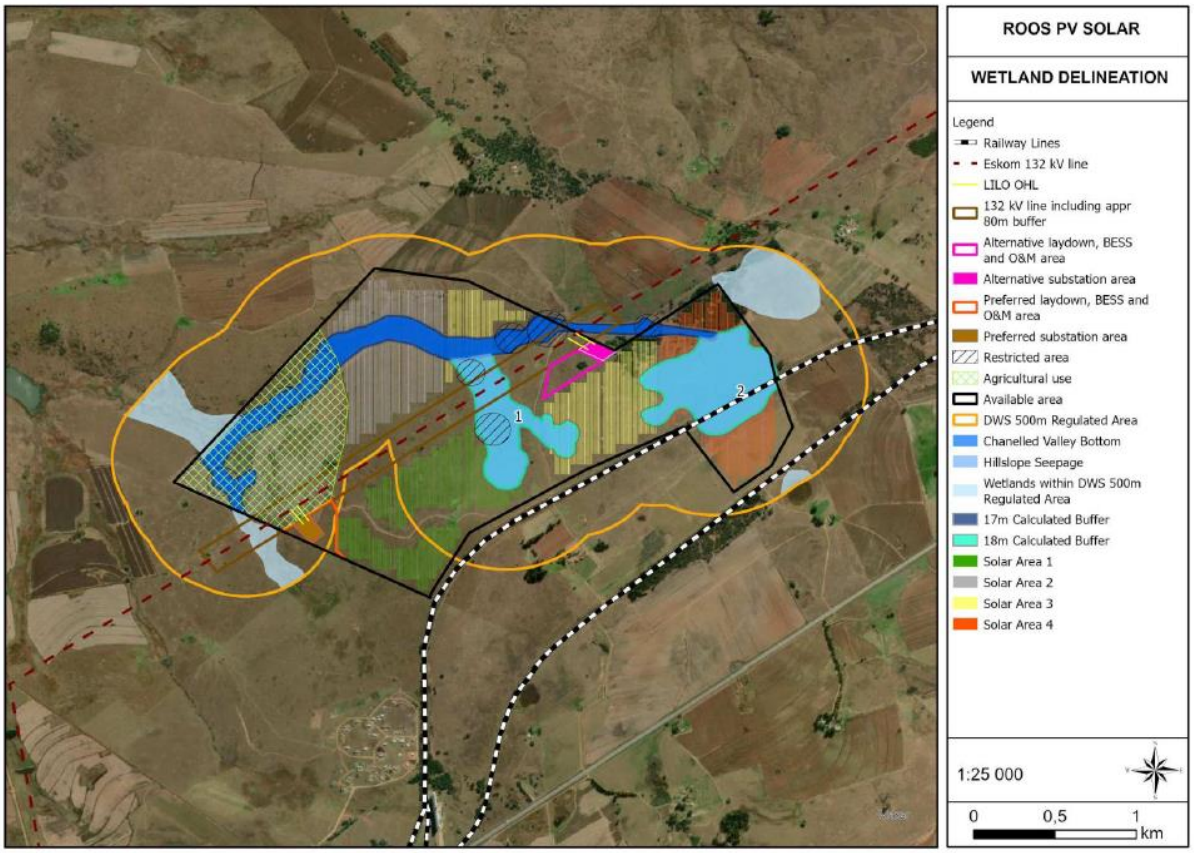

Figure 11: Delineated watercourses, their calculated buffers and DWS regulated area relative to the study site.

9.6 Agriculture

A Soils and Agricultural Potential Impact Assessment was undertaken by Eco Assist (June 2023).

9.6.1 Land Types

The Land Type data was used to obtain generalised soil patterns and terrain types for the site. Land Type data exists in the form of published 1:250 000 maps. These maps indicate delineated areas of similar terrain types, pedosystems (uniform terrain and soil pattern) and climate (Land Type Survey Staff, 1972 - 2006).

The Roos project area falls within land types Ib34, Ad1, and Ea8. The Ib34 landtype is dominated by the crest and midslope landscape positions and consists largely of Glenrosa and Hutton soil forms. The average slope for this land type is steep with slopes ranging from 12% to 100%. Clay content is estimated at between 15% and 40%.

The Ad1 landtype is dominated by the crest and midslope landscape positions and consists largely of the Clovelly and Glenrosa soil forms. The average slope for this land type ranges from 0% to 8%. Clay content is estimated at between 10% and 40%.

The Ea8 landtype is dominated by the midslope and footslopes landscape positions and consists largely of Hutton, Shortlands, and Glenrosa soil forms. The average slope for this land type steep with slopes ranging from 0% to 8%. Clay content is estimated at between 30% and 60%.

The average soil depth according to the landtype data for the project area is between 100mm and 600mm (see Figure 8-11).

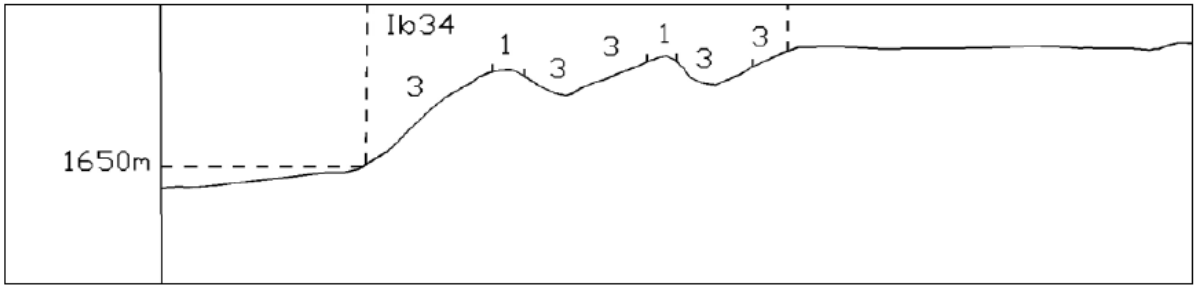

Figure 12: Hillslope catena for land type Ib34.

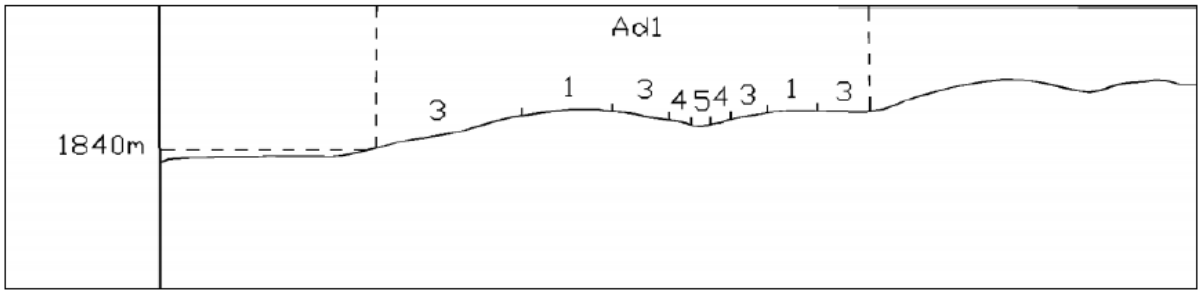

Figure 13: Hillslope catena for land type Ad1.

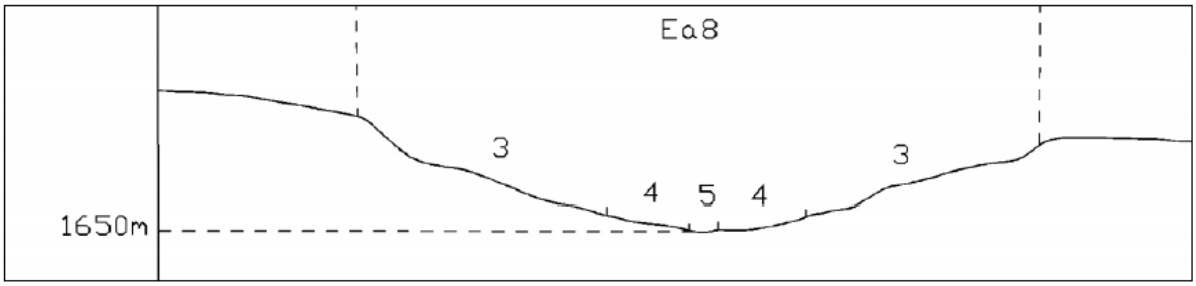

Figure 14: Hillslope catena for land type Ea8.

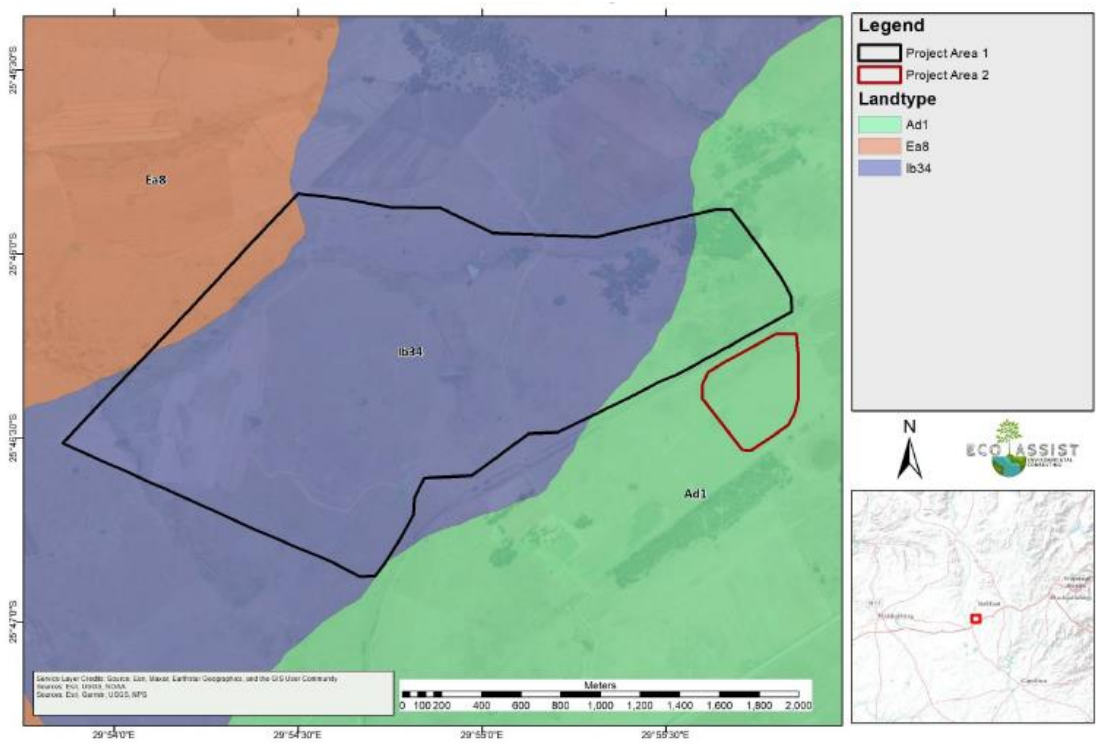

Figure 15: Landtype within the Roos PV project area.

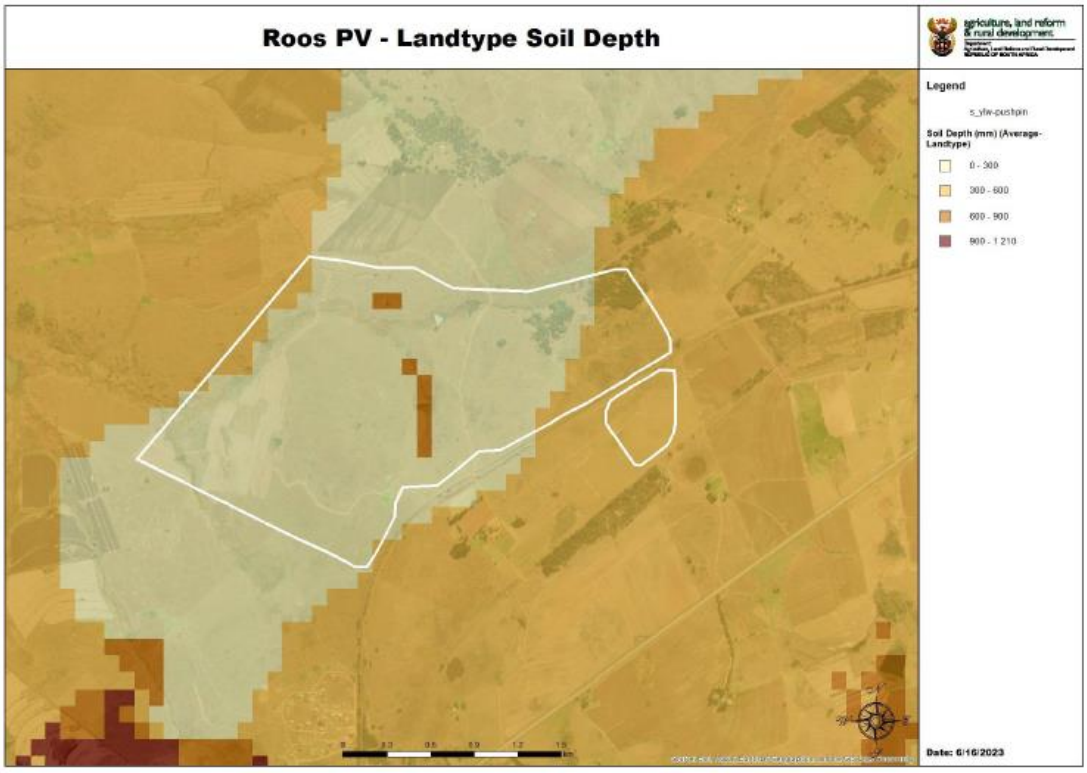

Figure 16: Landtype soil depths within the Roos PV project area.

9.6.2 Soil Capability

Soil capability takes into consideration all aspects pertaining to the characteristics of the soil and their contributions towards plant production (Department of Agriculture, Forestry and Fisheries, 2017).

Three databases were used a part of the soil capability modelling:

- Land type data modelled and mapped into topographical units (Beukes). The data were modelled and rasterised form the original land type data base and the 90 m SRTM DEM. All the soil attributes are linked to fixed boundary zones. The soil concerns, issues and data are therefore aimed at an attribute rather than a spatial level;
- The land type soil attribute data base (ARC); and
- Soil fertility data (DAFF).

Three main modelling concerns formed part of the soil capability modelling:

- Plant available water;
- Soil sensitivity; and
- Soil fertility.

The soil capability for the overall project area ranged from Very-Low to Moderate-High. The area earmarked for the Solar PV was dominated by Very-Low with a small portion to the east being rated as Moderate. A very narrow edge of Moderate-High capability occurs on the northern edge of the project area (see **Figure 17**).

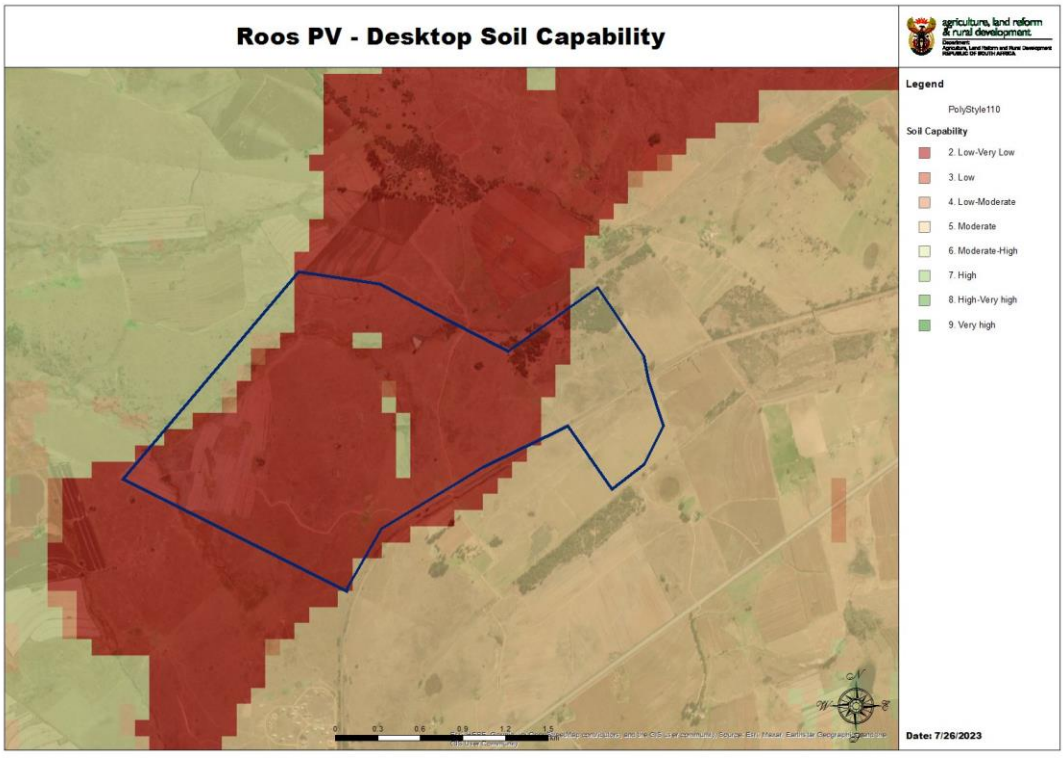

Figure 17: Soil capabilities within the Roos PV project area (Department of Agriculture, Forestry and Fisheries, 2017).

9.6.3 Land Capability

Land capability is defined as the most intensive long-term use of land for purposes of rainfed farming determined by the interaction of climate, soil and terrain.

To represent the distribution of the land capability evaluation values in the country, used as one of the input data layers to determine and demarcate all high value agricultural land for ensuring that these areas, pending availability, are preserved for continued agricultural production, thereby ensuring long-term national food security (Department of Agriculture, Forestry and Fisheries, 2017).

The data layer is a seamless data layer and does not exclude permanently transformed areas (built up; waterbodies; mining etc.).

The land capability for the overall project area ranged from Low-Very Low to Moderate-High. The area earmarked for the Solar PV was dominated by Low to Low-Moderate with a small portion to the east being rated as Moderate (see **Figure 18**).

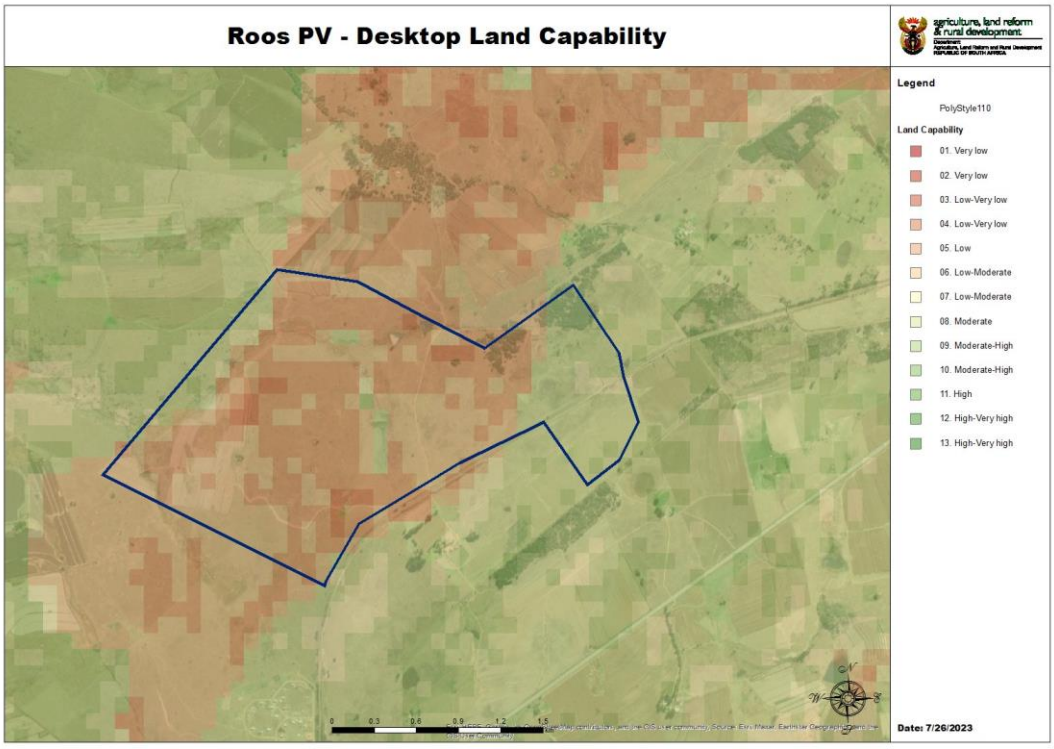

Figure 18: Land capabilities within the Roos PV project area (Department of Agriculture, Forestry and Fisheries, 2017)

9.6.4 Grazing Capacity

The long-term production potential of the herbaceous layer (grasses and forbs) of an area of vegetation that is required to maintain an animal with a weight of 450 kg (1 Large Stock Unit (LSU)) with an average fodder intake of 10 kg dry mass per day over a period that vegetation is suitable for grazing (mostly 1 year) without degrading the natural resources (vegetation and soil) and is measured in “Hectares per Large Stock Unit” (ha/LSU) (South Africa (Republic), 2018).

The long-term sustainable grazing capacity for the project area was 5ha per large stock unit (see **Figure 19**).

9.6.5 Cultivated Fields

The cultivated area maps (see **Figure 20**) shows that the project area only has very small portions being utilised for rainfed crop production in the western corner as well as a small section on the eastern edge.

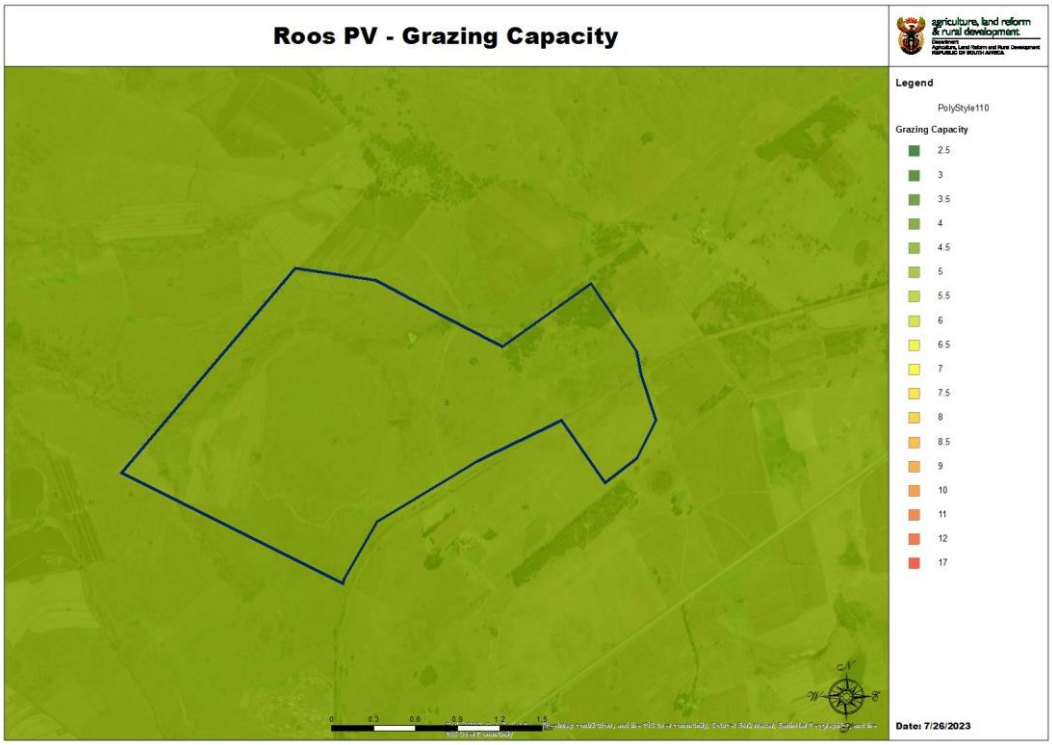

Figure 19: The grazing capacity within the Roos PV project area (South Africa (Republic), 2018).

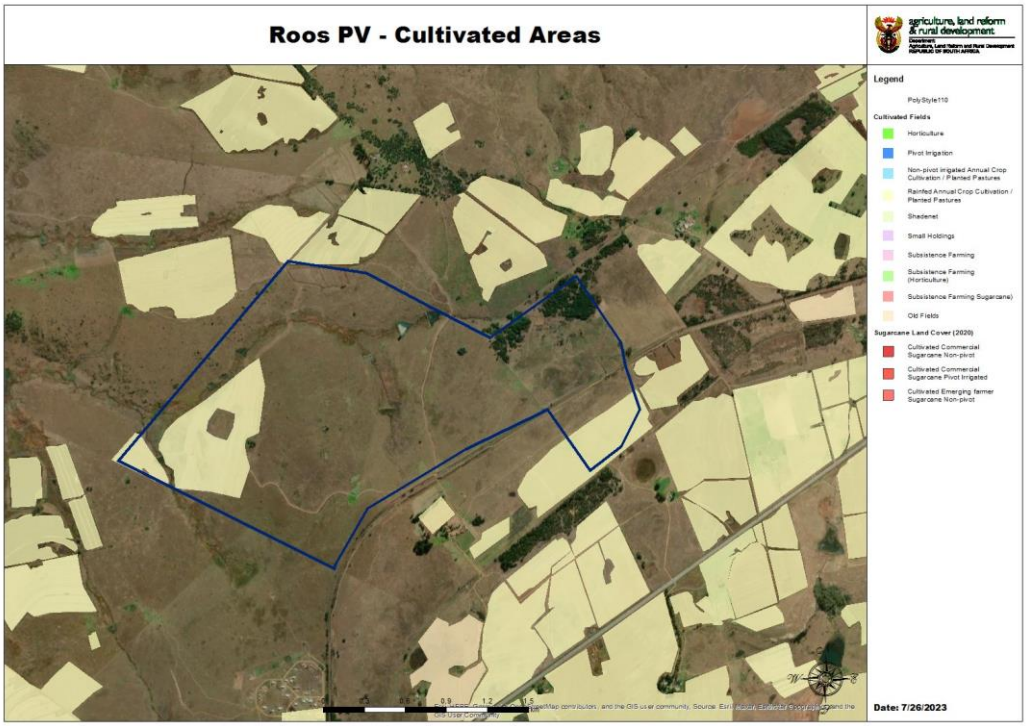

Figure 20: The cultivated areas within the Roos PV project area (South Africa (Republic), 2018).

9.6.6 Agro-Ecosystem Assessment Finding

The sensitivity analysis has identified the project area to have a Medium to Low sensitivity, with small areas of High sensitivity where existing agricultural fields are. Therefore, an Agro-ecosystem impact assessment is required.

The desktop results as well as the field verification and detailed soils assessment have determined that the agricultural potential is rated as Medium to High based on the climatic conditions as well as the soils identified on site. The following indicates the desktop and in field findings:

Desktop Results;

- DEA screening assessment determined the agricultural sensitivity to be Medium to Low, with small areas of High;
- The project has small areas of crop field boundaries;
- The desktop land capability rated the project area as Low to Low-Moderate with a small portion to the east being rated as Moderate;
- The climate capability was determined to be Moderate;
- The desktop soil capability rated the project area as Very-Low with a small portion to the east being rated as Moderate. A very narrow edge of Moderate-High capability occurs on the northern edge of the project area; and
- The desktop grazing capability rated the project area as 5ha/LSU.

Site Assessment Results;

- Land capability was determined as grazing to light cultivation;
- Land potential was determined to be L2 (high potential) to L4 (moderate potential); and
- Land use showed natural grasslands used for cattle grazing and small areas of maize farming.

9.7 Biodiversity (Fauna and Flora)

A Terrestrial Biodiversity Impact Assessment was undertaken by Enviro-Insight CC (June 2023).

9.7.1 Vegetation Unit and Threatened Ecosystem

The study area is located in the Steenkampsberg Montane Grassland Gm30 and Endangered Eastern Highveld Grassland Gm12 (Mucina & Rutherford, 2006 – as amended) (**Figure 21**).

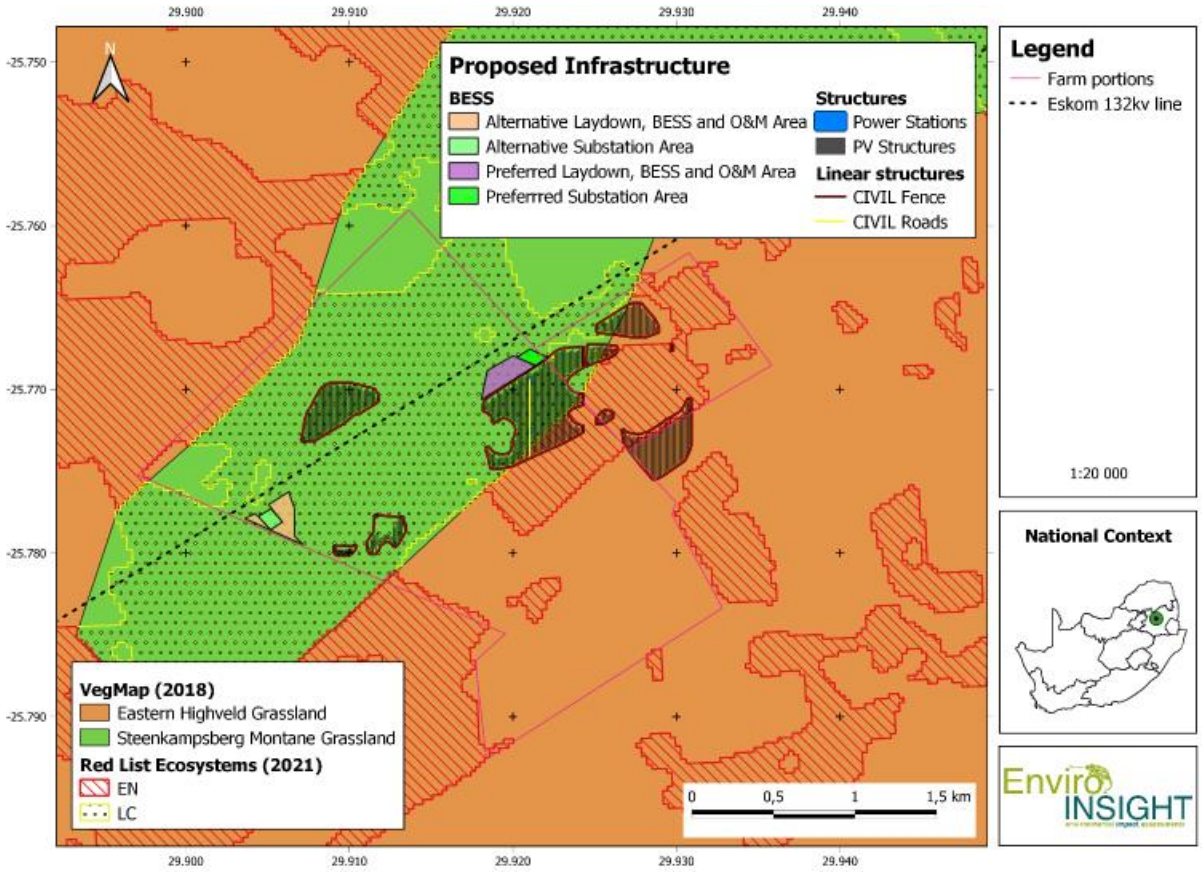

Figure 21: Roos PV Facility in relation to vegetation units (SANBI 2018)

9.7.2 Mpumalanga Critical Biodiversity Areas

A map of the study area in relation to the 2014 Mpumalanga CBA's is presented in **Figure 22** indicating that the study area is located primarily in CBA Optimal, Other Natural Areas, Heavily Modified, and a small section in CBA Irreplaceable and Moderately Modified. Areas of high biodiversity value including CBA Irreplaceable and Optimal should be avoided as far as possible concerning transformation of land cover.

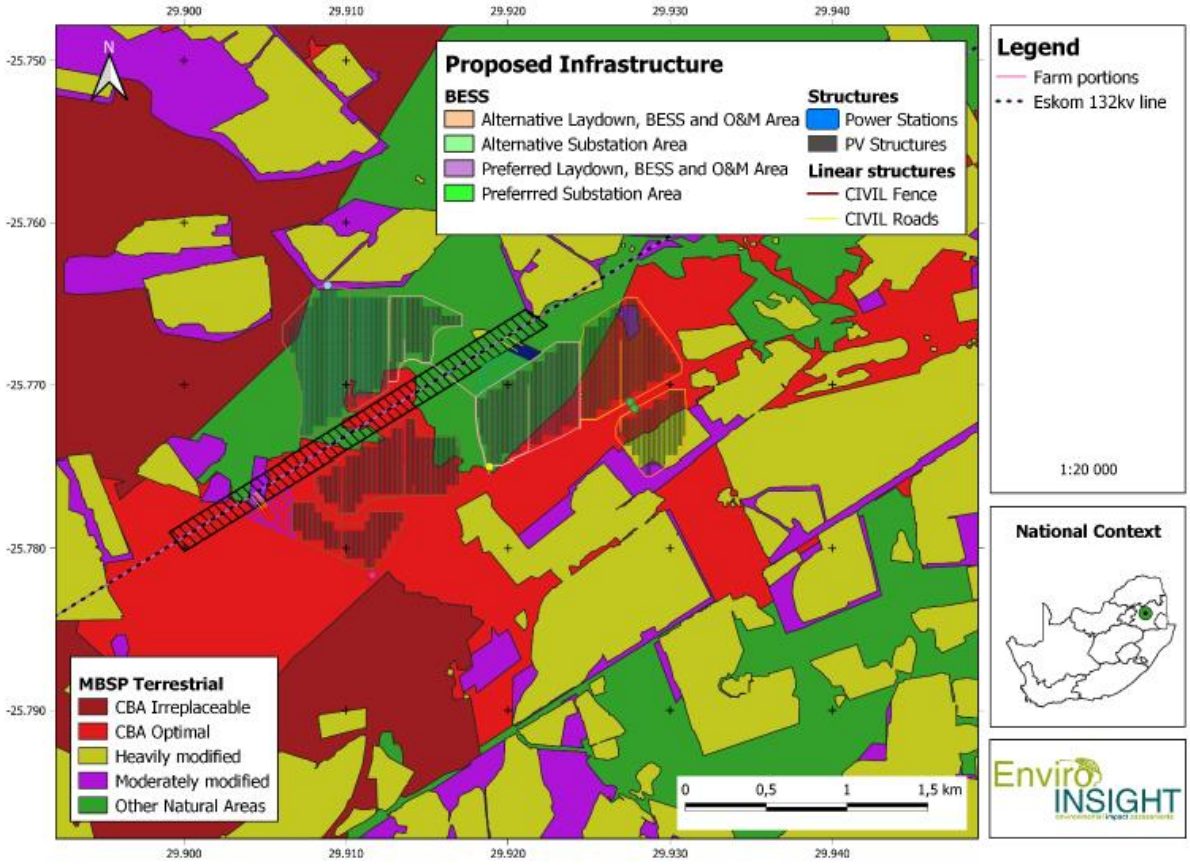

Figure 22: Roos PV Facility in relation to 2014 Mpumalanga CBA's

9.7.3 Habitats and Species Composition

The species diversity is generally moderate to high with diversity increasing on hilly grassland slopes and primary natural grassland. Four main habitats were identified based on species composition and structure as well as agriculture and transformed areas where no or limited vegetation remains (**Figure 23**). The five habitats include: Primary Grassland, Rocky Grassland, Watercourse and Disturbed Grassland. The main driver of vegetation pattern in the area is substrate.

Georeferenced photographs were taken to assist in both the site characterisation as well as the sensitivity analysis and provide lasting evidence for future queries. The specialist coverage is considered optimal as every habitat was surveyed, taking into consideration the large study area. Furthermore, all areas of the study area were clearly visible, but not completely accessible due to the extent of the study area and road access limitations.

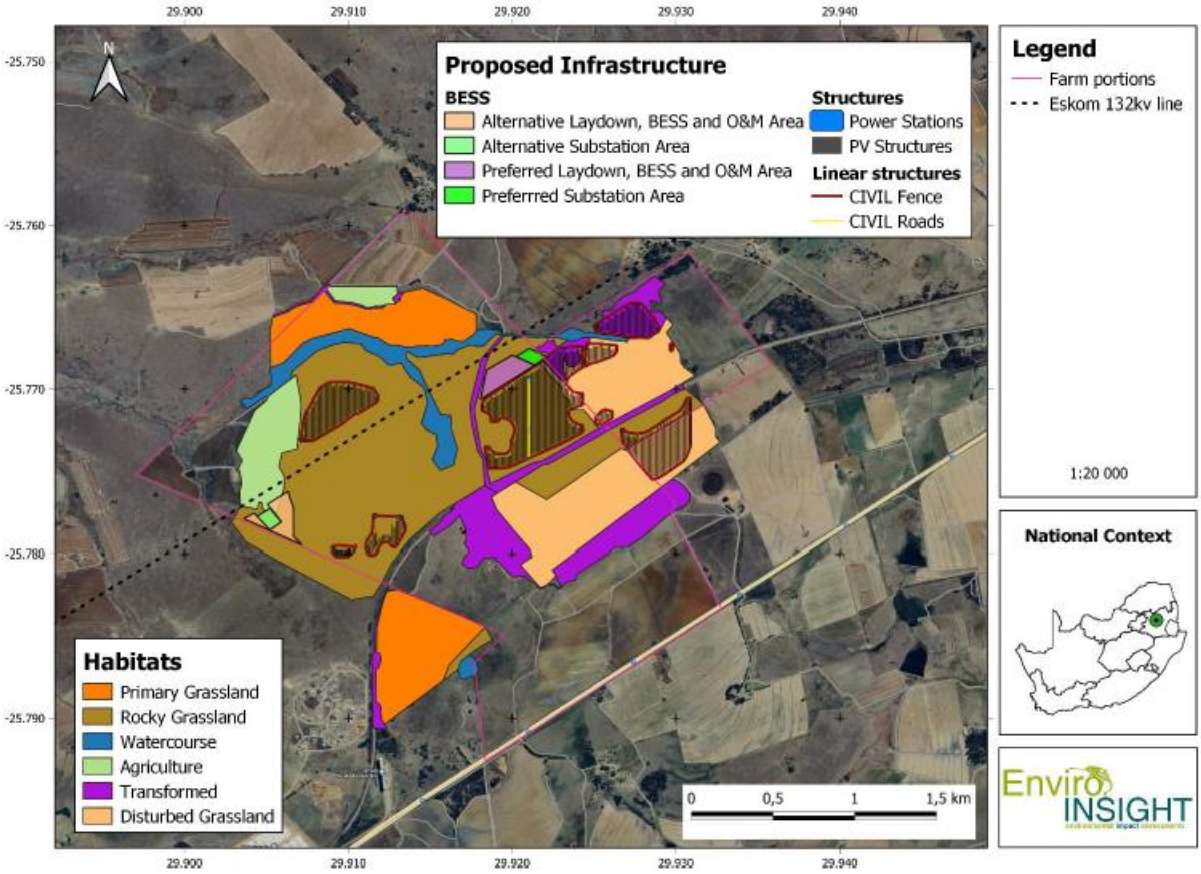

Figure 23: The site is located within the Eastern Highveld Grassland (Mucina & Rutherford 2006).

Primary Grassland

This is representative of the Eastern Highveld Grassland which is characterised by slightly to moderately undulating plains, including some low hills and pan depressions and consist of short, dense grassland, dominated by Highveld grasses. The Grassland is in a good ecological condition but is surrounded by disturbed and transformed areas which causes large edge effects on the remaining patches.

The floristic composition of the region is dominated by herbs, followed by grasses, geophytes, succulents and dwarf shrubs. Dominant species recorded include:

- Grasses: *Aristida junciformis, Alloteropsis semialata, Cymbopogon pospischilii, Cynodon dactylon, Eragrostis racemose, Themeda triandra, Tristachya leucothrix*
- Succulents: *Aloe greatheadii, Aloe verdoorniae, Delosperma sutherlandii, Khadia carolinensis*
- Herbs: *Acalypha villicaulis, Pelargonium luridum, Hermannia transvaalensis, Indigofera melanadenia, Polygala hottentotta, Helichrysum rugulosum, Gladiolus crassifolius, Seriphium plumosum, Crassula capitella subsp. nodulosa, Hebenstretia comosa, Pentanisia angustifolia, Hilliardiella aristata, Leobordea foliosa, Oxalis obliquifolia, Chlorophytum cooperi, Scabiosa columbaria, Babiana bainesii, Ipomoea ommanneyi, Blepharis subvolubilis, Becium obovatum, Senecio bupleuroides, Senecio coronatus, Hyparrhenia hirta, Cyanotis speciosa, Alloteropsis semialata, Senecio venosus, Hilliardiella aristate, Cycnium adonense, Lotononis sp, Cucumis*

hirsutus, Monopsis decipiens, Erythrina zeyheri, Helichrysum nudifolium, Macledium zeyheri, Cyphia sp., Hibiscus sp.

- Sedges: *Cyperus congestus, Cyperus erectus*
- Shrubs and Trees: *Elephantoriza elephantina, Searsia tumulicola var. meeuseana, Xysmalobium undulatum*

The sensitive species *Khadia carolinensis* and *Aloe verdoorniae* were recorded on site and suitable habitat is present throughout this habitat. The sensitivity of the Primary Grassland is considered to be High. As far as possible, the development footprint must be reduced, and no transformation must take place in this habitat.

Figure 24: Vegetation and landscape features of the Primary Grassland

Disturbed Grassland

The Disturbed Grassland comprises secondary grassland with alien invasive plant species present, dominating in some areas. Although it is situated in a CBA, owing to its disturbed nature and is heavily modified in some places it is not deemed sensitive. This is due to land use changes in the last 8-10 years which has seen an increase in cattle grazing, mowing of grass to be used as fodder, the spread of alien invasive species due to mismanagement and owing to edge effects from surrounding land uses, including transformation of indigenous vegetation to agricultural land.

Dominant species include:

- Grasses: *Aristida junciformis, Cynodon dactylon, Eragrostis racemose, Hyparrhenia hirta, Pennisetum clandestinum.*
- Herbs: *Commelina africana subsp. krebsiana, Chlorophytum cooperi, Cirsium vulgare, Conyza scabrida, Conyza bonariensis, Helichrysum nudifolium, Helichrysum rugulosum, Hibiscus trionum, Hypoxis rigidula, Monopsis decipiens, Nidorella anomala, Rumex crispus, Sonchus dregeanus, Tagetes minuta, Verbena bonariensis, Verbena brasiliensis.*
- Shrubs and Trees: *Acacia mearnsii, Acacia dealbata Erythrina zeyheri, Ricinus communis, Seriphium plumosum, Xysmalobium undulatum.*
- Sedges: *Cyperus congestus,*
- Geophytes: *Boophone disticha, Gladiolus crassifolius*
- Succulents: *Agave americana*

No sensitive species have been recorded and a moderate probability of occurrence is likely within this habitat since sections of it still occurs in a CBA owing to suitable habitat. The vegetation and ecological functioning have degraded over time, and indigenous species composition and diversity has declined.

Figure 25: Vegetation and landscape features of the Disturbed Grassland

Rocky Grassland

This habitat is representative of the Steenskampsberg Montane Grassland where the landscape is hilly and often rocky, with hill slopes and shallow valleys. Grasslands are short with high forb diversity. Some areas are infested with alien invasive species owing to farm roads, watercourse running through the site and cattle grazing.

No sensitive species have been recorded and a moderate probability of occurrence is likely within this habitat since sections of it still occurs in a CBA owing to suitable habitat. The vegetation and ecological functioning is still in a natural state with numerous indigenous species.

Dominant plant species include:

- Herbs: *Afroaster serrulatu, Alectra sessiliflora, Cirsium vulgare, Commelina africana, Dicoma anomala, Haemanthus humilis, Helichrysum nudifolium, Lactuca inermis, Leonotis leonurus, Macledium zeyheri, Pearsonia sessilifolia, Pelargonium luridum, Polygala hottentotta, Scabiosa columbaria, Senecio inornatus, Tephrosia elongate, Wahlenbergia undulata*
- Geophytic herbs: *Boophone disticha, Eucomis montana, Hypoxis rigidula, Gladiolus crassifolius*
- Succulents: *Aloe greatheadii, Aloe verdoorniae, Crassula capitella subsp. nodulosa*
- Grasses: *Aristida junciformis, Diheteropogon filifolius, Paspalum dilatatum, Themeda triandra*
- Ferns: *Cheilanthes viridis, Pellaea calomelanos,*
- Trees and Shrubs: *Diospyros lycioides, Gymnosporia buxifolia, Lantana rugosa, Lopholaena coriifolia, Protea caffra subsp. caffra, Psoralea polysticta, Rubus ludwigii, Searsia dentata, Searsia tumulicola var. meeuseana, Seriphium plumosum, Xysmalobium undulatum*

Figure 26: Vegetation and landscape features of the Rocky Grassland

Watercourse

The habitat consists of a system of artificial dams, wetlands and streams. It is considered a seep within the mesic grassland system. In general, the system is in a good ecological condition where only some areas are impacted on by cattle trampling and alien invasive species.

Suitable habitat is present for two plant SCC which have a high probability of occurring on site, which has been mapped and indicated as no-go areas. Watercourses are not easily restored without significant intervention. Habitat specialist flora are unlikely to survive in any other habitat in the development area and are thus highly dependent on functional watercourse habitat.

Dominant species include:

- Herbs: *Chaenostoma floribundum, Cirsium vulgare, Crabbea cf. ovalifolia, Exochaenium grande, Helichrysum aureum, Lobelia flaccida, Monopsis decipiens, Moraea pubiflora, Moraea elliotii, Verbena bonariensis, Verbena brasiliensis.*
- Geophytic herb: *Eucomis autumnalis, Hypoxis argentea,*
- Grasses: *Imperata cylindrica, Hyparrhenia tamba, Phragmites australis*
- Sedges: *Schoenoplectus sp., Juncus sp.*

Figure 27: Vegetation and landscape features of the Watercourse

9.7.4 Plant SCC

National and Provincial Plant Species

Approximately fifteen sensitive plant species are likely to occur in the study area map of the study area. Two species were recorded during the survey and is discussed in more detail below. Suitable habitat is also present for 2 additional species which have a high probability to occur on site.

Khadia carolinensis (L.Bolus) L.Bolus

The species is a South African endemic where it occurs in Mpumalanga in the Steenkampsberg Montane Grassland, Eastern Highveld Grassland, and Rand Highveld Grassland vegetation units. It prefers well-drained, sandy loam soils among rocky outcrops, or at the edges of sandstone sheets, at about 1700 m. It forms large, flattened clumps that can be up grow up to 0.5 m in diameter. It has white to cream -coloured flowers and six-locular capsules that are woody and close fully again after they have opened.

The species is listed as Vulnerable (A3c) owing to coal mining (coal reserves are found underneath the sandstones on which this species is found) which has seen an increase in new applications for coal mining in the last 15 years. Should these applications be granted (and many more are likely to come in within the next few years), the habitat will be severely impacted by open cast mining. In 2007, it was estimated that up to 45% of the range (EOO) of this species could be destroyed within the next 10-20 years should the current applications go ahead (Lötter et al., 2007).

Aloe verdoorniae Reynolds

A poorly known species with a limited distribution range. This species has a limited range, from the eastern outskirts of Pretoria in Gauteng eastwards to Dullstroom and Belfast in Mpumalanga. It occurs on rocky slopes in grassland and woodland. It may be overlooked due to taxonomic confusion. It is likely to be declining around Witbank, Bronkhorstspruit, Cullinan and Dullstroom due to habitat loss to development and urban expansion. If it is a distinct species, it is possibly in danger of extinction, although more recent field data is needed to confirm this. If it is merely a form of the widespread and common *A. davyana*, it is not likely to be threatened (Mtshali & von Staden, 2020). As noted by some authors, it is difficult to distinguish from the widespread and common *A. davyana*, and possibly does not warrant recognition as a distinct taxon (Van Wyk and Smith 2014).

Provincially Protected Species

In addition to the above species, provincially protected species under Schedule 11 of the Mpumalanga Conservation Act (Act 10 of 1998) and Act 5 of 2005 (Mpumalanga Tourism and Parks Agency Act).

Provincially protected species under schedule 11 of the Act observed on site include:

- all species of aloes (Aloe spp.), excluding: (a) all species not occurring in Mpumalanga.
- all species of pineapple flower (Eucomis spp.).
- Boophone disticha.
- all species of gladioli (Gladiolus spp.).
- all species of watsonia (Watsonia spp.).
- all species of orchids / all species of the family Orchidacaea.

9.7.5 Site Ecological Importance (SEI)

The results of the SEI are indicated in the Tables below for each habitat. While most of the features that will be included in the conservation importance (CI) will be provided by the screening tool, it is important to note that CI is evaluated at a much finer spatial scale and based on fieldwork data collection and comprehensive desktop analyses performed by the specialist during the Environmental Authorisation (EA) process.

Table 14: Determination of Site Ecological Importance (SEI)

Habitat	CI	FI	BI= CI + FI	RR	SEI= BI + RR
Watercourse	High	High	High	Very Low	Very High
Primary Grassland	High	High	High	Low	Very High
Rocky Grassland	High	Medium	Medium	Low	High
Disturbed Grassland	High	Medium	Medium	Medium	Medium

It is very important to note that SEI is specific to the proposed development activities and cannot be meaningfully compared between different proposed projects with different associated activities on the same spatial location.

Summary of the SEI:

- The Watercourse and Primary Grassland are considered to have Very High sensitivity regarding Terrestrial Biodiversity and Plant SCC. No destructive development activities should be considered. Avoidance mitigation wherever possible. changes to project infrastructure design to limit the amount of habitat impacted. Limited development activities of low impact acceptable.
- The Rocky Grassland overall is considered to have High sensitivity regarding Terrestrial Biodiversity and Plant SCC; however, this is not applicable for the entire habitat as micro-habitats exist which present favourable habitat for specialist plants to thrive in. Accordingly, only the habitat-specific sites have been included as highly sensitive habitat, and the remaining extent is considered medium sensitivity from a Plant SCC perspective. Avoidance mitigation wherever possible. changes to project infrastructure design to limit the amount of habitat impacted. Limited development activities of low impact acceptable.
- The Disturbed Grassland is considered to have Medium sensitivity regarding Terrestrial Biodiversity and Plant SCC. Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.

9.7.6 Sensitivity Map

A sensitivity map was generated for the study area, where low sensitivity is considered ideal for development and highly sensitive areas must be avoided (no-go areas). The sensitivity map is indicated in **Figure 28** below. The sensitivity map is based on the CBA verification, threatened ecosystem, primary vegetation, sensitive features including SCC and their respective buffers.

The following sensitivity levels are applicable for the terrestrial biodiversity features:

- Very High sensitivity features include (no-go areas):
    - Primary Grassland and Watercourse habitats
    - Khadia *carolinensis* with 200m buffer.

- High sensitivity features include: The Primary Grassland, Rocky Grassland and Watercourse habitats.
- Medium sensitive areas: Disturbed Grassland.
- Low sensitivity: Transformed areas.

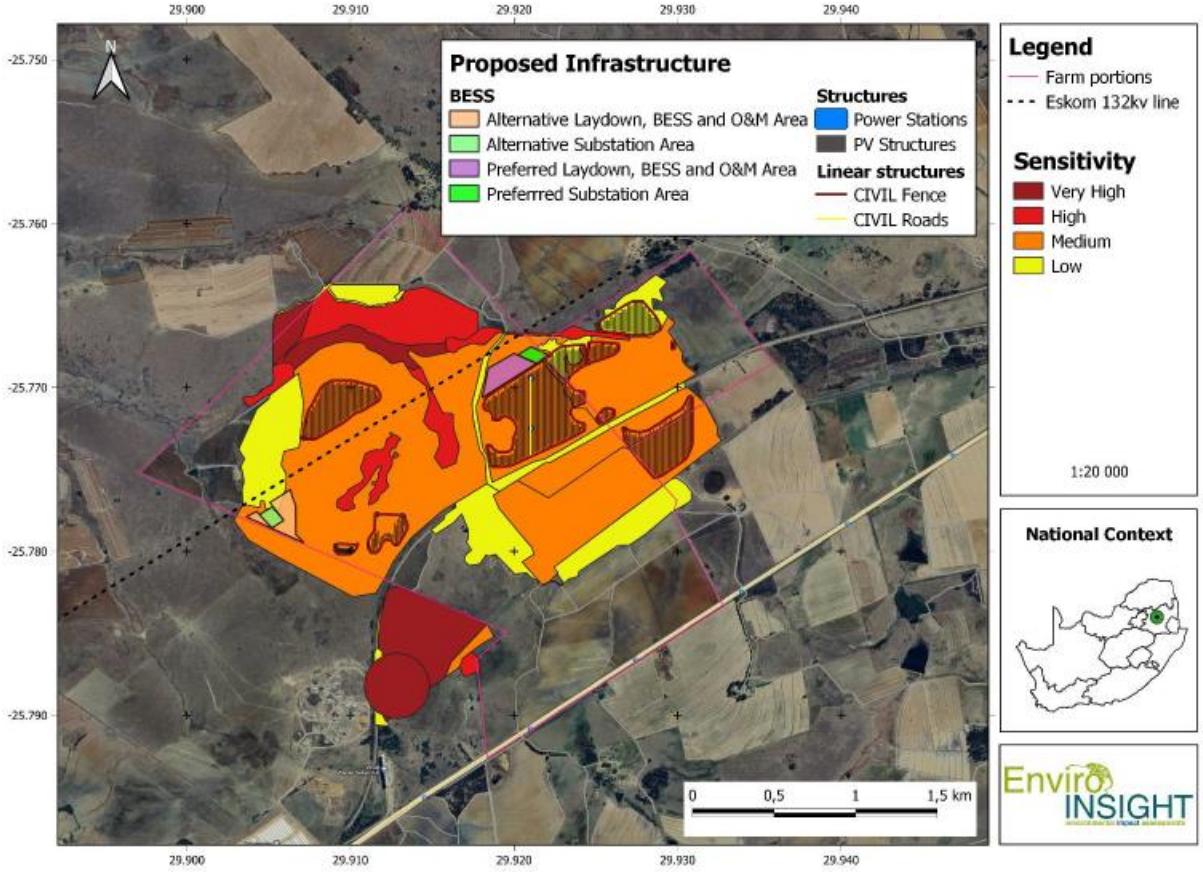

Figure 28: Sensitivity map based on SEI Calculations.

9.8 Avifauna

An Avifaunal Assessment was undertaken by Enviro-Insight (June 2023).

9.8.1 Description of major bird habitat

The primary avifaunal habitats are described in tabular formats below with accompanying representative photographs. It must be noted that the habitats have been delineated (**Figure 29** and **Figure 30**) in accordance with the ecology of the prevailing avifaunal assemblages which may merge botanically divergent habitats and subsequently converted to sensitivity mapping. In situ habitat delineation can be viewed in the accompanying terrestrial ecology report while the designated avifaunal habitat sizes are shown as **Table 15**.The sensitivity of these habitat types was evaluated according to "avifaunal value" which relates to species diversity, endemism and the presence of topographical features or primary habitat units with the intrinsic ability to sustain certain avifaunal assemblages (with specific reference to SCC), their food supply and breeding habits, with specific relation to solar energy infrastructure and activities. It is apparent throughout the PA that most of the habitats are capable of

supporting a wide range of general avifaunal species and Red-Listed / SCC although some habitats are more generic in nature and therefore the presence/ absence of SCC is less easily predicted. Due to the high diversity and density of the below-mentioned SCC recorded during the survey, (including regionally and globally listed Endangered and Vulnerable birds), the PAOI as a whole is an area of avifaunal importance, and the impact assessment that follows prioritises avoidance mitigation and the monitoring of avifaunal SCC.

Table 15: Avifaunal Habitats and Area within the proposed Roos SEF

Habitat	Sensitivity	SEI	Area (ha)	Proportion	Percentage
Wetland	High	Very High	12.81	0.06	5.80
Disturbed habitat	Medium	Low	56.04	0.25	25.38
Natural grassland	High	Very High	128.57	0.58	58.22
Cropland	Medium	Low	13.76	0.06	6.23
Alien trees	Low	Very Low	9.56	0.04	4.33
Dam	High	Medium	0.08	0.00	0.04

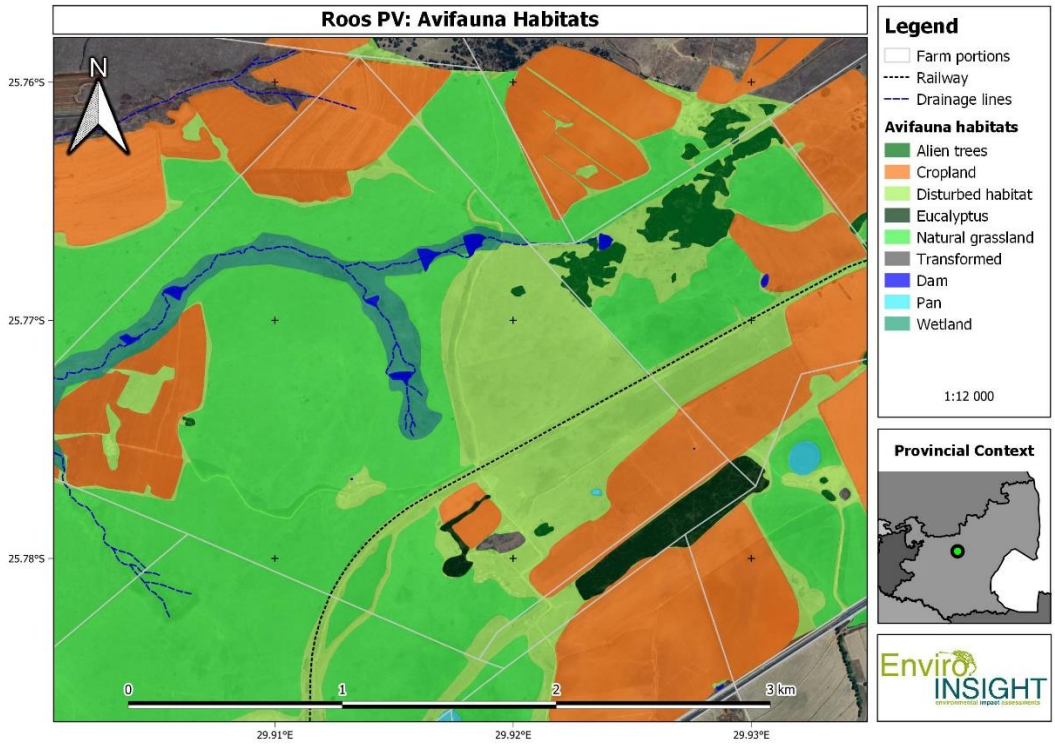

Figure 29: Avifaunal habitats for Roos SEF

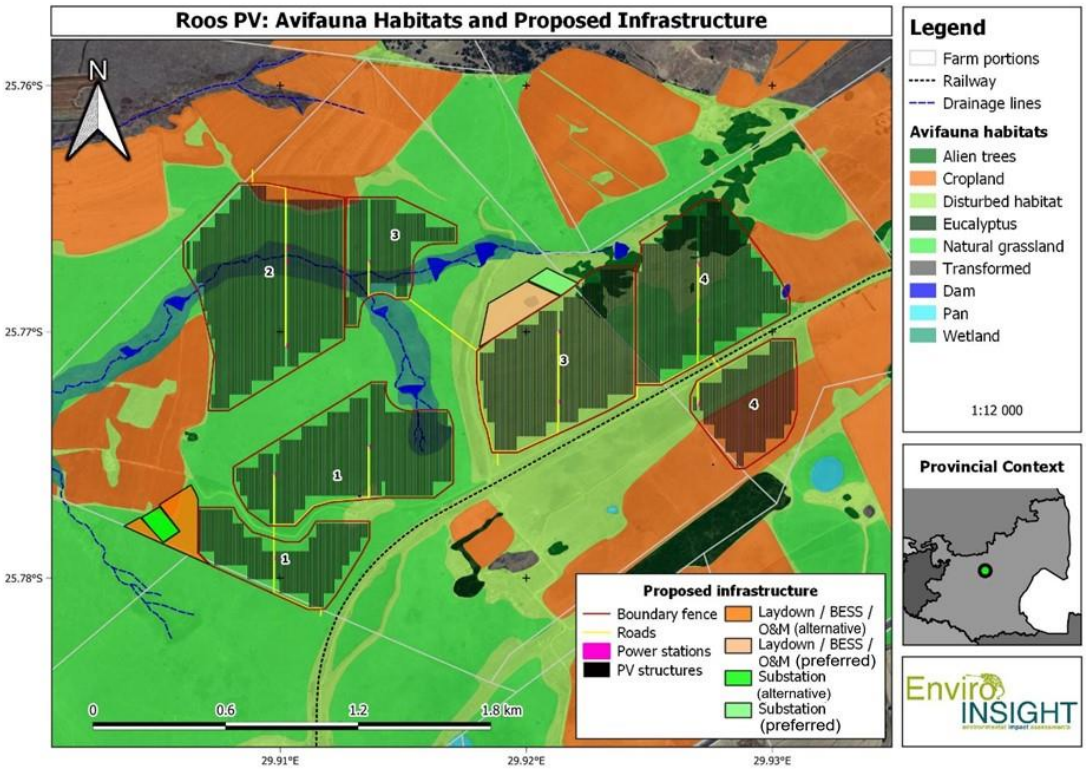

Figure 30: Avifaunal habitats for the Roos SEF with Infrastructure Overlay

Aquatic features

Avifaunal assemblages differed depending on the classification of the impoundments and drainage line systems as well as the season. Most of the drainage line systems are seasonally ephemeral or permanent while the impoundments are mostly permanently inundated. Thus, most of the bird associations are linked to the prevailing vegetation and soil types within the delineated drainage line habitats or standing water. In summary, drainage lines with vegetative layers showed a much higher diversity of avifauna. SCC such as Cranes and Marsh Harriers can occur in varying but potentially great densities depending on the prevailing ecological conditions.

The seasonal drainage lines and accompanying riparian shrubs act as linear dispersal corridors for terrestrial bird species. Much greater species diversity (as well as a unique composition) was observed in this habitat and therefore, these systems are classified to be of high avifaunal importance. The drainage lines, especially in association with ridges act as important flight corridors for cranes, passerines and raptors between foraging and roosting sites.

Figure 31: Ephemeral and endorheic drainage lines and impoundments

Natural Grassland

These habitats exhibit high population density of reptiles, small mammals and ground birds, hares and korhaans which provide a sound prey base for larger at-risk priority bird species. Within the PAOI as well as the regional linkage to the drainage line habitats. Natural grassland habitats provide structural complexity allowing for a higher species diversity and often show higher densities of avifauna due to the aforementioned abundance of specific prey species that are found within.

The natural grassland habitats show an increased structural complexity and vegetation which provides for a more specific species diversity albeit often at high densities of individuals.

Figure 32: Natural grassland

Alien Vegetation: Wattles and Eucalyptus Groves

The localised low population densities of small mammals such as rodents and hares within the habitat and poor understory vegetation, reduces the overall ecological importance of this habitat for avifauna. The habitats provide structural complexity which often showed lower diversity and densities of avifauna due to the lack of abundance of prey species that are found in this habitat.

Figure 33: Alien Trees

Agricultural Activities: Cropland and Distributed Grassland

The localised high population densities of small mammals such as rodents, within the habitat type as well as the local linkage to the grassland habitats, elevates the overall ecological importance of this habitat for avifauna. The crop provide structural complexity which often shows lower diversity but high densities of avifauna due to the abundance of forage and prey species that are found in this habitat.



Figure 34: Alien Trees

Powerline and Railway Infrastructure

The Powerlines have proven to be important habitat for large raptors, especially Martial Eagle and Snake Eagles, which nest frequently on the powerline pylon infrastructure and utilise the pylons to launch hunts from.


Figure 35: Powerline and railway infrastructure

Rocky Hillsides

The Rocky Hillsides have proven to be important habitat for large raptors, especially Martial Eagle and White-backed Vultures, which hunt frequently within the habitat.

Figure 36: Rocky Hillsides

9.8.2 Critical Biodiversity Areas (CBA)

A map of the study area in relation to the 2014 Mpumalanga CBA's is presented in **Figure 37** indicating that the study area is located primarily in CBA Optimal, Other Natural Areas, Heavily Modified, and a small section in CBA Irreplaceable and Moderately Modified. Areas of high biodiversity value including CBA Irreplaceable and Optimal should be avoided as far as possible concerning transformation of land cover.

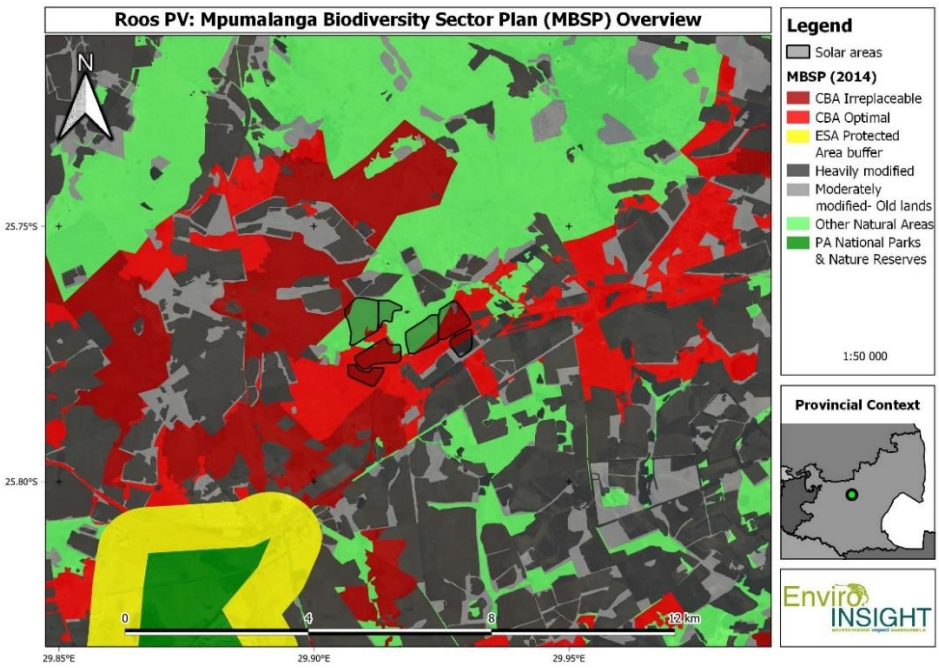

Figure 37: The proposed Roos SEF Cluster in relation to the Mpumalanga Critical Biodiversity Areas (2014)

9.8.3 Protected areas and Important Bird areas

The proposed Roos SEF is not located in an Important Bird Area (IBA) or protected area but borders the expansive Steenkampsberg IBA. There are many protected areas located within 30 km of the Roos project areas, including the Cecilia Private Nature Reserve, Nooitgedacht Dam Nature Reserve, Greater Lakenvlei Protected Environment, Middelpunt Nature Reserve, Langkloof Private Nature Reserve, Ermelo Private Nature Reserve, and Nederwelt Private Nature Reserve.

9.8.4 Expected and Observed Fauna

The PA supports a medium to high diversity and abundance of avifauna, which is to be expected in an arid area with a high habitat diversity such as the Mpumalanga Highveld Grassland region. A total of 81 species were observed during the surveys. This medium to high diversity is predominantly due to a number of factors including:

- High regional aridity which shows a high temporal variability (turnover) in species diversity between seasons;
- Diverse habitat types (with some highly sensitive habitat such as drainage lines and temporary pans within the PAOI);
- Climate change which is characterised by lower rainfall and increased temperatures but with stochastic high rainfall events (La Niña) as occurred during 2022;
- Powerline infrastructure bisecting the PA (raptor nesting habitat).

9.8.5 Sensitivity

Delineated habitats and other important features for avifauna (e.g., powerline infrastructure) were evaluated in relation to the risk to priority species occurring in these habitats/features from the placement of SEF infrastructure. There is a presence of a number (mainly four) SCC and fifteen priority species in the PA (examples including Martial Eagle, Verreaux's Eagle, Secretarybird and Southern Bald Ibis), recorded and occurring relatively widespread through the proposed SEF area. In addition, there are several raptors utilising the PAOI, some of them priority species and/or of conservation concern, such as the Long-crested Eagle, Brown Snake Eagle, Black-chested Snake Eagle, Jackal Buzzard, African Harrier Hawk, Pale-chanting Goshawk and Black-winged Kite.

The placement of infrastructure on primary grasslands/ grassland ridges and near impoundments/ drainage lines, which are vital to maintaining populations of habitat obligate sensitive species would result usually in a high probability of displacement for such SCC. However, these species are fairly ubiquitous in the region with the exception of primary grassland species which is an extremely threatened biome within South Africa. Consequently, avoidance mitigation is required for such habitats when siting panels. A 50 m buffer was applied around these habitat features and must be considered NO-GO where no panels and associated infrastructure may be located. A 200 m buffer was also applied around seasonally inundated watercourses in the PAOI, as these features function as flyways and attract birds under certain conditions and could be the only locations were certain sensitive species such as ducks, herons, storks and water birds are likely to occur. The sensitivity analysis is representative of unmitigated infrastructure placement and buffered high sensitivity areas must be, where possible, avoided by the developer where no panels and associated infrastructure should be located (**Figure 38**).

Several of the proposed panel positions and associated infrastructure coincide with areas currently demarcated as High (not No Go) and Medium sensitive features and consequently were subjected to the mitigation hierarchy. The layout was carefully re-evaluated in order to firstly avoid and secondly minimise negative interaction between SEF infrastructure and priority species. Finally, the presence of the Distribution line is a highly significant attractant for SCC and other priority species, with particular concern for the Martial Eagles which may establish nests within the powerline infrastructure. The presence of this species warrants detailed discussion below.

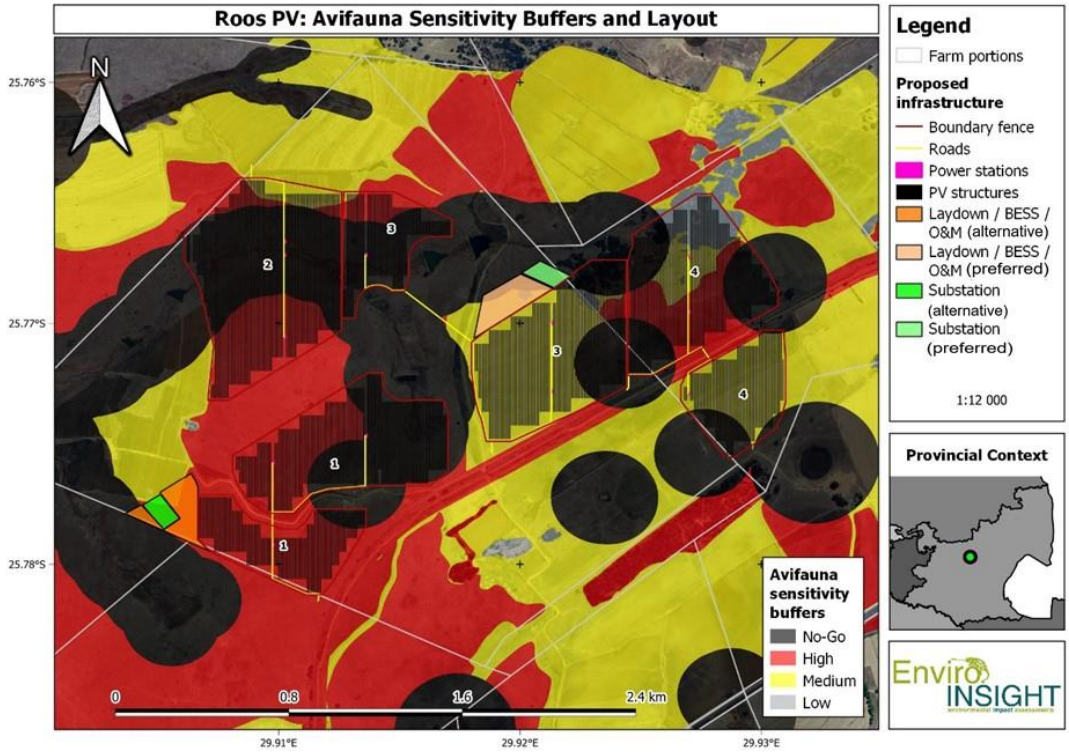

Figure 38: Avifauna Sensitivity Buffers with preferred solar infrastructure placement for the proposed Roos SEF.

9.8.6 Conclusion

The PA is located in a region dominated by natural grassland, drainage lines, disturbed grassland, cropland and stands of alien invasive trees. Several drainage lines and small farm dams can be found scattered across the PA with most being mostly permanent with some seasonal flow/ inundation. The powerline infrastructure that traverses the PAOI is a significant habitat for Martial Eagles and other raptors.

Fifteen (15) priority species were predicted during the initial surveys, including Secretarybirds, Martial Eagles, Black-chested Snake Eagle, Southern Bald Ibis and White Storks Of these, the Secretarybirds and Martial Eagle were the most concerning large bird species. At the commencement of the survey, the PAOI was characterised by an extreme rainfall event (wet season) may have atypically transformed the PAOI where it is possible that increased densities (and perhaps diversity) of avifaunal assemblages may have been recorded due to an abundance of high forage value habitat. However, although the density and diversity of Priority Species was high, most of these species were common and widespread and largely synanthropic (water and natural grassland associates excluded) and the density and

diversity of SCC was very low. Delineated habitats and other important features for avifauna (e.g., powerline infrastructure) were evaluated in relation.

9.9 Cultural/Historical Environment

A Heritage Impact Assessment was undertaken by CTS Heritage (report dated May 2023).

9.9.1 Baseline Assessment

Cultural Landscape

According to the report, the site layered cultural landscape that is present in this area. Furthermore, it is evident from the known heritage resources located in proximity to the development area that the known heritage resources are dominated by burial grounds and graves, structures and stone walling. Due to the scale of the proposed development, and the potential for cumulative impact, it is likely to change the sense of place associated with this landscape, and may impact the way that this historic landscape reads by obscuring layers of the past. Cognisance must be taken of this unique cultural landscape, consisting of farm werfs etc in the proposed layout. Based on the desktop assessment, this area has moderate sensitivity for impacts to the cultural landscape. In order to mitigate this impact, it is recommended that a 500m no development be implemented around the N4 route between Middelburg and Belfast. This recommendation is based on best-practice precedent for PV development.

Archaeology

While no known sites have been formally recorded within or near the development area, aerial imagery has enabled us to identify a number of features that are very likely to be associated with Late Iron Age occupation of the area. As the development area has not previously been assessed, these features require ground-truthing however, based on the available information it is very likely that the proposed development will impact negatively on archaeological resources associated with the Late Iron Age and also likely burial grounds and graves as well as stone age archaeological resources. Areas of high archaeological sensitivity based on a survey of aerial imagery as well as the topographic map for the area have been mapped in the desktop heritage screening assessment. This area was further investigated in the field assessment completed.

Palaeontology

According to the SAHRIS Palaeosensitivity Map, the area proposed for the development of the Roos PV Facility is predominantly underlain by sediments of zero palaeontological sensitivity however some of the southern sections may impact on sediments which have very high palaeontological sensitivity (**Figure 39**). According to the extract from the Council of Science Map for Pretoria 2528 the geology underlying this development area is ascribed to the Dullstroom Formation (Zero sensitivity) and the Vryheid Formation (Very High sensitivity).

Figure 39: SAHRIS palaeosensitivity map for the site for the proposed development area shown within the lilac polygon. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

9.9.2 Heritage fieldwork findings and heritage sensitivities

As noted in the desktop assessment, the broader area surrounding this proposed for this development is known for a variety of kinds of heritage resources including Stone Age and Iron Age archaeology, significant structures and living heritage sites such as significant baobab trees as well as burial grounds and graves. The survey results confirm these findings. The survey proceeded with limited constraints and limitations, and the project area was comprehensively surveyed for heritage resources.

9.9.3 Preliminary Conclusions

The Iron Age remains identified in the field assessment likely reflect a much more extensive past settlement and as such, CTS Heritage has mapped out the areas of high archaeological sensitivity associated with this. These areas are reflected in RED in the maps above and must be considered strict no-development areas as the likelihood of impacting significant archaeological heritage in these areas is very high.

9.10 Visual

A Visual Impact Assessment was undertaken by Visual Resource Management Africa CC (July 2023).

Landscape character is defined as the distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. Regional and local topography has the potential to strongly influence landscape character, as well as the extent of the Zone of Visual Influence. In order to better understand these aspects of the study, a Digital Elevation Model was generated making use of the NASA STRM digital elevation model.

9.10.1 Zone of Visual Influence

The visible extent, or viewshed, is "the outer boundary defining a view catchment area, usually along crests and ridgelines" (Oberholzer, 2005). In order to define the extent of the possible influence of the proposed project, a viewshed analysis was undertaken from the proposed site at a specified height above ground level as indicated in the table below. This is to define the theoretical extent where the proposed landscape change could be visible from. This theoretical viewshed excludes vegetation, structural development as well as distance from the location where atmospheric influence would reduce visual clarity over increasing distance. The viewshed analysis makes use of open-source NASA ASTER Digital Elevation Model data (NASA, 2009).

The extent of the viewshed analysis was restricted to a defined distance that represents the approximate zone of visual influence (ZVI) of the proposed activities, which takes the scale, and size of the proposed projects into consideration in relation to the natural visual absorption capacity of the receiving environment. The maps are informative only as visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature (Hull & Bishop, 1988). Based on the theoretical viewshed and the site visit appraisal of the nature of the landscape, an assessment of the Zone of Visual Influence (ZVI) is made. The ZVI is the area where the proposed landscape change is most likely to be noticed by the casual observer, taking the site visit into account where vegetation, existing development and distance is taken into consideration. This is a subjective appraisal but informed by the viewshed and the other factors mentioned.

Viewshed Analysis

A viewshed analysis was undertaken for the site making use of an Offset value representing the height of the proposed development was used to represent the approximate height of the proposed development as reflected in the table below. The viewshed was also capped at a defined extent to take atmospheric influences into consideration where the landscape change would not be clearly visible from. The height of 4m above ground level was chosen for the OV Offset above ground, with 1.5m being used to represent the height of the receptors (target). The viewshed extent was capped at 24km.

Table 16: Proposed Project Heights

Proposed Activity	Height (m)	Model Extent	Motivation
PV Structures	5m	24km	The undulation of the surrounding terrain in conjunction with atmospheric influences, is likely to contain the ZVI to the 24km distance at the outer extent.
LILO and Substation	30m	12km	Due to the small size of the structure and limited length of the LILO, the extent of the viewshed is highly unlikely to exceed 12km.

The PV viewshed is mapped and can be viewed in **Figure 40** and on the next page, with the LILO/ Substation viewshed mapped in **Figure 41**. This depicts the theoretical area where the proposed landscape change could be visible. This theoretical viewshed excludes vegetation, structural development as well as distance from the location where atmospheric influence would reduce visual clarity over increasing distance. As a result of the similar topographic location of the PV Sites, a combined viewshed was generated. This is also to reflect the cumulative effect of the four PV sites viewed together. Individual viewsheds for the Preferred and Alternative LILO/ Substation locations were generated to reflect the different topographic location of these landscape changes.

The extent of the PV viewshed is defined as partially topographically contained, with limited views to the north, east and south, but extending up to the 24km distance in the northwest. While some limited extent views of the PV area would extend to the southwest around the town of Wonderfontein, but they would become topographically fragmented after the three-kilometre distance. Of relevance to the viewshed, is the location of the bulk of the PV areas in a small valley that would effectively limit clear views of the PV structures from receptors not having views into the valley. As such, there are no eastern receptors, even though some farmsteads are located in close proximity. Receptors included in the viewshed are listed as:

- Agri-Village.
- Wonderfontein Town.
- Western Rural Farmsteads.

The extent of the two LILO/ Substation landscape change depicts a similar spatial configuration as the PV due to the predominantly valley topography, but with less extent due to the smaller size and scale of the LILO/ Substation areas. The Preferred LILO/ Substation Option has a slightly larger viewshed as this locality is slightly less valley contained, with the Alternative LILO/ Substation Option located more in the valley, channelling the viewshed more directly west. As a result of the topographic variance, there is less visual exposure to receptors who are located more to the southwest along the N4 Highway. The Preferred LILO/ Substation Option receptors include:

- Agri-Village.
- Wonderfontein Town.
- Western Rural Farmsteads.

The Alternative LILO/ Substation Option receptors include:

- Western Rural Farmsteads.

The Zone of Visual Influence (ZVI) is the area where the proposed landscape change is most likely to be noticed by the casual observer, taking the site visit into account where vegetation, existing development and distance is taken into consideration. This is a subjective appraisal but informed by the viewshed and the other factors mentioned.

With regards to the proposed PV development (combined views), the expected ZVI is likely to be contained to the Local Region influence and contained to the 6km to 12km distance zone. This is due to relatively higher elevation of the sites with regards to the lower lying lands to the west, but also depicting relatively constrained views to the north, east and south due to topographic screening.

While there is some close proximity variance between the two LILO/ Substations viewsheds, the overall extents are similar and are described as both having a Local Area influence and contained to the 6km distance range.

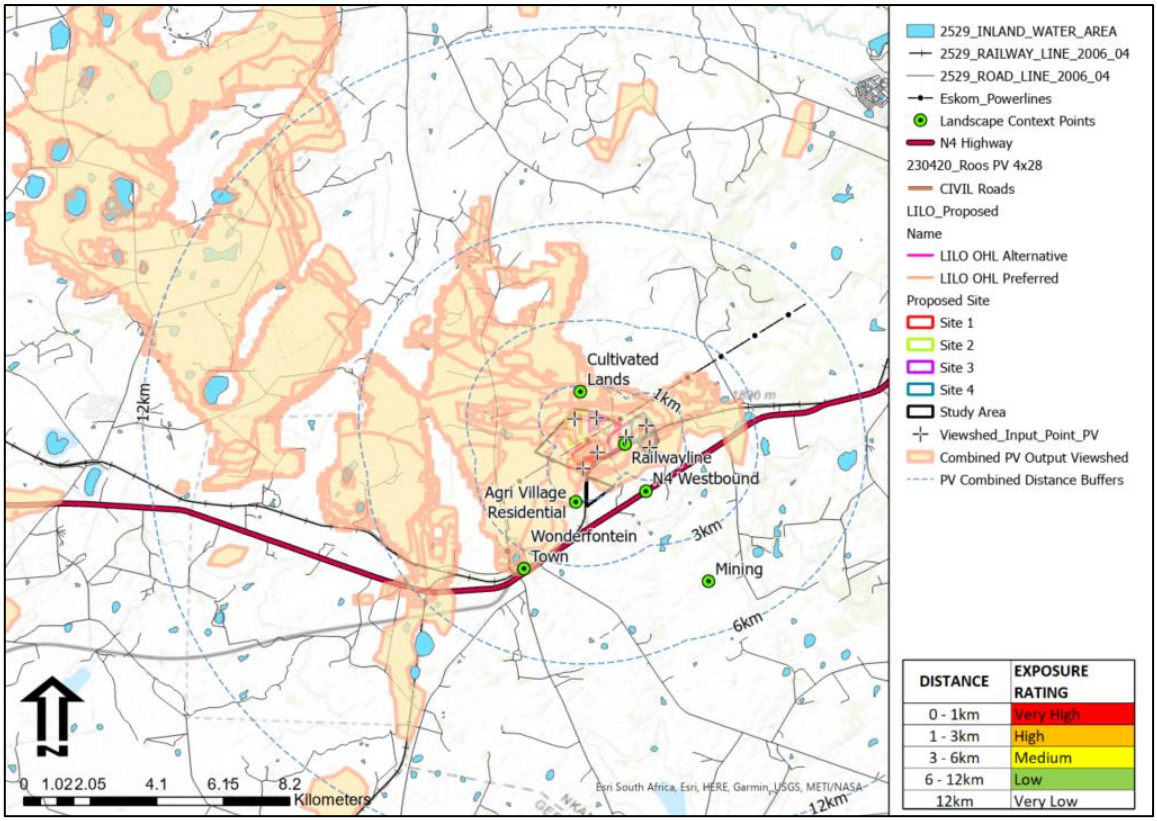

Figure 40: Viewshed analysis map of the combined proposed PV project for cumulative view effects.

9.10.2 Receptors and Key Observation Points

KOPs are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. The following table identifies the receptors identified within the ZVI, as well as motivates if they have significance and should be defined as KOP. The receptors located within the ZVI, and KOPs view lines are indicated on the map on the following page. As motivated and mapped in **Table 17** below and mapped on the previous page, the following receptors have been identified as Key Observation Points and should be used as locations to assess the suitability of the landscape change.

Table 17: KOP Motivation

Name	Theme	Exposure	Motivation
PV Development			
Agri village	Agri-village	Very High	A small Agri-village is located in close proximity to the southwestern portion of the development with partial views of the PV landscape change.
Eastern Rural and	Rural residential	Medium	The eastern area in the midground to background distance, comprises of cultivated farming areas where the

Name	Theme	Exposure	Motivation
Wonderfontein Town			remaining rural sense is likely to have value.
Alternative LILO/ Substation Development			
Agri village	Agri-village	Very High	A small Agri-village is located in close proximity to the southwestern portion of the development with partial views of the PV landscape change.
Eastern Rural	Rural residential	Medium	The eastern area in the midground to background distance, comprises of cultivated farming areas were the remaining rural sense is likely to have value.
Preferred LILO/ Substation Development			
Eastern Rural	Rural residential	Medium	The eastern area in the midground to background distance, comprises of cultivated farming areas were the remaining rural sense is likely to have value.

Due to the close proximity of the receptors to the proposed **PV landscape change, the Visual Exposure of both the PV and LILO/ Substation projects is rated High.**

9.10.3 Visual Resource Management Classes

The BLM has defined four Classes that represent the relative value of the visual resources of an area and are defined in terms of the VRM Matrix as follows:

- Classes I and II are the most valued.
- Class III represent a moderate value.
- Class IV is of least value.

The various classes are represented graphically in the figure below.

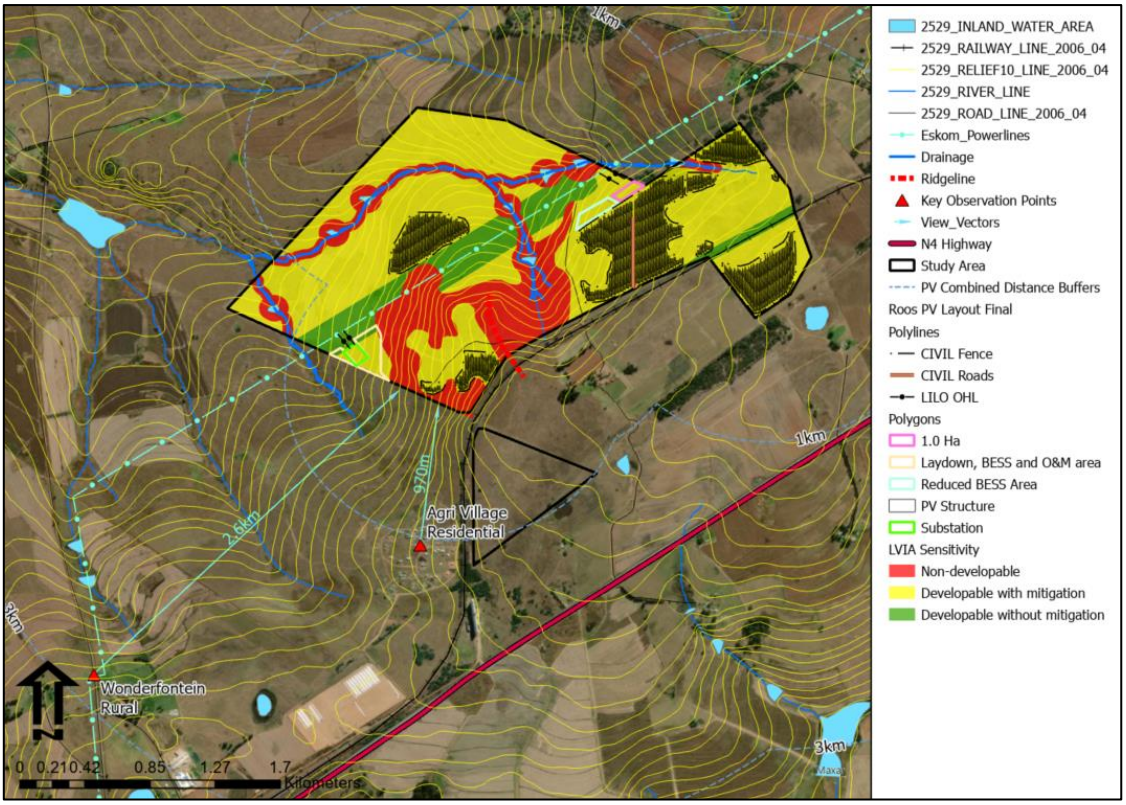

Figure 41: Visual Resource Management Classes and Key Observation Points map

Based on the above, the visual specialist has recommended that the proposed PV project should be authorised WITH Mitigation. With mitigation, the benefits of the PV related landscape change are likely to outweigh the landscape status quo, where scenic resources are limited.

9.11 Transportation

A Transportation Impact Assessment undertaken by SiVEST SA (Pty) Ltd (July 2023).

Existing Roads

The proposed development can be approached from the east and west directions using the N4 national route and then turning onto either Access Road 1 (AR1) or Access Road 2 (AR2) which lead to the common access point of the proposed facility.

- The N4 is a Class 1 primary distributor maintained by the South African National Roads Agency Limited (SANRAL). The route is the major link between the Gauteng cities of Johannesburg and Pretoria, and the Mpumalanga provincial capital of Mbombela, with several coal power stations and industrial activity along the way. At the time of the site visit, road upgrades were being carried out on the N4 in the vicinity of the development area but the road was comfortably usable by traffic in both directions. Engagements with SANRAL indicate that the road upgrades are scheduled to be completed in November 2024.
- AR1 and AR2 are essentially private farm access roads spaced approximately 1.5 km apart. They are approximately 5 m wide gravel roads that are in good condition; however, the grassed

verges require some maintenance to allow for safe passing of opposing vehicles and safe accommodation of foot traffic.

Site Access

The site can be accessed through Site Access SA1 - an existing access point which underpasses a railway through a culvert opening that is approximately 3 m wide and 3.5 m high. A portion of the proposed facility is bisected by the railway depicted above and hence can be considered to have a northern portion and a southern portion, with a proposed internal road linking these two portions. This proposed road will require a new railway crossing and will hence require the approval of Transnet. To avoid the necessity of a new railway crossing, consideration should be given to two separate and independent accesses to the portions of the site on either side of the railway. The proposed additional access is depicted as SA2.

Pre-development scenario

According to the report, the proposed development is situated in a farming area located along the N2 national route between two major cities, namely Johannesburg in the Gauteng province (± 205 km west) and the Mpumalanga provincial capital city of Mbombela (± 140 km east). The existing traffic conditions along the section of the N4 that passes the project area were established using record traffic data obtained from SANRAL as well as on-site traffic observations.

These traffic conditions are presented in **Table 18** below. It is noted that the depicted traffic data is crude but indicative. Should more accurate traffic data be required, a traffic count undertaken in accordance with TMH14 is recommended.

Table 18: Existing Traffic Conditions

Road	Position	Morning 07:00-08:00			Weekday Midday 09:00-15:00			Afternoon 16:00-17:00		
		LV	HV	**T**	LV	HV	**T**	LV	HV	**T**
N4	Intxn with AR1	709	416	1125	864	576	1440	782	459	1241
N4	Intxn with AR2	709	416	1125	864	576	1440	782	459	1241
AR1	Intxn with the N4	2	0	2	5	2	7	2	0	2
AR2	Intxn with the N4	4	1	5	8	3	11	4	1	5

Intxn: Intersection

Construction phase:

The construction phase will generate the highest number of trips for the proposed facility. Construction will typically involve earthworks, access roads, foundations, trenching, on-site buildings, electrical cables, transformers, switch gears, substations, battery energy storage systems and pylons where overhead electric cables are required. The traffic impact on the surrounding road network will result from the delivery of the associated plant, materials, equipment and abnormal loads, as well as the commuting of construction labour. The nature of the impact will be an increase in intersection traffic

conflicts, an increase in abnormal load and normal load traffic, an increase in pedestrian traffic, and an increased requirement for road maintenance.

Based on calculations and previous experience with solar energy facilities, an 18-month construction period has been estimated and is expected to generate a daily maximum of ±56 additional vehicle trips on the surrounding road network.

Of the total maximum daily vehicle trips, ±18 will be transporting staff and labour and will typically occur in the morning between 07:00 – 08:00 and in the afternoon between 16:00 – 17:00. These trips will therefore coincide with the morning and afternoon peak periods. Given the remote locality of the proposed development, it is anticipated that a fair amount of labour will travel to and from site in group transportation.

The remaining ±38 vehicle trips are expected to occur over the 6-hr period between the morning and afternoon peaks for the delivery of construction plant, material and equipment; and include both normal and abnormal loads. These equate to ±7 vehicle trips / hour.

In terms of TMH 16, developments that generate less than 50 peak hour trips are not required to undertake a detailed Traffic Impact Assessment (TIA). The Roos Solar Energy Facility is estimated to generate ±18 peak hour trips during the construction phase. The resulting traffic impact on the surrounding road network during this phase is therefore seen as nominal.

Operation and Maintenance Phase:

The Roos Solar Energy Facility is assessed at a design horizon of 20 years, which can be increased if financially viable. Based on similar existing facilities, the operation and maintenance of the proposed facility will be undertaken by a staff compliment of approximately 5-8 people. The traffic impact during this phase will result from employees commuting to and from the development, the occasional repair vehicle, and the occasional delivery of replacement components.

The development is estimated to add 5 vehicle trips per hour onto the surrounding road network during the morning and afternoon peaks over the life-span of the facility, while the occasional maintenance-related trips are deemed negligible. The overall traffic impact for this phase is therefore seen as nominal.

Decommissioning Phase:

The decommissioning of the proposed facility and associated infrastructure will generate considerably less trips than the construction phase. It is estimated that the decommissioning phase will generate an additional ±42 vehicles / day over a period of 6 months, ±15 of which will occur during the peak periods and ±27 during the off-peak period. It is assumed that the material removed will be transported Johannesburg for recycling or disposal. The impact of this phase is considered to be low.

9.12 Glint and Glare

A Glint and Glare Assessment was undertaken by SOLINK (June 2023).

Solar PV Array Layout and Orientation

The proposed solar PV facility will comprise a single-axis tracker system which allows for each solar array to track the sun's path for optimal solar production. The system has a north-south axis, where the solar arrays track the east-west direction and has a rotation angle of -60° to +60°. The ground coverage ratio has been specified as 68%. The pitch distance (or row-to-row spacing) for the proposed system is 8 m to mitigate near shading effects which has a significant impact on the solar yield. Due to a considerable space present between each solar PV array, the effects of glare are anticipated to be low.

Observer Point (Receptor) and Route Selection

The glare severity resulting from a solar PV facility is a function of the size of the facility and its proximity to the point of observation. For this assessment, receptor selection was based on the identified points from a viewshed analysis of the solar system's glare projection. A total of 22 observer points ("OP") at varying elevation, as well as 3 route receptors were selected around the site (**Figure 42**) for the simulation, listed below.

1. Afgri Wonderfontein Silo (OP 1 - 2)
2. BKB Grain Storage (OP 3)
3. Residential homes A - west of PV Area 1 (OP 4 - 14)
4. Residential homes B - South-east of PV Area 1 (OP 15 - 16)
5. Cattle Farming (OP 17)
6. National Road - N4 (Route)
7. North-South Main Road (Route)
8. Railway line (Route)
9. Farm housing units (x4) - north of PV Areas 4 and 5 (OP 18 - 22)

Figure 42: Roos Solar PV Farm identified glare receptors

Forgesolar Software Glare Simulations

The glint and glare analysis was conducted using the Solar Glare Hazard Analysis Tool (SGHAT) originally developed by SANDIA National Laboratories and licensed to Forge Solar. The analysis tool makes use of the coordinates and elevation of the solar PV arrays relative to those of the receptors to determine glare origination. The area of the arrays and the sun's position and path are then used in a set of vector calculations to determine the receptors susceptible to glare and the glare impact. The user is required to input details relating to the pitch and orientation of the PV arrays, the solar panel classification and reflectance and the ocular parameters for the simulation.

If glare is found, the simulation determines the retinal irradiance and subtended source angle (size/distance) of the glare which informs on the potential ocular hazards. The results are used to specify when glare will occur throughout the year, with color codes corresponding to the potential severity of the ocular hazard. The simulation models consider combining vertically aligned solar PV arrays (**Figure 43**).

Figure 43: Typical solar PV configuration – combined arrays

In instances where glare is anticipated to result in high intensity levels, a detailed analysis of solar PV arrays is assessed.

Figure 44: Typical solar PV array configuration – single arrays

Using smooth glass solar PV modules without an anti-reflective coating will result in either no glare, or green glare received at the assessed receptors. Green glare will not cause any harmful effect on nearby observers due to its low intensity and is therefore glare with a low potential for temporary after-image. As such, the proposed solar PV facility will not cause any significant, or harmful impact on nearby surroundings from a glint and glare perspective. SOLINK supports the findings of this report, as supplementary to the intended renewable energy project's Environmental Impact Assessment applications.

It must be noted that although the intended solar PV project does not trigger any requirements for an aviation-related glint and glare assessment according to South African Civil Aviation Authority regulations, it would be advisable to contact Air Traffic Navigation Services (ATNS) to confirm in writing that Obstacle Registration with ATNS is not required due to their requirements (for glint and glare assessments, and obstacle registration) not being triggered:

- The solar PV facility is not within 3 km of any aerodrome, airstrip, or helipad.
- The solar PV facility does not lie within the extended 8 km, 9 degree diverted runway viewshed.

9.13 BESS

A MHI Risk Assessment was undertaken by ISHECON (June 2023). The purpose of the report is to provide a high-level safety and health risk assessment of the battery energy storage system (BESS) proposed as part of the Roos PV Facility.

General

This Risk Assessment has found that with suitable preventative and mitigative measures in place, none of the identified potential risks are excessively high, i.e., from a Safety, Health and Environment (SHE) perspective no fatal flaws were found with either type of technology for the proposed BESS installation at the Roos Solar Energy Facility near Belfast, Mpumalanga.

At a large facility, without installation of the state-of-the art battery technology that includes protective features, there can be significant risks to employees and first responders. The latest battery designs include many preventative and mitigative measures to reduce these risks to tolerable levels. (Refer to tables in section 4 under preventative and mitigative measures). State-of-the-art technology should be used, i.e., not old technology that may have been prone to fire and explosion risks.

The design should be subject to a full Hazard and Operability Study (HAZOP) prior to commencement of procurement. A HAZOP is a detailed technical systematic study that looks at the intricacies of the design, the control system, the emergency system etc. and how these may fail under abnormal operating conditions. Additional safeguards may be suggested by the team doing the study.

Lithium Solid State Containerized Batteries

- With lithium solid-state batteries, the most significant hazard with battery units is the possibility of thermal runaway and the generation of toxic and flammable gases. There have been numerous such incidents around the world with batteries at all scales and modern technology providers include many preventative and mitigative features in their designs. This type of event also generates heat which may possibly propagate the thermal runaway event to neighbouring batteries if suitable state of the art technology is not employed.
- The flammable gases generated may ignite leading to a fire which accelerates the runaway process and may spread the fire to other parts of the BESS or other equipment located near-by.
- If the flammable gases accumulate within the container before they ignite, they may eventually ignite with explosive force. This type of event is unusual but has happened with an older technology container installed at McMicken in the USA in 2019.
- Due to a variety of causes, thermal runaway could happen at any point during transport to the facility, during construction or operation / maintenance at the facility or during decommissioning and safe making for disposal.
- Due to the containerized approach as well as the usual good practice of separation between containers, which should be applied on this project, and therefore the likely restriction of events to one container at a time, the main risks are close to the containers i.e., to transport drivers, employees at the facilities and first responders to incidents.
- 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. Based on the current proposed layout, impacts at the closest isolated farmhouses are not expected.
- In terms of a worst conceivable case explosion, the significant impact zone is likely to be limited to within 10m of the container and minor impacts such as debris within 50m. Based on the current proposed layout, impacts at the closest isolated farmhouses are not expected.
- In terms of a worst reasonably conceivable toxic smoke scenario, provided the units are placed suitably far apart to prevent propagation from one unit to another and large external fires are prevented, the amount of material burning should be limited to one container at any one time. In this case, beyond the immediate vicinity of the fire, the concentrations of harmful gases within the smoke should be low. Both the preferred and the alternative BESS installation locations are over 500m from any occupied development / farmhouse and therefore the risks posed by BESS are negligible.

Vanadium Redox Flow Battery Installations

- The most significant hazard with VRF battery units is the possibility of spills of corrosive and environmentally toxic electrolyte. Many preventative and mitigative features will be included in the

design and operation, e.g., full secondary containment, level control on tanks, leak detection on equipment etc. (Refer to tables in section 4 under preventative and mitigative measures).

- VRF batteries do not present significant fire and electrical arcing hazards provided they are correctly designed, operated, maintained and managed. Suitable Battery Management System (BMS), safety procedures, operating instructions, maintenance procedures, trips, alarms and interlocks should be in place.

Technology and Location of BESS Facilities

- From a safety and health point of view, the above Risk Assessment shows that risks posed by VRFB systems may be slightly lower than those of SSL facilities, particularly with respect to fire and explosion risks. From an environmental spill and pollution point of view the VRFB systems present higher short-term risks than the SSL systems. However, the above conclusions may be due to the fact that the VRFB technology is not as mature as SSL technology and therefore there is not as much operating experience and accident information available for the VRFB. Overall, from and SHE RA points of view, there is no specific preference for a type of technology.
- From a SHE risks assessment point of view, where there is a choice of location (not applicable on this project) that is further from public roads, water courses or isolated farmhouses/occupied developments, this would be preferred. VRFB hazards are mostly related to possible loss of containment of electrolyte and SSL batteries to fires producing toxic smoke and fire fighting which may result in contaminated of firewater runoff. One would not want these liquids to enter water courses nor the smoke to pass close to houses / public traffic.
- From a safety and health point of view, there are no significant cumulative impacts from any other BESS installation in the greater area.

10. DESCRIPTION OF THE SOCIO- ECONOMIC ENVIRONMENT

This chapter summarizes the attributes associated with the proposed project study area focusing on the social, economic, heritage and cultural aspects.

10.1 Socio Economic Characteristics

A Socio-economic Impact Assessment was undertaken by Social Risk Research (report dated June 2023).

The proposed development site is in the Emakhazeni Local Municipality in the Nkangala District Municipality of Mpumalanga Province next to the N4 Highway between Gauteng and Mbombela. Emakhazeni is bordered by Mbombela Local Municipality on the east and Steve Tshwete Local Municipality on the west. It is one of the six municipalities that fall within the Nkangala District Municipality. namely Dr JS Moroka Local, Emakhazeni Local, Emalahleni Local, Steve Tshwete Local, Thembisile Hani Local, and Victor Khanye Local.

Emakhazeni comprises of four towns:

- Emakhazeni (Belfast),
- Dullstroom,
- Entokozweni (Machadodorp) and
- Emgwenya (Waterval Boven).

The Emakhazeni Municipality is mainly a rural municipality with scattered rural settlements situated on farms. These settlements usually consist of a homestead, outbuildings, sheds, and farm workers' accommodation. Belfast is renowned for its excellent trout fishing conditions. Sheep and dairy farming take place here, and maize, potatoes and timber are produced. Coal and black granite are mined around Belfast. Dullstroom, also known as Emnothweni, lies 35 kilometres (22 miles) north of Belfast and some 53 kilometres (33 miles) south-west of Lydenburg on the R540 road. Dullstroom is known as a tourism and leisure town and is known for its trout fishing, arts, and crafts.

The proposed development is in Ward One of the Municipality and will be most affected by the direct impacts of the project. Whereas the total population of Emakhazeni is in the order of 54 400 in 2022/3, the population of Ward One was 5 853 in 2011 and they live throughout the ward on farms and in rural settlements. The towns of the municipality fall outside Ward One. Ninety-nine percent (99%) of the population in Ward One is from the Black population group with an even male and female gender split. The population is a young population with a mean age of 23 years and 46% of the people are younger than 19 years of age. About 5% of the population are older than 60 years. The main languages spoken in the Ward are isiZulu, isiNdebele, and SiSwati. Most (90%) of the households live in a house but 6% live in shacks. More than 82% of households receive water from the formal municipal service and 91% have access to flush or chemical toilets. 81% of the households receive formal refuse services.

The community of Ward One is poor, working mainly on the farms and in the mines with an average annual income of R29 400 per household in 2011 and with a high unemployment rate of more than 24%. Most of the formally employed persons work in the agriculture and mining sectors.

Economically Emakhazeni municipality is comparatively strong in the agriculture, mining, and tourism sectors. Farming is the dominant economic activity in the Emakhazeni area occupying the largest part of the physical area. The small towns serve as service centres to the agricultural sector. The most dominant agricultural activities include field crops, horticulture, animal husbandry, forestry, and some fishing. Agriculture generates an inter-regional income and has a high multiplier effect in the local economy. Belfast, Dullstroom, Machadodorp and Waterval-Boven act as service providers to the surrounding rural areas and provide social services as well as farming and household necessities to the farmers and farm workers in the region. Economically the leading sectors in terms of percentage contribution to the economy is mining, trade, and community services. Mining is the biggest contributor in GDP in the municipality.

The following mines operates within 25 km from the site:

- Exxaro Belfast Mine
- Wonderfontein Colliers
- NBC Coal Mine.

The profile of the economy of Emakhazeni shown in the following graphs indicate that the public sector is an important employer in the municipality followed by mining, agriculture, and retail sectors. The municipality has lost employment opportunities from 7 750 in 2014 to 6 500 in 2021. The loss in jobs in the municipality is ascribed to the low national economic growth, the impacts of Covid-19 and the slow decline of the mining and agricultural sectors as employers.

Within the immediate environment within 5 km radius of the site the following area of socio-economic value is identified:

- N4 Highway to the south of the site
- Agri-village to the west of the site

- Individual loose standing farm homesteads to the west, north and east of the site
- Wonderfontein town to the east
- Wonderfontein Service Station
- Wonderfontein Farmers Hall
- Golden Division Suppliers
- Westfert Biominerale Fertilizer supplier
- BKB Grain Storage Wonderfontein Depot
- Afgri Wonderfontein grain silos

11. POLICY AND LEGISLATIVE CONTEXT

The relationship between the project and certain key pieces of environmental legislation is discussed in the subsections to follow.

11.1 The Constitution

The Constitution of the Republic of South Africa, Act 108 of 1996 sets the legal context in which environmental law in South Africa occurs and was formulated. All environmental aspects should be interpreted within the context of the Constitution, National Environmental Management Act 107 of 1998 and the Environment Conservation Act 73 of 1989.

The Constitution has enhanced the status of the environment by virtue of the fact that an environmental right has been established (Section 24) and because other rights created in the Bill of Rights may impact on environmental management through, for example, access to health care, food and water and social security (Section 27). An objective of local government is to provide a safe and healthy environment (Section 152) and public administration must be accountable, transparent and encourage participation (Section 195(1) (e) to (g)).

Section 24 of the Constitution states that:

"Everyone has the right –

- *To an environment that is not harmful to their health or well-being; and*
- To *have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:*
  - *Prevent pollution and ecological degradation;*
  - *Promote conservation and*
  - *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*

The Constitution is the overarching legislation for South Africa. Although it provides for certain rights and obligations, the NEMA has been promulgated in order to manage the various spheres of both the social and natural environment.

11.2 National Environmental Management Act (107 of 1998)

The National Environmental Management Act (Act No. 107 of 1998) was promulgated in 1998 but has since been amended on several occasions from this date.

The act intends to provide for:

a) co-operative environmental governance by establishing principles for decision-making on matters affecting the environment;
b) institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state;
c) to provide for the prohibition, restriction or control of activities which are likely to have a detrimental effect on the environment; and
d) to provide for matters connected therewith.

NEMA is the overarching legislation which governs the BA process and environmental management in South Africa. Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities which may not commence without an EA. Activities that may significantly affect the environment must be considered, investigated and assessed prior to implementation.

According to Section 2(3) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), "development must be socially, environmentally and economically sustainable", which means the integration of these three factors into planning, implementation and decision-making so as to ensure that development serves present and future generations.

The EIA Regulations, 2014 (as amended) identify lists of activities which have the potential to result in detrimental environmental impacts and thus require EA, subject to either "Basic Assessment" or "Scoping and Environmental Impact Assessment". The Regulations prescribe the procedural and substantive requirements for the undertaking of EIAs and the issue of EA's.

The proposed project triggers listed activities under Listing Notice 1, and 3 and thus requires an EA subject to a Basic Assessment (BA) Process. The listed activities are further detailed in Section 7 above.

11.3 Environmental Impact Assessment (EIA) Guideline for Renewable Energy Projects, DFFE Notice 989 of 2015

The purpose of this document is primarily to provide guidance on the environmental management legal framework applicable to renewable energy operations and all the role players in the sector. The guideline is principally intended for use by the following stakeholder groups:

- Public Sector Authorities (as regulator and/or competent authority);
- Joint public sector authorities and project funders (e.g., Eskom, IDC, etc.);
- Private Sector Entities (as project funder / developer / consultant); and
- Other interested and affected parties (as determined by the project location and/or scope).

This guideline seeks to identify activities requiring authorisation prior to commencement of that activity and provide an interface between national EIA Regulations and other legislative requirements of various authorities.

The guidelines are applicable for the construction, installation and/or development of the following renewable energy projects:

- Concentrating Solar Power (CSP) Plant;
- Wind Energy Facility (WEF);

- Hydropower Station; and
- Photovoltaic (PV) Power Plant.

11.4 National Water Act (Act 36 of 1998)

The National Water Act (NWA) No 36 of 1998 was promulgated on the 20th of August 1998. This Act is important in that it provides a framework to protect water resources against over exploitation and to ensure that there is water for socio-economic and economic development, human needs and to meet the needs of the aquatic environment. The Act also recognises that water belongs to the whole nation for the benefit of all people.

Water resources as defined include a watercourse, surface water, estuary or aquifer. Specifically, a watercourse is defined as (inter alia):

- A river or spring;
- A natural channel in which water flows regularly or intermittently; and
- A wetland, lake or dam into which, or from which water flows.

Due to the possible encroachment into the wetland areas, the following Section 21 water uses in terms of the NWA may be triggered and require licensing:

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

In light of the above, there are a number of stipulations within the NWA that are relevant to the potential impacts on rivers, streams and wetlands that may be associated with the proposed development. A Surface Water Impact Assessment (**Appendix 6**) has however been conducted to explore how the proposed development may impact on identified water resources as protected by the Act. Should the proposed development require a General Authorisation (GA) or Water Use Licence (WUL), it will be determined and applied for separately prior to construction.

11.5 The National Heritage Resources Act 1999 (25 of 1999)

The National Heritage Resources Act promotes good management of the heritage resources of South Africa which are deemed to have cultural significance and to enable and encourage communities to ensure that these resources are maintained for future generations.

The aim of the Act is to introduce an integrated, three-tier system for the identification, assessment and management of national heritage resources (operating at a national, provincial and local level). This legislation makes provision for a grading system for the evaluation of heritage resources on three levels which broadly coincide with their national, provincial and local significance.

This Act requires investigation to determine the impact of heritage resources when developments exceed the thresholds list in section 38 (1) of the act:

(a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
(b) the construction of a bridge or similar structure exceeding 50 m in length;
(c) any development or other activity which will change the character of a site—

(i) exceeding 5 000 m^2 in extent; or
(ii) involving three or more existing erven or subdivisions thereof; or
(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or
(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

The proposed development would involve; (a) the construction of a power line exceeding 300m in length, (c) the development of grid connection infrastructure (substation) that will change the character of more than 0.5ha, and (d), the rezoning of a site that will exceed 1ha.

Under the legislation, the South African Heritage Resources Agency (SAHRA) was established, which replaced the National Monuments Council. SAHRA is responsible for the preservation of heritage resources with exceptional qualities of special national significance (Grade I sites). A Provincial Heritage Resources Authority, established in each province, will protect Grade II heritage resources which are significance within the context of a province or region. Buildings and sites of local interest (Grade III sites) are the responsibility of local authorities as part of their planning functions. In this case, the Mpumalanga Heritage Resources Authority (MHRA) will need to be consulted.

Within the scope of this project, Section 38 of the NHRA (25 of 1999), states that, as described above, an assessment of potential heritage resources in the development area needs to be done. An Archaeological Impact Assessment (AIA) and Paleontological Impact Assessment (PIA) has therefore been commissioned to explore how the proposed development may impact on heritage resources and potential cultural artefacts as protected by the Act.

11.6 National Environmental Management: Biodiversity Act (NEM:BA) (Act No. 10 of 2004, as amended)

As the principal national Act regulating biodiversity protection, the National Environmental Management: Biodiversity Act (NEM:BA) (Act No. 10 of 2004), which is administered by the DFFE, is concerned with the management and conservation of biological diversity, as well as the use of indigenous biological resources in a sustainable manner. The term biodiversity, according to the Convention on Biodiversity (CBD), refers to the variability among living organisms from all sources including, inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity in genes, species and ecosystems.

The overarching aim of the NEM:BA, within the framework of the NEMA, is to provide for:

- The management and conservation of biological diversity within South Africa, and of the components of such biological diversity;
- The use of indigenous biological resources in a sustainable manner; and
- The fair and equitable sharing among stakeholders of benefits arising from bio-prospecting involving indigenous biological resources.

In terms of this Act, the developer has a responsibility to:

- Conserve endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations);
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity; and
- Limit further loss of biodiversity and conserve endangered ecosystems.

The South African National Biodiversity Institute (SANBI) was established in terms of the NEM:BA, its purpose being (inter alia) to report on the status of the country's biodiversity and the conservation status of all listed threatened or protected species and ecosystems.

The NEM:BA provides for a range of measures to protect ecosystems and for the protection of species that are threatened or in need of protection to ensure their survival in the wild, including a prohibition on carrying out a 'restricted activity' involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7 of the Act. According to Section 57 of the Act, 'Restricted activities involving listed threatened or protected species':

A Terrestrial Biodiversity Assessment (**Appendix 6**) has been conducted to explore how the proposed development may impact on biodiversity as protected by the Act.

In addition, all relevant conservation departments (such as the SANBI and Mpumalanga Tourism and Parks Agency) will be invited to provide comments with regards to the proposed development.

11.7 National Environmental Management: Protected Areas Act, 2003 (Act No.57 of 2003 as amended)

The overarching aim of the National Environmental Management: Protected Areas Act (NEMPAA) No. 57 of 2003, within the framework of NEMA, is to provide for:

- the declaration and management of protected areas;
- co-operative governance in the declaration and management of protected areas;
- effect a national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity;
- a representative network of protected areas on state land, private land and communal land;
- promote sustainable utilisation of protected areas for the benefit of people, in a manner that would preserve the ecological character of such areas;
- promote participation of local communities in the management of protected areas, where appropriate; and
- the continued existence of South African National Parks.

The proposed project is not located in close proximity to any protected areas.

11.8 National Forests Act (NFA) (Act No. 84 of 1998)

The National Forest Act (NFA) (Act No. 24 of 1998) was enacted to:

- Provide for the protection, management and utilisation of forests;

- The protection of certain plant and animal life;
- The regulation of trade in forest produce; and
- The control and management of a national hiking way system and National Botanic Gardens.

The NFA enforces the necessity for a license to be obtained prior to destroying any indigenous tree in a natural forest and, subject to certain exemptions, cutting, disturbing, damaging, destroying or removing any protected tree. The list of protected trees is currently contained in GN 908 of 21 November 2014. Licenses are issued by the Minister and are subject to periods and conditions as may be stipulated.

Protected trees

According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.

Forests

Prohibits the destruction of indigenous trees in any natural forest without a licence.

The NFA is relevant to the proposed development as the removal and/or disturbance and/or clearance of indigenous vegetation will be required and a license in terms of the NFA may be required for this to be done.

A Terrestrial Biodiversity Assessment (**Appendix 6**) has been conducted to explore how the proposed development may impact on vegetation as protected by the Act.

In addition, all relevant conservation departments (such as the SANBI and MTPA) will be invited to provide comments with regards to the proposed development.

11.9 National Veld and Forest Fire Act (Act No. 101 of 1998)

Provides requirements for veldfire prevention through firebreaks and required measures for firefighting. Chapter 4 of the Act places a duty on landowners to prepare and maintain firebreaks. Chapter 5 of the Act places a duty on all landowners to acquire equipment and have available personnel to fight fires.

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

The Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 1983) controls the utilisation of natural agricultural resources in South Africa. The Act promotes the conservation of soil, water sources and vegetation as well as the combating weeds and invader plants. The Act requires the protection of land against soil erosion and the prevention of water logging and salinization of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and watercourses are also addressed.

The primary objective of the Act is to conserve natural agricultural resources by:

- maintaining the production potential of land;
- combating and preventing erosion and weakening or destruction of the water resources;
- protecting vegetation; and

- combating weeds and invaders plants.

In terms of this Act, no degradation of natural land is permitted. Rehabilitation after disturbance to agricultural land is also managed by this Act. The CARA is relevant to the proposed development as the construction of a solar PV plant as well as other components (such as the on-site switching substation and permanent guard house) may impact on agricultural resources and vegetation on the site. The Act prohibits the spreading of weeds and prescribes control measures that need to be complied with in order to achieve this. As such, measures will need to be taken to protect agricultural resources and prevent weeds and exotic plants from invading the site as a result of the proposed development.

Declared Weeds and Invaders in South Africa are categorised according to one (1) of the following categories:

- Category 1 plants: are prohibited and must be controlled.
- Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.
- Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.

An Agricultural and Soils Site Verification **(Appendix 6)** has been conducted to explore how the proposed development may impact on the agricultural production potential of the proposed site. According to this assessment, the potential impact on the loss of agricultural land will be of medium to low for the majority of the project area. The area to the west does however have areas that are currently being utilised for agriculture and therefore these areas dispute the DFFE rating of medium to low. Therefore, the project area does have potential to be of high sensitivity in these areas. The assessment would require an Agro-ecosystem impact assessment.

11.11 National Road Traffic Act (NRTA) (Act No. 93 of 1996, as amended)

The National Road Traffic Act (NRTA) (Act No. 93 of 1996, as amended) provides for all road traffic matters and is applied uniformly throughout South Africa. The Act enforces the necessity of registering and licensing motor vehicles. It also stipulates requirements regarding fitness of drivers and vehicles as well as making provision for the transportation of dangerous goods.

All the requirements stipulated in the NRTA will need to be complied with during the construction and operational phases of the proposed development.

11.12 Civil Aviation Act (CAA) (Act No. 13 of 2009)

The Civil Aviation Act (CAA) (Act No. 13 of 2009) controls and regulates aviation within South Africa. It provides for the establishment of a South African Civil Aviation Authority (SACAA) and independent Aviation Safety Investigation Board in compliance with Annexure 13 of the Chicago Convention. It gives effect to various conventions related to aircraft offences, civil aviation safety and security, and provides for additional measures directed at more effective control of the safety and security of aircrafts, airports and matters connected thereto.

Although the Act is not directly relevant to the proposed development, it should be considered as the establishment of electricity distribution infrastructure (such as a substation and power lines) may impact on aviation and air traffic safety, if located directly within aircraft flight paths.

The Air Traffic and Navigation Services Company Limited (ATNS) and the SACAA will be consulted throughout the BA process and the required approvals will be obtained, where necessary. It is not however anticipated that any approvals will be required.

11.13 Astronomy Geographic Advantage Act (Act No. 21 of 2007)

The Astronomy Geographic Advantage Act (Act No. 21 of 2007) provides for:

- The preservation and protection of areas that are uniquely suited for optical and radio astronomy; and
- Intergovernmental cooperation and public consultation on matters concerning nationally significant astronomy advantage areas and matters connected therewith.

Under Section 22(1) of the Act, the Minister has the authority to protect the radio frequency spectrum for astronomy observations within a core or central astronomy advantage area. As such, the Minister may under section 23(1) of the Act, declare that no person may undertake certain activities within a core or central Astronomy Advantage Area (AAA). These activities include the construction, expansion or operation; of any fixed radio frequency interference source, facilities for the generation, transmission or distribution of electricity, or any activity capable of causing radio frequency interference or which may detrimentally influence the astronomy and scientific endeavours.

In terms of section 7(1) and 7(2) of this Act, national government established the following AAAs:

- Central Karoo AAA (GN 198 of 2014) – proposed development falls outside this AAA
- Sutherland Central AAA – proposed development falls outside this AAA
- Northern Cape AAA (GN 115 of 2010) – proposed development falls outside of this AAA

Even though the proposed development falls outside the respective AAAs, the relevant authorities, including the Square Kilometre Array (SKA) and South African Large Telescope (SALT), will be consulted throughout the BA process.

11.14 National Energy Act (Act No. 34 of 2008)

South Africa has two (2) acts that direct the planning and development of the country's electricity sector, namely:

i. The National Energy Act of 2008 (Act No. 34 of 2008); and
ii. The Electricity Regulation Act (ERA) of 2006 (Act No. 4 of 2006).

The National Energy Act (Act No. 34 of 2008), promulgated in 2008, has, as one (1) of its key objectives, the promotion of diversity of supply of energy and its sources. From this standpoint, the Act directly references the importance of the renewable energy (RE) sector, with a mention of the solar energy sector included. The aim is to ensure that the South African economy is able to grow and develop, fast-tracking poverty alleviation, through the availability of a sustainable, diverse energy mix. Moreover, the goal is to provide for the increased generation and consumption of RE (Republic of South Africa, 2008).

11.15 Electricity Regulation Act (Act No. 4 of 2006)

In 2011, the electricity regulation on new generation capacity was published under Section 35(4) of the Electricity Regulation Act (ERA) (Act No. 4 of 2006). These regulations apply to the procurement of new generation capacity by organs of state.

The objectives of the regulations include:

- To facilitate planning for the establishment of new generation capacity;
- The regulation of entry by a buyer and a generator into a Power Purchase Agreement (PPA);
- To set minimum standards or requirements for PPAs;
- The facilitation of the full recovery by the buyer of all costs efficiently incurred by it under, or in connection with, a PPA including a reasonable return based on the risks assumed by the buyer thereunder and to ensure transparency and cost reflectivity in the determination of electricity tariffs; and
- The provision of a framework for implementation of an Independent Power Producer (IPP) procurement programme and the relevant agreements concluded.

The Act establishes a National Energy Regulator as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licenses and registration as the manner in which generation, transmission, distribution, trading and the import and export of electricity are regulated.

11.16 Protection of Public Information Act (Act No. 4 of 2013)

The Protection of Public Information Act (Act No. 4 of 2013) (POPIA) recognises the Constitutional requirement that everyone has a right to privacy.

Ultimately the Act promotes “the protection of personal information processed by public and private bodies; to introduce certain conditions so as to establish minimum requirements for the processing of personal information; to provide for the establishment of an Information Regulator to exercise certain powers and to perform certain duties and functions in terms of this Act and the Promotion of Access to Information Act, 2000 (PAIA); to provide for the issuing of codes of conduct; to provide for the rights of persons regarding unsolicited electronic communications and automated decision making; to regulate the flow of personal information across the borders of the Republic; and to provide for matters connected therewith”.

Due to the requirements around the Public Participation Process, SIVEST will process, and capture information aligned to the POPIA and always obtain consent for I&APs information to be gathered, stored and distributed for the purpose of this project.

11.17 Additional Relevant Legislation

- White Paper on the Energy Policy of the Republic of South Africa (1998)
- Occupational Health and Safety Act (Act No. 85 of 1993) [OHSA];
- Environment Conservation Act (Act 73 of 1989) [ECA]
- Road Safety Act (Act No. 93 of 1996) [RSA];
- National Environmental Management: Air Quality Act (Act No. 39 of 2004) [NEM:AQA];

- National Environmental Management: Waste Act (Act No. 59 of 2008, as amended) [NEM;WA];
- Development Facilitation Act (Act No. 67 of 1995) [DFA];
- Promotion of Access to Information Act, (Act No. 2 of 2000); [PAIA]
- The Hazardous Substances Act (Act No. 15 of 1973) [HSA];
- Water Services Act (Act No. 108 of 1998) [WSA];
- Municipal Systems Act (Act No. 32 of 2000) [MSA];
- Subdivision of Agricultural Land Act, 70 of 1970 [SALA], and
- Mineral and Petroleum Resource Development Act (Act No. 28 of 2002, as amended) [MPRDA].

12. KEY DEVELOPMENT STRATEGIES AND GUIDELINES

In his 2021 State of the Nation Address, President Cyril Ramaphosa announced government are taking the following measures to rapidly and significantly increase generation capacity outside of Eskom:

- *One of the priority investment areas is to rapidly expand energy generation capacity.*
- *Restoring Eskom to operational and financial health and accelerating its restructuring process is central to achieving this objective. Eskom has been restructured into three separate entities for generation, transmission and distribution.*
- *A Section 34 Ministerial Determination will be issued shortly to give effect to the Integrated Resource Plan 2019, enabling the development of additional grid capacity from renewable energy, natural gas, hydro power, battery storage and coal.*
- *We will initiate the procurement of emergency power from projects that can deliver electricity into the grid within 3 to 12 months from approval.*
- *The Department of Mineral Resources and Energy gazetted the Amended Schedule 2 of the Electricity Regulation Act 4 of 2006 on 12 August 2021, for 100 Megawatts of embedded electricity generation as approved by Minister Gwede Mantashe.*
- *We will negotiate supplementary power purchase agreements to acquire additional capacity from existing wind and solar plants.*
- *We will also put in place measures to enable municipalities in good financial standing to procure their own power from independent power producers.*

Policy decisions taken in the next decade will largely determine the dimension of the impact of climate change. Local government is in the front line of implementation and service delivery, and thus needs to pursue adequate mitigation and adaptation strategies which should include participation from the public sector, the private sector and NGOs.

The DoE gazetted its White Paper on Renewable Energy in 2003 and introduced it as a 'policy that envisages a range of measures to bring about integration of renewable energies into the mainstream energy economy.' At that time, the national target was fixed at 10 000GWh (0.8Mtoe) renewable energy contribution to final energy consumption by 2013. The White Paper proposed that this would be produced mainly from biomass, wind, solar and small-scale hydropower. It went on to recommend that this renewable energy should be utilised for power generation and non-electric technologies such as solar water heating and biofuels. Since the White Paper was gazetted, South Africa's primary and secondary energy requirements have remained heavily fossil-fuel dependent, both in terms of indigenous coal production and use, as well as the use of imported oil resources. Alongside this, the projected electricity demand of the country has led the National utility Eskom, to embark upon an

intensive build programme to secure South Africa's longer-term energy needs, together with an adequate reserve margin.

The National Development Plan (NDP), 2011 – 2030, aims to address parts of the South African triple development challenges of poverty and inequality by 2030. In order to achieve this, numerous enabling milestones and critical actions have been formulated. One (1) of the critical actions is the formulation and implementation of interventions that aim to ensure environmental sustainability and resilience to future shocks.

The emphasis is on South African investment and assistance in the exploitation of various opportunities for low-carbon energy in the clean energy sources of Southern Africa (National Planning Commission, 2011). A more efficient and competitive infrastructure is envisaged, particularly infrastructure that facilitates economic activity and is conducive to growth and job creation. The plan identifies key services that need strengthening; namely commercial transport, energy, telecommunications and water, while ensuring their long-term affordability and sustainability. The National Planning Commission maintains that South Africa has missed a generation of capital investment in many infrastructure opportunities including electricity. Therefore, one (1) infrastructure investment priority is in the procurement of at least 20000MW of renewable energy-efficiency (National Planning Commission, 2011).

The proposed project is thus well aligned with the aims of the NDP which is further detailed in the following national and provincial plans:

- National Integrated Resource Plan for Electricity (2010-2030).
- Integrated Resource Plan (IRP 2019)
- National Infrastructure Plan 2012, as amended.
- The Mpumalanga Spatial Development Framework (SDF) (MPSDF, 2019)
- Emakhazeni Municipality Integrated Development Plan, 2020-2021

12.1 Provincial Policies

The Mpumalanga Provincial Spatial Development Framework was finalised in January 2019 and identifies the spatial and land-use development strategy for the province and the local municipalities. The spatial development vision for the province is to have "A Mpumalanga that has a sustainable, vibrant and inclusive economy developing all resources and promoting a healthy environment through innovation."

Table 19: Relevant National and Provincial legislation and policies

Policy	Key policy objectives	Source
National Policy: South Africa		
The Constitution of the Republic of South Africa 1996	• "Everyone has the right to an environment that is not harmful to their health or well-being" (S24) • The environment should be protected for the benefit of present and future generations, through reasonable legislative and other measures that: • Prevent pollution and ecological degradation; • Promote conservation; • Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development	(Constitution of the Republic of South Africa, 1996)
National Development Plan, 2030	The National Development Plan (NDP) identifies the need for South Africa to invest in a strong network of economic infrastructure designed to support the country's medium- and long-term economic, social, and environmental goals. Energy infrastructure is a critical component that underpins economic activity and growth across the country, and it needs to be robust, extensive, and affordable enough to meet industrial, commercial, and household needs. In formulating its vision for the energy sector, the NDP took as a point of departure the Integrated Resource Plan for electricity (IRP) 2010 to 2030 as promulgated in March 2011. This was subsequently updated, and the promulgated IRP 2019 replaced the IRP 2010 in October 2019 as the country's official electricity infrastructure plan to 2030.	(NPC, 2012)
New Growth Path Framework, 2011	• Infrastructure investment • Main economic sectors as employment sectors seizing the potential of new economies. • Investing in social capital and public services • Fostering rural development and regional integration.	(South African Government, 2011)
Renewable Energy Vision 2030 South Africa	• Renewable energy as an exceptional source of flexible supply within the context of uncertain energy demand • Comprehensive renewable energy base will support a resilient South African future • A sustainable energy mix that excludes undue risks for the environment.	(World Wildlife Fund, 2014)
Integrated Resource Plan 2019	• South Africa should continue to track a diversified energy mix which lessens reliance on a few primary energy sources. • A total of 9 980 MW of additional wind capacity is to be introduced in South Africa by 2030. The wind Independent Power Producers (IPPs) constitute the largest single renewables technology procured to date	(Department of Energy, 2019)

Policy	Key policy objectives	Source

	under the Renewable Energy Independent Power Producer Procurement Programme.
	• Allocations to safeguard the development of wind energy projects aligned with the Integrated Resource Plan (IRP) 2010 should continue to be pursued:
	  ○ Ensure energy security and supply
	  ○ Reduce environmental impacts
	  ○ Endorse job creation and localisation
	  ○ Lessen cost of energy
	  ○ Reduce water consumption
	  ○ Diversify supply sources
	  ○ Promote energy efficiency
	  ○ Promote energy access.
	• Additionally, the IRP (2019) indicates that wind energy will be 22.5% of the energy mix compared to solar at 11% by 2030	

White Paper on Energy Policy of the Republic of South Africa 1998	• Seeks to ensure that an equitable level of national resources is invested in renewable technologies, given their potential, and compared to investments in other energy supply options. • Aims to create energy security by diversifying the energy supply and energy carriers.	(Department of Minerals and Energy, 1998)
White Paper on the Renewable Energy Policy of RSA 2003	• Pledges government support for the development, demonstration, and implementation of renewable energy sources for both small- and large-scale applications	(Department of Minerals and Energy, 2003)
A Framework for a Just Transition in South Africa and Just Energy Transition Investment Plan (JET IP)	Just Transition in South Africa may be summarised as: • Just transition aims to achieve a quality life for all South Africans, in the context of adverse impacts of climate and fostering climate resilience. • Just transition aims at decent work for all, social inclusion, and the eradication of poverty. • Just transition puts people at the centre of decision making, especially the poor, women, people with disabilities, and the youth, empowering them for new opportunities of the future. • Just transition builds the resilience of the economy and people through renewable energy systems; conservation of natural resources; equitable access of water resources; an environment that is not harmful to one's health and well-being; and sustainable, equitable, inclusive land-use for all, especially for the most vulnerable.	Presidential Climate Commission Report, 2022

Policy	Key policy objectives	Source
Provincial Policy: Mpumalanga		
Mpumalanga Economic Growth & Development Path	• Highlights the current economic landscape of Mpumalanga with a view of the future growth and development of the province. • The MEGDP identifies the following key sectors: ○ Infrastructure · Mining ○ Green Economy · Manufacturing ○ Agriculture · Tourism • The MEGDP focuses on the production of technologies for solar, wind and biofuels and is also supported by the Energy Integrated Resource Plan	(Mpumalanga Economic Growth & Development Path, 2011)
Mpumalanga Draft Green Economy Sector Plan, 2016	• The Plan aims to provide an integrated approach towards developing the green economy in Mpumalanga by 2030 in line with the Vision 2030. Specific objectives include: • Developing a sector plan based on the province's strengths in natural resources endowments. • Expanding on the economic, green and environmental initiatives that are already under way in the province in order to facilitate quick wins. • Support the DEDT's drive in sustainable economic development • Develop an action plan for implementation	(DNA Economics, 2016)
Mpumalanga Tourism and Parks Agency Strategic Plan	• Mpumalanga possesses significant potential to capture large numbers of international and domestic tourists. In particular, the Kruger National Park, several other reserves, natural and cultural and historical heritage sites are attractions that are in demand by all tourist groups. • While the environmental sector often puts much emphasis on biodiversity conservation it does not necessarily link it with eco-tourism. The plan states that much naivety has been observed about what ecotourism can do. The plan calls for improved implementation of policy that will see biodiversity promotion being embraced by the broader tourism industry and the need for improved awareness from players within the sector to reduce the adverse environmental impacts of tourism.	Mpumalanga Tourism and Park Agency

12.2 The Mpumalanga Spatial Development Framework (SDF)

The Mpumalanga Provincial Spatial Development Framework was finalised in January 2019 and identifies the spatial and land-use development strategy for the province and the local municipalities. The spatial development vision for the province is to have "A Mpumalanga that has a sustainable,

vibrant and inclusive economy developing all resources and promoting a healthy environment through innovation."

The proposed site is located on the N4 which is the main development corridor through the Province and along which most of the economic activities in the Province are located.

Important from the composite SDF is the number of tourism nodes that are located to the east of the proposed site and the fact that the area around the site serves as a "tourism gateway" to the tourism interests of the Province in the Lowveld and on the highland's escarpment. Although there are no tourism attractions close to the site itself, it is an important socio-economic feature of the local economy.

12.3 Emakhazeni Municipality Integrated Development Plan, 2020/21 (IDP)

The vision of the Emakhazeni Municipality is to have a developmental local municipality accelerating provision of quality services to the satisfaction of its communities. Within the IDP the municipality focuses on the high levels of poverty and unemployment and the need to develop economic opportunities for the youth through enterprise and skills development. The important economic sectors in the municipality highlighted by the IDP are mining, agriculture, tourism, and the tertiary sectors. To address the focus area of the municipality it has developed the following sector plans:

- Spatial development framework (SDF)
- Local economic development strategy (LED)
- Rural development chapter/sector plan (RDP)
- Disaster management plan (DMP)
- Integrated waste management plan (IWMP)
- Water services development plan (WSDP).

In terms of the SDF the municipality identified a place close to the site for the development of a rural settlement for upgrading and formalisation. With respect to Ward One, the SDF identifies a number of service delivery concerns and aspects to be addressed. From an economic perspective the need for business creation and employment opportunities are high on the agenda.

The eastern parts of the municipality near Belfast, Dullstroom, Machadodorp and Waterval Boven is part of a provincial tourism corridor. The area serves as a gateway to the tourism parks and private reserves in the Lowveld areas of the Province. Popular tourism resorts are developed in this area based on trout fishing and the natural scenic beauty of the area. These areas start about 40 km east of the site on the N4 towards Mbombela.

13. NEED AND DESIRABILITY

13.1 National Renewable Energy Requirement

In 2010, South Africa had 44,157MW of power generation capacity installed. Current forecasts indicate that by 2025, the expected growth in demand will require the current installed power generation capacity to be almost doubled to approximately 74,000MW (SAWEA, 2010).

This growing demand, fueled by increasing economic growth and social development within Southern Africa, is placing increasing pressure on South Africa's existing power generation capacity. Coupled with this, is the growing awareness of environmental impact, climate change and the need for sustainable development. Despite the worldwide concern regarding Greenhouse Gas (GHG) emissions and climate change, South Africa continues to rely heavily on coal as its primary source of energy, while most of the countries renewable energy resources remain largely untapped (DME, 2003). There is therefore an increasing need to establish a new source of generating power in SA within the next decade.

The use of renewable energy technologies, as one of a mix of technologies needed to meet future energy consumption requirements is being investigated as part of Eskom's long-term strategic planning and research process. It must be remembered that wind energy is plentiful, renewable, widely distributed, clean and reduces GHG emissions when it displaces fossil-fuel derived from electricity. In this light, renewable wind energy can be seen as desirable.

The REIPPP programme and the competitive nature of the bidding process has resulted in significant lowering of solar and wind tariff prices since 2011. Further projects will increase the competitive nature of the REIPPP program and further result in cost savings to South African consumers.

13.2 National Renewable Energy Commitment

In support of the need to find solutions for the current electricity shortages, the increasing demand for energy, as well as the need to find more sustainable and environmentally friendly energy resources, South Africa has embarked on an infrastructure growth programme supported by various government initiatives. These include the National Development Plan (NDP), the Presidential Infrastructure Coordinating Commission (PICC), the DoE's IRP, the National Strategy for Sustainable Development, the National Climate Change Response White Paper, the Presidency of the Republic of South Africa's Medium-Term Framework, and the National Treasury's Carbon Tax Policy Paper.

The Government's commitment to growing the renewable energy industry in South Africa is also supported by the White Paper on Renewable Energy (2003) which sets out the Government's principals, goals and objectives for promoting and implementing renewable energy in South Africa. In order to achieve the long-term goal of achieving a sustainable renewable energy industry, the DoE has set a target of contributing 17,8GW of renewable energy to the final energy consumption by 2030. This target is to be produced mainly through, wind and solar; but also through biomass and small scale hydro (DME, 2003; IRP, 2010). Further renewable energy targets have been proposed within the latest IRP, which was gazetted in 2019.

The 2019 Integrated Resource Plan (2019) (IRP2019) was released on 18 October 2019 and includes the following capacity allocation:

- 1 500 MW of new coal power (noting that there will be decommissioning of coal capacity over the period);
- 2 50 0MW of hydro power;
- 6 000 MW solar;
- 14 400 MW wind;
- 2 000 MW of storage;
- 3 000 MW from gas.

13.3 Realisation of Global and Local Commitments

The Roos SEF (along with this Project, to connect the SEF to the National Grid) will contribute to the countries' efforts to reduce our carbon emissions and play our role as part of various international commitments to combat climate change and promote sustainable development. South Africa is a signatory to the Paris Climate Accord (Paris Agreement), the United Nations' Development Programmes' (UNDP) Sustainable Development Goals (SDGs) and the Kyoto Protocol.

The Paris Agreement is a legally binding international treaty signed by 196 countries at the COP 21 in Paris, on 12 December 2015, to combat climate change. The goal of the Paris Accord is to limit global warming to well below 2 degrees Celsius, compared to industrial levels to avoid catastrophic natural disasters which are driven by the global temperature increase. To achieve this long-term temperature goal, countries aim to reach global peaking of GHG emissions as soon as possible to achieve a climate-neutral world by 2050.

The SDGs were adopted by all member states to the United Nations in 2015 as a universal call to action to end poverty, protect the planet and ensure peace and prosperity of all people by 2030. There are 17 integrated SDGs (recognizing that action in one area will influence other areas).

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCC) aims to curb air pollution associated with accelerated global climate change. The South African Government acceded to the Kyoto protocol in July 2012.

The authorisation of the SEF and associated infrastructure to connect it to the National Grid (i.e., this Project) will further align with South Africa's National Climate Response White Paper which outlines the country's efforts to manage the impacts of climate change and to contribute to the global efforts to stabilise the GHG concentrations in the atmosphere

13.4 Site Suitability

The site is preferred due to the suitable climate, conditions and topography. The site is considered highly preferred in terms of the development of a solar PV facility. As such, no property or location alternatives have been considered.

12.3.1 Topography, Site Access and IPP Competition

The topography of the site consists of slightly to moderately undulating plain with some low hills and pan depressions.

The site can be accessed through Site Access SA1 - an existing access point which underpasses a railway through a culvert opening that is approximately 3 m wide and 3.5 m high.

There is a fair amount of other IPP competition in the area, regarding renewable energy facilities; thus, the Project will further aid in the socio-economic development of the area.

12.3.2 Environmental

All the environmental constraints were considered in the area at the time of undertaking the prefeasibility analysis. Key environmental specialists were consulted to identify any potential impacts/environmental

constraints which may be associated with a proposed SEF at the onset of the project. An agricultural specialist, aquatic specialist, heritage specialist, social specialist, visual specialist, transportation specialist, terrestrial ecologist, glint and glare specialist and risk assessment specialist were appointed to undertake detailed pre-feasibility assessments which was used to determine the preliminary layout which has taken into account most of the environmental sensitivities from the onset. The National Department of Environmental Affairs (DEA) screening tool was also utilized to generate a site sensitivity report for the proposed project to guide the level of specialist input that would be required.

Thus, it was concluded that the development at the selected farm may have a minimal impact on the area's flora and fauna.

13.5 Land Availability

The proposed project is located within the Emalahleni REDZ (REDZ 9) which has been identified by the government as renewable energy development zones that are of strategic importance for the development of large-scale wind and solar projects. The proposed development will provide socio-economic benefits to the region it is situated in and will have a high commercial attractiveness. In addition, the negative environmental impacts associated with the proposed development can be mitigated to acceptable levels.

All affected landowners have given their consent and have signed letters of consent for the undertaking of the BA Process and the subsequent development of the proposed Roos SEF project.

In terms of the agricultural assessment, the project area is identified to have a Medium to Low sensitivity, with small areas of High sensitivity where existing agricultural fields are. Therefore, an Agro-ecosystem impact is required.

13.6 Reduce dependency on fossil fuels

At present, more than 90% of South Africa's energy is generated by coal-fired power stations. Apart from the fact that these are finite resources that will eventually run out, fossil fuels are also harmful to the environment when used to produce electricity. During combustion, fossil fuels such as coal emit many by-products into the atmosphere, two (2) of which are carbon dioxide (CO_2) and sulphur dioxide (SO_2). Both these gases have been shown to contribute to the worsening climate crisis. Wind is a free and infinite resource that occurs naturally in the environment. Converting wind energy into electricity releases no harmful by-products into the environment and will reduce the dependency on fossil fuels.

13.7 Stimulate the economy

A significant portion of the capital expenditure envisaged for the project will be spent on procurement of goods and services within South Africa and specifically within the Mpumalanga Province. If goods and services are procured locally (i.e., within South Africa), it increases the production of the respective industries. This has a positive impact on the national economy and economies of the municipalities where inputs are procured.

The proposed development has the potential to stimulate the demand for other industries, among others construction services, engineering service, transport services, steel structures, cement and other aggregates, and electrical equipment. At the local level, increase in demand for accommodation, personal services, perishable and non-perishable goods is expected, which will stimulate the local

economies of the towns and settlements, where labour will be procured from or where migrant workers will be temporarily located.

Some of the local businesses could benefit from sub-contracting opportunities, if the construction companies appointed by the developer implement a local community procurement policy, and consumer expenditure of the construction crew. Furthermore, the demand for hospitality services (including accommodation and catering in the towns Belfast and other nearby towns) is expected to increase and provide for much-needed stimulus for the local economy.

13.8 Power Generation

The Project will also aid in assisting in overcoming the power shortages that are currently faced in the country. In 2020, South Africa witnessed its longest recorded hours of load shedding, with the power being off for 859 hours of the year. The South African Government has taken strides to try to reduce these power cuts through the implementation of bid Windows in REIPPPP and lifting the independent power generation threshold to 100 MW, but it is still expected that the country will undergo more load shedding. Over the years the construction and management of solar energy facilities has become cheaper, and less time-consuming.

Thus, acting as a faster and more efficient method of meeting the ever-growing demand for electricity in the country. Furthermore, after the COP26, South Africa signed an international partnership that will facilitate the funding of USD 8.5 billion from Germany, France, the USA, the UK, and the European Union over the next three to five years to aid in the country's transition towards a low-carbon economy. This opens an opportunity for Renewable Energy IPPs to aid in the country's quest to reduce its GHG emissions, and also help resolve the ongoing electricity crisis in the country.

The Council for Scientific and Industrial Research (CSIR) reported that renewable energy assisted in relieving pressure on the constrained South African power system during load shedding in the first quarter of 2019. This indicates that renewable energy is a key factor in ensuring that the country does not face further load shedding in the future.

Moreover, Eskom plans to decommission approximately 5 400MW of power generated from coal power stations by the year 2022, 10 500MW by the year 2030, and up to 35 000MW by the year 2050. Subsequently, Eskom has considered options for repurposing these power stations with the core aims of reusing existing power transmission infrastructure, developing new generation capacity, proving ancillary services, and mitigating socio-economic impact. Thus, the Project will assist Eskom achieve its diversification goal as well as contribute positively to meeting the evergrowing demand for electricity in the country.

13.9 Job opportunities and household livelihoods

Solar energy projects create both temporary and permanent job opportunities in South Africa for both skilled and unskilled workers. According to the Social Impact Assessment, the erection of solar PV in the area will create employment opportunities for both skilled and unskilled workers during the construction stage. If recruitment processes are efficiently managed, work opportunities can be localised as much as possible, with a trend visible in the industry that local people will be most ready to take up unskilled jobs, while employment requiring specialised skills tends to attract specialists from across the country. Business opportunities associated with the construction phase may also be open

for local enterprises, especially in the supply of goods and services, such as food and other essential supplies.

In addition to those benefitting from direct employment created at the project, various multiplier effects will assist in temporarily supporting existing jobs in the businesses offering services and goods that will be procured during construction activities. The increased temporary income earned by these businesses will, in turn, stimulate consumer spending, creating another round of multiplier effect, positively impacting on the employment situation in the area. There will be opportunities for skills development (refer below) and training.

13.10 Skills development

In addition to the job creation, there is valuable opportunities for skills enhancement and knowledge transfer as quite often input from experts are required in this field. Therefore, opportunities for guiding and training of local workers is created. A variation of skill sets is required ranging from semi-skilled construction workers to highly skilled engineers. The skill set of the majority of the municipality's residents comprises of low skills, which means that with proper planning and recruitment strategies, many of the local unemployed residents could be hired as temporary construction workers on site provided, they satisfy any other recruitment criteria.

Those employed will either develop new skills or enhance current skills. This implies that inexperienced workers will have the opportunity to attain and develop new skills, while experienced workers will further improve their existing skills. Albeit the employment is temporary, the skills attained will be of long-term benefit to employees. However, as any skills set it will need to be supported and practised on a regular basis to maintain its currency.

14. DETAILS OF PROCESS FOLLOWED TO REACH THE PREFERRED ALTERNATIVE

14.1 Details of alternatives

14.1.1 Introduction

As per the 2014 EIA Regulations (as amended), feasible and reasonable alternatives are required to be considered during the BA process. Alternatives are defined in Chapter 1 of the 2014 EIA Regulations (as amended) as "different means of meeting the general purpose and requirements of the activity". These alternatives may include:

(a) The property on which or location where it is proposed to undertake the activity;
(b) The type of activity to be undertaken;
(c) The design or layout of the activity;
(d) The technology to be used in the activity;
(e) The operational aspects of the activity; and
(f) The option of not implementing the activity.

Each of the alternatives in relation to the proposed development is discussed in the sections below.

14.1.2 Location/Site alternatives

Prior to the initiation of the EIA, alternative properties / sites were considered for the location of the proposed development. As discussed above, the selection of a potential solar farm site includes several key aspects including solar resource, grid connection suitability/infrastructure as well as environmental and social constraints, topography and access. This proposed project site was selected based on the above criteria ahead of other regional properties / sites due to the cumulative assessment of all criteria. This internal process takes several weeks to complete and ensures that the least environmentally sensitive property / site is selected in the specific region of development.

Based on the reasons above no site alternatives have been considered during the EIA process for this proposed development. The placement of solar energy facilities is dependent on the factors discussed above, all of which are favourable at the proposed site location. The proposed project site has topography which is suitable for the development of a SEF and is in close proximity to a grid connection that has been identified to have sufficient capacity to evacuate the generation. In addition, the proposed site is easily accessible off the public roads N4 and AR1 or AR2. The site is therefore considered highly suitable for the proposed development of a SEF and no other locations have been considered.

14.1.3 The type of activity to be undertaken

No other activity alternatives have been considered. Renewable Energy developments in South Africa are highly desirable from a social, environmental and development perspectives respectively. The importance of renewable energy has been outlined in Section 10 and 11 above highlighting national, district and local support. The solar resource in this area along with the rapid advancements in solar energy technology efficiency serves as further motivations for the proposed development.

South Africa is under immense pressure to provide clean sources of electricity generating capacity in order to reduce the current electricity demand from aging and polluting coal-fired power stations. With the global focus on climate change, the government is under severe pressure to explore alternative energy sources in addition to coal-fired power stations. Although solar energy is not the only solution to solving the energy crisis in South Africa, it is a suitable sustainable solution to the energy crisis and this project could contribute to addressing the problem. This project will thus aid in achieving South Africa's goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation.

14.1.4 Design or Layout alternatives

Layout alternatives have been considered and assessed as part of the BA process. The alternatives which have been considered and assessed as part of the application include two (2) substations, laydown areas, BESS and O&M area alternatives. All alternatives have been comparatively assessed by the respective specialists and assessed against the 'no-go' alternative (i.e., status quo).

Powerline route

Two electrical grid infrastructure are being considered and have been comparatively assessed by the EAP and specialists. Grid Integration for both the preferred and alternative substations will be connected in the same manner. The substation will connect to the existing 132kV overhead powerline via a double circuit 132kV loop-in, loop-out (LILO) overhead powerline configuration. The LILO is expected to be approximately 150m long within a corridor of approximately 100m. Pylon structures may be either steel

lattice, steel monopole or woodpole structures. The powerline structure will be determined at final design stage after technical consultation with Eskom Engineers and after the geotechnical and topographical surveys have been conducted.

Refer to **Figure 45** for the preliminary layouts.

14.1.5 No – go option

The 'no-go' alternative is the option of not undertaking the proposed grid connection infrastructure project. Hence, if the 'no-go' option is implemented, there would be no development. This alternative would result in no environmental impacts from the proposed project on the site or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the BA process.

The option of not implementing the activity, or the "no-go" alternative, has been considered in this BA process. South Africa is under immense pressure to provide clean sources of electricity generating capacity in order to reduce the current electricity demand from aging and polluting coal-fired power stations. With the global focus on climate change, the government is under severe pressure to explore alternative energy sources in addition to coal-fired power stations. Although wind energy is not the only solution to solving the energy crisis in South Africa, not establishing the proposed SEF and associated infrastructure would be detrimental to the mandate that the government has set to promote the implementation of renewable energy. It is a suitable sustainable solution to the energy crisis and this project could contribute to addressing the problem. This project will thus aid in achieving South Africa's goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation.

The no-go alternative will result in the current status quo being maintained as far as the avifauna, aquatic, terrestrial, visual agricultural and heritage are concerned. The above-mentioned alternatives (including 'no-go' alternative) were all assessed by the appointed specialists as part of the BA process (this application). All the above-mentioned power line corridor route alternatives were informed by the identified environmental sensitive and/or 'no-go' areas (i.e., status quo). The respective alternatives which were considered as part of the BA process for the proposed development were also comparatively assessed.

14.1.6 Comparative Assessment of Alternatives

The development area presented in the Basic Assessment Report has been selected as a practicable option for the Roos SEF considering technical preference and constraints, as well as no-go layers informed by the relevant specialist during the screening studies. The applicant would like to consider the proposed alternative laydown and BESS area for additional panels at a later stage. This area has already been assessed by the specialists and no fatal flaws were identified.

14.2 Motivation and concluding statement for preferred alternative

No activity alternatives are being considered. Renewable Energy development in South Africa is highly desirable from a social, environmental and development point of view. Solar energy installations are more suitable for the site because of the good solar resource. The choice of technology selected for the

Roos SEF was based on environmental constraints and technical and economic considerations. The preliminary layout is reflected in the figure below:

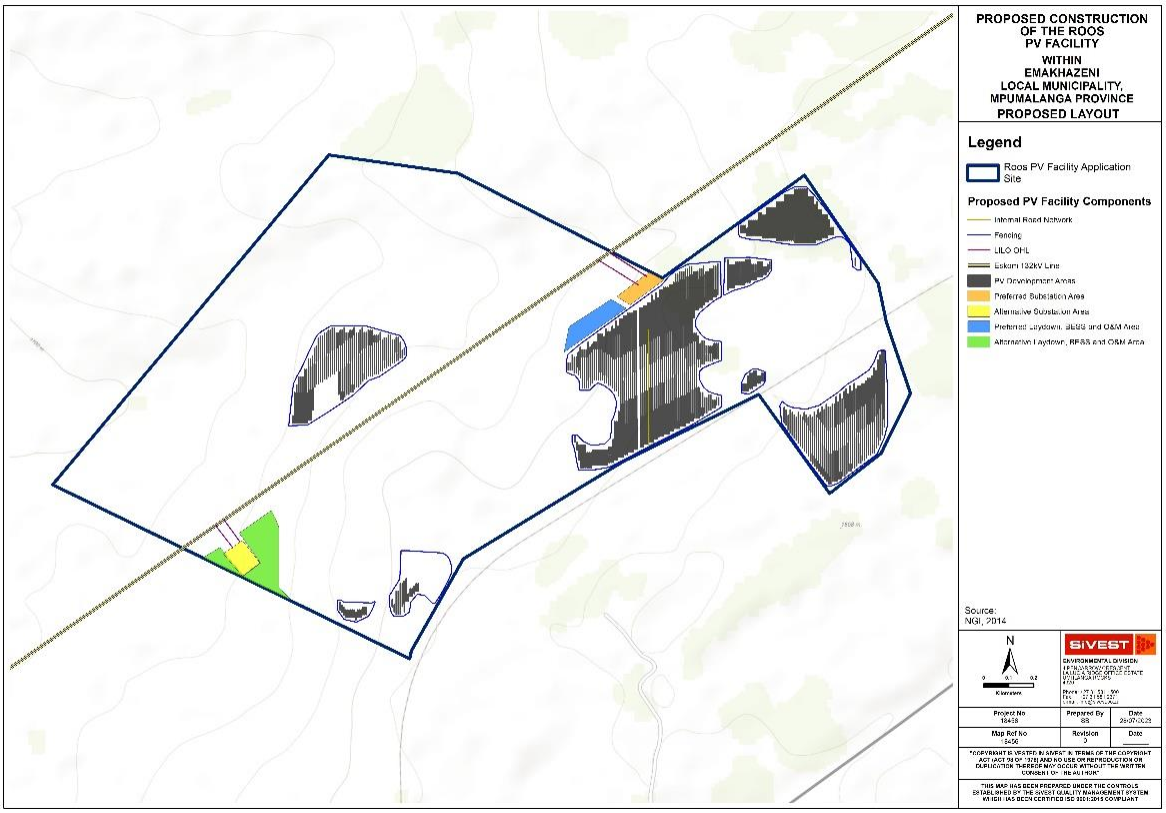

Figure 45: Preliminary Layout

The above layout has been assessed by the specialists in their respective specialist studies. All constraints identified to date as indicated in the sensitivity mapping below have been taken into account and the layout has been refined to avoid all no-go areas (e.g. The preliminary layout did not avoid pan wetlands within the site boundary which were identified by the specialist following their detailed assessment. The proposed layout has been refined to avoid these pans and associated buffers).

It should be noted that the alternative substation, laydown, BESS and O&M areas were originally the preferred alternative. However, following the specialist studies and the elimination of the area surrounding this site due to environmental sensitivities, the applicant elected to change the preferred alternative to the site closer to the PV arrays.

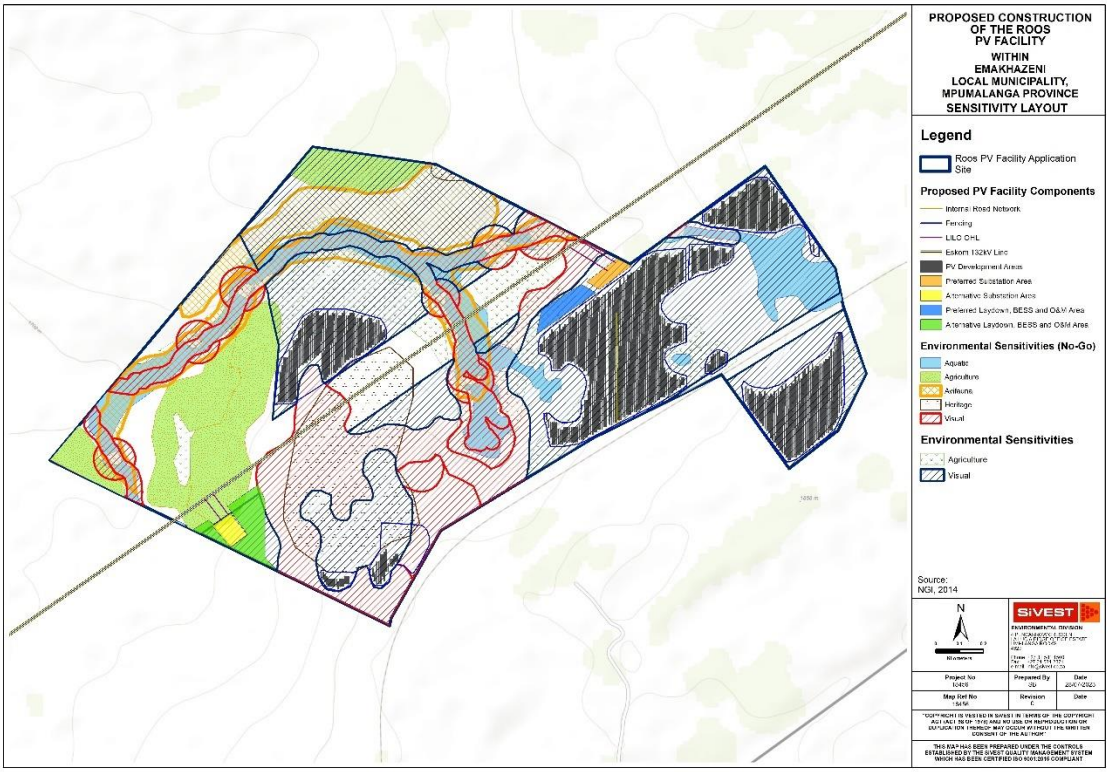

Figure 46: Sensitivity mapping of proposed layout

14.3 Public Participation Process undertaken

Public participation is the cornerstone of any EIA. The principles of the National Environmental Management Act (NEMA) as well as the EIA Regulations (as amended 2017) govern the EIA process, including public participation. These include provision of sufficient and transparent information on an ongoing basis to stakeholders to allow them to comment, and ensuring the participation of previously disadvantaged people, women and the youth. All documents relating to the PP process have been included in **Appendix 5**.

The aim of the Basic Assessment Process is to collect the issues, concerns and queries of interested and affected parties (I&APs). The main objective is to:

- Inform the stakeholders about the proposed project and the environmental assessment process to be followed;
- Provide opportunity to all parties to exchange information and express their views and concerns;
- Obtain contributions from stakeholders (including the client, consultants, relevant authorities and the public) and ensure that all issues, concerns and queries raised are fully documented;
- Evaluate the issues raised and identify the significant issues; and
- Provide comment on how these issues are to be assessed as part of the Environmental Assessment Process.

14.3.1 Identification of Key Stakeholder and I&AP's

Liaison with the relevant authorities plays a crucial role in the successful completion of any environmental assessment process. In addition to the competent authority, DFFE, key stakeholders, the local municipality as well as other potentially affected I&APs, including adjacent property owners and dwellers, are identified.

The following key stakeholders were identified for this project:

- Agri SA;
- SANRAL;
- Sentech;
- ATNS
- Eskom Transmission Limited;
- SALT – The Southern African Large Telescope;
- South African Weather Services;
- South African Astronomical Observatory;
- Mpumalanga Provincial Heritage Resource Authority (MPHRA)
- Birdlife South Africa;
- Nkangala District Municipality;
- Department of Agriculture;
- DFFE
- Department of Water and Sanitation;
- Square Kilometre Array
- Department of Public Works;
- Air Traffic Navigation Services;
- Steve Tshwete Local Municipality;
- DARDLEA (Agriculture);
- DARDLEA (Environmental Affairs)
- National Department of Economic Development;
- Department of Mineral Resources;
- Department of Transport;
- Department of Public Works Roads and Transport (MP)
- WESSA;
- SA Civil Aviation Authority;
- Telkom SA;
- Mpumalanga Provincial Government;
- Transnet;

This list will be updated as the project progresses and based on responses received.

14.3.2 Responsibilities of interested and affected parties (I&AP's)

Members of the public who want to participate in the assessment process need to register and are referred as I&AP's. Registered I&APs are entitled to comment, in writing, on all written submissions to the authority and to raise any issues that they believe may be significant, provided that:

- Comments are submitted within the timeframes set by the competent authority or extensions of timeframes agreed to by the applicant, EAP and competent authority.
- A copy of the comments submitted directly to the competent authority is served on the applicant or EAP.
- The I&AP discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.

14.3.3 Steps taken to notify key stakeholders and potential I&APs

<u>Notification of BA process to be undertaken as follows:</u>

- Issuing of the notifications and initial landowner consultation (to be circulated to all I&APs in **August 2023** respectively as part of the Draft BAR (proof to be included in Final BAR).

- Placement of site notices in English and Afrikaans (as per regulations) were placed along the entrance road to the application site and around the site itself on **29 June 2023** (proof included in the BAR).
- Notification letters to be sent via E-mail or sms (if cellphone number / email is available, it is assuming the I&AP have an email or cellphone).
- Public notification of the BA process was advertised, in a local newspaper (namely Middleburg Observer) on the **04th of August 2023**, as required according to Regulation 41(2) (c) of the EIA Regulations (2014), as amended. Proof to be included in the Draft/Final BAR.

Availability of report for review:

- Report available on SiVESTs website for download.
- Electronic copies can be made available to parties via a secure digital link that will be emailed upon request for the documentation.
- CDs / Flash drive to be posted, only if requested.
- The Draft BAR will be located and available for review at the following locations:
    - Emakhazeni Local Municipality, 25 Scheepers Street, eMakhazeni, Mpumalanga, South Africa

14.3.4 Summary of issues raised

To be updated once the Public Comment Period has been completed.

14.3.5 Details of notification of landowners

Regulation 39 (1) of the EIA Regulations, 2014 (as amended), states that 'if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an EA in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land'.

Regulation 39 (2) of the 2014 NEMA EIA Regulations, 2014 (as amended), further states that 'sub-regulation (1) does not apply in respect of: (a) linear activities; (b) activities constituting, or activities directly related to prospecting or exploration of a mineral and petroleum resource or extraction and primary processing of a mineral or petroleum resource; and (c) strategic integrated projects as contemplated in the Infrastructure Development Act, 2014'.

The proposed Roos PV Facility and associated grid infrastructure development constitutes a linear activity and landowner consent is therefore not required. The proposed SEF will be located on Portion 17 of Leeubank 427JS, Portion 19 of Leeubank 427JS, Portion 14 of Generaalsdraai 423 JS, Portion 8 of Wintershoek 390, Portion 14 of Generaalsdraai 423 JS, Portion 38 of Leeubank 427 and Portion 9 of Wintershoek 390 JS, the landowner's consent has been obtained from the landowner. Furthermore, the landowners and/or occupants of the applicable farm portions will however be notified accordingly.

15. IMPACTS AND RISKS IDENTIFIED FOR THE PREFERRED ALTERNATIVE

The SiVEST Impact Assessment method dated 28 July 2017 (attached as **Appendix 7**) has been utilised to assess the following potential impacts identified in the assessment phase and is presented in the following sections.

The method used in this impact assessment determines significance (can be both positive and negative) of an impact by multiplying the value of the environmental system or component affected by the magnitude of the impact on that system or component (System or Component Value x Impact Magnitude).

In this method, all significant impacts on the natural or biophysical environment are assessed in terms of the overall impacts on the health of ecosystems, habitats, communities, populations and species. Thus, for example, the impact of an increase in stormwater runoff generated by a development can only be assessed in terms of the impact on the health of the affected environmental systems.

Similarly, all significant impacts on the social and socio-economic environment are assessed in terms of the overall impacts to the quality of life, health and safety of the affected population, communities and/or individuals, with the exception of impacts on resources that are assessed on their own.

The following impacts have been identified for the proposed project:

15.1 Impact Assessment

The potential impacts for the identified environmental aspects have been assessed and mitigation measures identified below. The detailed impact assessments on the preliminary layouts are in the respective specialist studies (**Appendix 6**).

15.1.1 Planning

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Aquatic																				
None identified																				
Terrestrial																				
None identified																				
Agricultural																				
None identified																				
Avifaunal																				
None identified																				
Heritage (Palaeontology)																				
None identified																				
Social																				
None identified																				
Transportation																				
None identified.																				
Glint and Glare																				

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
None identified																				
Visual																				
None identified																				
Risk Assessment																				
None identified																				

15.1.2 Construction Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Aquatic																				
Changes in sediment entering and exiting the system.	Changes in sediment regimes of the aquatic ecosystem and its sub -catchment by for example sand movement, meandering river mouth /estuary, changing flooding or sedimentation patterns. Construction and maintenance activities will result in earthworks and soil disturbance as well as the disturbance of natural vegetation. This could result in the loss of topsoil, sedimentation of the watercourses and pan and increase the turbidity of the water. Possible sources of the impacts include: • Earthwork activities during construction • Clearing of surface vegetation will expose the soils, which in rainy events would wash through the watercourse, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees can spread easily into these eroded soil. • Disturbance of soil surface	3	3	2	2	2	2	24	-	MEDIUM	• Sediment traps should be installed • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area. • During the construction phase measures must be put in place to control the flow of excess water so that it does not impact on the adjacent surface vegetation. • Sediment control should be effective and not allow any release of sediment pollution downstream. This should be audited on a monthly basis to demonstrate compliance with upstream conditions. • Any excavated soil/ should not be stored close to watercourses. Mixture of the lower and upper layers of the excavated soil should be kept to a minimum, so as for later usage as backfill material. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.	2	2	2	2	2	2	20	-	LOW

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
	• Disturbance of slopes through creation of roads and tracks adjacent to the watercourse • Erosion (e.g. gully formation, bank collapse)										• Monitoring should be done to ensure that sediment pollution is timeously addressed.									
Changes in water flow regime	Changes to hydrological function at a landscape level 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). The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary, seasonal, permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). Changes to base flows (e.g. too little/too much water in terms of characteristics and requirements of system). Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal). The sources of this impact include the compaction of soil, the removal of vegetation, surface water redirection, changes to watercourse morphology or input of high energy surface water which could occur during construction and operation of the solar plant	3	3	3	2	2	2	26	-	MEDIUM	• During the construction phase, best practice mitigation measures should be implemented. • Excavated materials should not be contaminated and it should be ensured that the minimum surface area is taken up • Where possible Demarcate the watercourse areas and buffer zones to limit disturbance, clearly mark these areas as no-go areas • Where development activities are located upslope from wetlands, effective stormwater management should be a priority during both construction and operational phase. This should be monitored as part of the EMP.	2	2	2	2	2	2	20	-	LOW
Introduction and spread of alien vegetation	The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles. Invasions of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plans can easily colonise and impact on downstream users.	3	3	2	2	2	2	24	-	MEDIUM	• Long-term monitoring for the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish, as specified in the Alien Vegetation Management Pan • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area and returning it where possible afterwards.	2	2	2	2	2	2	20	-	LOW
Changes in water quality due to pollution	Construction and operational activities may result in the discharge of solvents and other industrial chemicals, leakage of fuel/oil from vehicles and the disposal of sewage resulting in the loss of sensitive biota in the wetlands/rivers and a reduction in watercourse function. Chemical and Thermal Pollution: Potential risk of chemical pollution from storage and handling of chemicals used for panel cleaning or maintenance. Additionally, solar plants with concentrated solar power (CSP) technology may release heated water into nearby water bodies, leading to thermal pollution and potential impacts on aquatic organisms	3	3	3	2	2	2	26	-	MEDIUM	• Where possible Locate the infrastructure outside the calculated buffer zone. Where designs do not allow for changes a watercourse offset plan and/or a Water use licence should be developed and authorised. This should be discussed with the relevant authorities, and if deemed necessary an offset plan should be developed and approved. • Provision of adequate sanitation facilities located outside of the watercourse area or its associated buffer zone • The development footprint must be fenced off from the watercourses and where possible for the non-perennial watercourses and no related impacts may be allowed into the watercourse e.g. water runoff from cleaning of equipment, vehicle access etc.	2	2	2	2	2	2	20	-	LOW

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Loss of aquatic biota	Loss of instream habitat, deposition of wind-blown sand, loss of fringing vegetation and erosion, alteration in base flow, natural fire regimes and subsequent loss of non-marginal and marginal vegetation. Increase in invasive species due to disturbance. Change in water quality. Changes in flow. Loss and disturbance of biota due to direct development on the watercourse as well as changes in habitat including water quality, the water column, increased sediment, increased alien vegetation fire regime and habitat fragmentation	3	3	3	2	2	2	26	-	MEDIUM	• Ensure that no unnecessary vegetation is removed during the construction phase • Avoid unnecessary aquatic ecosystem crossing - limit work within the stream, river or wetland. The use of single access points for crossings. • Implement weed control in aquatic ecosystem and buffer zones. • Monitor the establishment of alien invasive species within the areas affected by the construction and maintenance of the proposed infrastructure and take immediate corrective action where invasive species are observed to establish. • Identify and protect important habitats for aquatic biota, such as wetlands, rivers, and streams, within and near the solar plant site. Implement habitat restoration projects to enhance and create suitable habitats for aquatic organisms. • Implement measures to maintain and improve water quality, such as implementing erosion control practices, managing stormwater runoff, and reducing the discharge of pollutants into water bodies. Regular monitoring of water quality parameters should be conducted to ensure compliance with standards and prompt identification of any issues	2	2	2	2	2	2	20	-	LOW
Loss and disturbance of watercourse habitat and fringe vegetation	Loss and disturbance of watercourse habitat and fringe vegetation due to direct development on the watercourse as well as changes in management, fire regime and habitat fragmentation	3	3	3	2	2	2	26	-	MEDIUM	• Monitor the establishment of alien invasive species within the areas affected by the construction and take immediate corrective action where invasive species are observed to establish. • Develop a restoration and replanting plan to mitigate the loss of habitat and fringe vegetation. This may involve revegetation with native plant species, especially in areas where vegetation has been removed or disturbed during construction.	2	2	2	2	2	2	20	-	LOW
Terrestrial																				
Habitat Loss and Fragmentation	• Vegetation clearing for access roads, solar arrays and their service areas and other infrastructure will impact on vegetation	2	4	3	3	4	4	64	-	VERY HIGH	• Placement of permanent infrastructure within High Sensitivity areas must be avoided. • Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas where possible. • Minimise the development footprint and construction activities as far as possible. • Rehabilitate disturbed areas that are no longer required by the operational phase of the development immediately after construction is completed for a PV facility. Inadequate rehabilitation could result in limited revegetation of indigenous species and/or an invasion of alien vegetation which will result in long term ecological degradation and damage.	2	3	3	3	3	3	42	-	MEDIUM
Loss of plant species of conservation concern	• Vegetation clearing for access roads, solar arrays and their service areas and other infrastructure will impact on SCC	2	4	4	3	4	4	68	-	VERY HIGH		2	3	3	3	3	3	42	-	MEDIUM
Loss of provincial protected species and protected trees	• Vegetation clearing for access roads, solar arrays and their service areas and other infrastructure will impact on provincially protected species	2	4	3	3	3	3	45	-	HIGH		1	2	2	3	2	2	20	-	LOW

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Alien and invasive plant species	• Disturbance could see an increase of alien invasive plant species at disturbed areas	2	4	2	3	3	3	45	-	HIGH	• A Rehabilitation Management Plan must be developed and implemented during the construction phase as construction is complete at each site. • The number of roads should be reduced to the minimum possible and routes should also be adjusted to avoid areas of high sensitivity as far as possible. Where possible, existing roads must be used to avoid additional habitat loss and fragmentation. • Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However, caution should be exercised to avoid using material that might entangle fauna. • An Environmental Control Officer (ECO) must be appointed to monitor the clearing of vegetation for the construction of roads and hardstands. • A comprehensive Plant Search and Rescue Operation must be undertaken by a suitably qualified botanical specialist prior to vegetation clearance during the construction phase, specifically related to permit applications and locating all individuals of SCC within the development footprint. • All relevant plant permits must be obtained from the provincial authority prior to the removal or relocation of SCC, including provincially protected species. • K. carolinensis must be protected in situ and a 200m buffer must be implemented where no construction activities take place. • Rehabilitate construction areas not part of operational phase (such as laydown areas, roads) according to rehabilitation plan. • Replanting of protected SCC as part of rehabilitation efforts post-construction. • A site-specific Alien Invasive Species (AIS) Management Plan must be implemented during the construction phase and continued monitoring and eradication needs to take place throughout the life of the project. • Alien vegetation, within the development footprints, should be removed from the site and disposed of at a registered waste disposal site. • The development footprints and immediate surroundings should be monitored for the growth/regrowth of alien vegetation throughout the construction and operation phases of the project. • Soil Erosion and Rehabilitation Plan to be part of the EMPr. • The clearance of vegetation, at any given time, must be kept to a minimum to reduce the possibility of soil erosion. This is especially relevant in areas with a slope where surface water runoff is generally higher. • Rehabilitation of eroded areas on a regular basis during the construction period.	1	2	2	2	2	2	18	-	LOW
Increased risk of erosion and flash floods	• Disturbance would leave the site vulnerable to wind and water erosion.	2	3	2	3	3	3	39	-	MEDIUM		2	2	2	2	2	2	20	-	LOW
Disturbances or displacement impacts on fauna including traffic, noise and dust	• Could result in an increase in noise and dust within the proposed site and surrounds which could have negative impacts on faunal activity including breeding and feeding	2	3	2	3	3	3	39	-	MEDIUM		1	2	2	2	2	2	18	-	LOW

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											• All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.									
Agricultural																				
Soil as a Resource	• Loss of topsoil as a resource – Contamination, Disturbance, Erosion, and Compaction	2	3	2	3	4	3	42	-	MEDIUM	• Ensure proper storm water management designs are in place; • If any erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; • If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; • Only the designated access routes are to be used to reduce any unnecessary compaction; • Compacted areas are to be ripped to loosen the soil structure; • The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; • Topsoil stockpiles are to be kept to a maximum height of 4m; • Topsoil is to be stripped when the soil is dry, as to reduce compaction; • Bush clearing contractors will only clear bushes and trees larger than 1m the remaining vegetation will be stripped with the top 0.3 m of topsoil to conserve as much of the nutrient cycle, organic matter, and seed bank as possible (only after alien vegetation has been removed); • The subsoil approximately 0.3 – 0.6 m thick will then be stripped and stockpiled separately; • The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate significantly; • Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; • Topsoil stockpiles should only be used for the rehabilitation of the area; • The stockpiles will be vegetated in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil. • Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks; • If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities; • All vehicles are to be serviced in a correctly bunded area or at an off-site location; • Leaking vehicles will have drip trays place under them where the leak is occurring;	2	3	1	3	2	3	33	-	MEDIUM
High Value Land Capability	• Loss of Land Capability	2	4	2	2	4	3	42	-	MEDIUM		2	3	2	2	2	3	33	-	MEDIUM
Agricultural Resources	• Loss of Agricultural Resources and Infrastructure	2	4	2	1	2	2	22	-	LOW		2	2	2	1	2	2	18	-	LOW
Alternative Substation: Soil as a Resource	• Loss of topsoil as a resource – Contamination, Disturbance, Erosion, and Compaction	2	4	2	3	4	4	60	-	HIGH		2	3	1	3	2	3	33	-	MEDIUM
Alternative Substation: High Value Land Capability	• Loss of Land Capability	2	4	2	2	4	4	56	-	HIGH		2	3	2	2	2	3	33	-	MEDIUM
Alternative Substation: Agricultural Resources	• Loss of Agricultural Resources and Infrastructure	2	4	2	1	2	3	33	-	MEDIUM		2	2	2	1	2	2	18	-	LOW
Avifaunal																				

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Habitat destruction	• Significant habitat loss (including foraging and breeding) and fragmentation due to displacement (avoidance of disturbance) because of infrastructure installation (panels, powerlines, roads, fences and sub surface cables) and associated dust effects. Habitat loss has the tendency to not only destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.	3	4	3	4	2	3	48	-	HIGH	Impacts associated with the loss of bird foraging habitat due to construction activity cannot be mitigated in relation to the majority of the habitats but can be mitigated by avoiding avifaunal specific highly sensitive areas and their associated buffers, such as the local drainage lines, impoundments, smaller watercourses, high value sandy dunes, pans and rocky koppies. The overall severity of the impact can be reduced to being insignificant if avoidance mitigation is applied related to the positioning of the panels and supporting infrastructure and minimisation mitigation is applied. Finally, and for all panel infrastructure, commencement of construction should be, if possible, limited to the months of December, January, February, March, April, May, September, October, November (latest) to minimise dust effects and subsequent destruction of the avifaunal habitats, especially during foraging and breeding season. **For detailed wetland specific mitigation measures, refer to Section 5.3 below.**	2	2	2	2	4	2	24	-	MEDIUM
Disturbance of bird roosting and breeding sites	• The destruction or disturbance of bird roosts during the construction phase	3	4	3	4	2	3	48	-	HIGH	As with other impacts, this impact can be mitigated by preferably timing construction to May, June, July and August in order to avoid breeding periods of species within the sensitive drainage lines, wetlands and the general region. If construction takes place outside of May, June, July and August, all noise generated by machinery and maintenance operations must be kept to a minimum.	2	3	2	2	2		22	-	LOW
Disturbance due to noise such as, machinery movements and maintenance operations	• Disturbance (including of nesting SCC) due to noise such as, machinery movements and maintenance operations during the construction phase the proposed PV solar farm causing loss of offspring for a generation.	3	3	1	2	3	3	36	-	MEDIUM	As with other impacts, this impact can be mitigated by preferably timing construction to May, June, July and August in order to avoid breeding periods of species within the sensitive drainage lines, wetlands and the general region. If construction takes place outside of May, June, July and August, all noise generated by machinery and maintenance operations must be kept to a minimum.	3	2	1	2	3	2	22	-	LOW
Heritage																				
Impacts to archaeological heritage resources	• Construction activities that take place near to archaeological resources may result in their destruction.	1	4	4	4	4	4	68	-	VERY HIGH	No development activities should take place within the high archaeological sensitivity area identified. Should any previously unknown archaeological resources be impacted during construction, work must cese in the vicinity of the find and the relevant heritage authority must be contacted	1	1	4	4	4	1	14	-	LOW
Impacts to palaeontological resources	• Construction activities that take place near to palaeontological resources may result in their destruction.	1	2	4	4	4	1	15	-	LOW	Implementation of the Chance Fossil Finds Protocol	1	2	4	4	4	1	15	-	LOW

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Impacts to the cultural landscape	• Construction activities that take place near to cultural landscape elements may result in their destruction.	1	2	1	3	1	3	24	-	MEDIUM	Implementation of the recommendations included in the VIA	1	1	4	1	4	1	11	-	LOW
Social																				
Direct and Indirect economic benefits due to the investment in construction and manufacturing of the infrastructure and installations.	• Economic multiplier effects from the use of local goods and services during the construction phase. The economic benefits through investment into capital construction and infrastructure and equipment manufacturing leads to growth in the national GGP, Income and production output of the private and government sectors.	4	4	1	1	1	2	22	+	LOW	• Not applicable	4	4	1	1	1	2	22	+	LOW
Employment opportunities during construction with accompanying skills development.	• Construction of the project will result in the creation of several direct and indirect employment opportunities, which will contribute towards lessening the unemployment levels within the area and aid in skills development of communities in the area.	2	4	1	1	1	2	18	+	LOW	• Skills development during construction of local employees	2	4	1	1	3	2	22	+	LOW
Influx of job seekers	• An influx of people into the area leading to a temporary increase in social disruption, pressures on basic services change in social dynamics, increase in HIV, pregnancies, and drug abuse.	2	2	2	1	1	2	16	-	LOW	• Management of the recruitment practices to avoid an influx of persons seeking employment. Community information and training concerning the project and recruitment requirements.	2	2	2	1	1	2	16	-	LOW
Temporary increase in safety, security and uncontrolled fire risks	• Temporary increase in safety and security concerns associated with the influx of people during the construction phase. An influx of job seekers, and or construction workers to an area is a contributor to increased criminal activities in an area, such as increased safety and security risk for neighbouring properties and damage to property, increased risk of veld fire, stock theft and crime etc.	2	3	2	1	1	2	18	-	LOW	• Integrate the site security systems in the regional and farmer security processes, systems and networks.	2	3	2	1	1	2	18	-	LOW
Temporary increase in traffic disruptions and movement patterns	• Temporary increase in traffic disruptions and movement patterns during construction. Increased traffic due to construction vehicles and heavy vehicles could cause disruptions to road users and increase safety hazards. The use of local roads and transportation systems may cause road deterioration and congestion.	2	3	2	1	1	2	18	-	LOW	• Driver training and local traffic management systems	2	3	2	1	1	2	18	-	LOW

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Nuisance impacts in terms of temporary increase in noise and dust	• Nuisance impacts in terms of temporary increase in noise and dust, and wear and tear on access roads to the site. Impacts associated with construction related activities include noise, dust and disruption or damage to adjacent properties. Site clearing activities increase that risk of dust and noise being generated, which can in turn negatively impact on adjacent properties.	2	3	2	1	1	2	18	-	LOW	• Use of dust management practices during construction	2	3	2	1	1	2	18	-	LOW
Transportation																				
Normal Load Traffic	• Increase in normal load traffic	2	4	1	2	1	3	30	-	MEDIUM	• Group transportation of staff and labour • Stagger the delivery of materials, plant and components • Construction of an on-site concrete batching plant to reduce trips	2	4	1	2	1	2	20	-	LOW
	• Increase of incidents with pedestrians	2	4	2	4	1	2	26	-	MEDIUM	• Maintain verges of access and internal roads to provide safe walking space • Implementation of pedestrian safety initiatives	2	3	2	4	1	1	12	-	LOW
	• Increased need for road maintenance	2	3	2	2	2	2	22	-	LOW	• Implement a road maintenance program under the auspices of the Mpumalanga Department of Transport	2	3	2	2	1	2	20	-	LOW
Abnormal Loads	• Additional Abnormal Loads	3	2	1	2	1	1	9	-	LOW	• Schedule abnormal load transportation for off-peak periods • Stagger the delivery of abnormal loads • Adequate enforcement of traffic laws and Abnormal Load permit conditions	3	2	1	2	1	1	9	-	LOW
Access and Internal Roads	• Need for new / Upgraded Access points	1	4	1	2	1	1	9	-	LOW	• Adequate road signage according to the SARTSM • Designs to be undertaken by a registered civil engineering professional • Approval from the Mpumalanga Department of Transport and SANRAL	1	4	1	2	1	1	9	-	LOW
Glint and Glare																				
None identified																				
Visual																				
Loss of Landscape Resources	• Drainage lines and wetland features are located on the site that are a key factor that define the local landscape resources. As these areas are excluded, the rural agrarian landscape integrity is retained.	1	3	2	2	3	3	33	-	MEDIUM	• Some steeper areas (less than 1 in 10m) are used for PV development and soil erosion management on these areas is important.	1	3	2	2	3	2	22	-	LOW

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Wind blown dust	• Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	1	4	1	2	1	2	18	-	LOW	• Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC.	1	2	1	1	1	1	6	-	LOW
Dust from moving vehicles	• Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site.	2	4	2	2	1	3	33	-	MEDIUM	• Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC.	2	2	1	2	1	1	8	-	LOW
Buildings, structures and finishings	• Buildings painted bright colours can increase the visual presence of the structures in a rural landscape, creating higher levels of visual contrast and attracting the attention of the causal observer.	1	3	1	2	1	2	16	-	LOW	• The buildings should be painted a grey-brown colour (or other colour in keeping with the surrounding landscape) to assist in reducing colour contrast. Sheet metal structures should make use of mid-grey colour, and preferable have a rough texture material.	1	2	1	1	1	1	6	-	LOW
Litter	• Litter has the potential to degrade landscape character and can be contained by fencing around the construction camp/ laydown.	1	2	1	2	1	1	7	-	LOW	• Littering should be a finable offence. Fencing around the laydown should be diamond shaped to catch wind blown litter. The fences should be routinely checked for the collection of litter caught on the fence.	1	1	1	1	1	1	5	-	LOW
Fencing	• Long fencing lines has the potential to be visually dominating, degrading the rural landscape sense of place.	1	3	2	2	3	2	22	-	LOW	• Fencing should be simple and appear transparent from a distance and located around the construction camp, not encircle the total project area.	1	1	1	1	1	1	5	-	LOW
Security Light Spillage at night (See Annexure)	• Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	2	3	1	2	1	2	18	-	LOW	• Light spillage mitigation from security lighting should be implemented and monitored by the ECO during construction to ensure that light spillage does not create a glowing effect. No overhead/ flood lighting of structures or areas. No up lighting to be used.	1	2	1	1	1	1	6	-	LOW
Un-necessary roads	• Un-necessary roads have the potential to create a visual disturbance long after the usage as past.	1	2	2	2	2	2	18	-	LOW	• Limit road access to an efficient minimum by coordinated planning between the project management and the environmental control officer. Temporary roads should be well marked and should only cross drainage lines on areas identified as permanent road features where erosion and soil loss management can be contained. Noncompliance with road signage and utilisation of no authorised roads should become a finable offence.	1	1	1	1	1	1	5	-	LOW
Alternative LILO, Substation, BESS and Laydown: Loss of Landscape Resources	• Moderate loss of landscape character due to existing rural farmlands in close proximity to the existing Eskom powerline and corridor where future powerline are most likely to be routed.	1	2	2	1	3	1	9	-	LOW	• Careful management of cut and fills to ensure that erosion does not take place and effective rehabilitation takes place post construction.	1	1	2	1	3	1	8	-	LOW

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Alternative LILO, Substation, BESS and Laydown: Wind blown dust	• Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	1	2	1	2	1	2	14	-	LOW	• Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC.	1	2	1	1	1	1	6	-	LOW
Alternative LILO, Substation, BESS and Laydown: Dust from moving vehicles	• Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site.	2	2	2	2	1	3	27	-	MEDIUM	• Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC.	2	2	1	2	1	1	8	-	LOW
Alternative LILO, Substation, BESS and Laydown: Buildings, structures and finishings	• Buildings painted bright colours can increase the visual presence of the structures in a rural landscape, creating higher levels of visual contrast and attracting the attention of the causal observer.	1	3	1	2	1	2	16	-	LOW	• The buildings should be painted a grey-brown colour (or other colour in keeping with the surrounding landscape) to assist in reducing colour contrast. Sheet metal structures should make use of mid-grey colour, and preferable have a rough texture material.	1	2	1	1	1	1	6	-	LOW
Alternative LILO, Substation, BESS and Laydown: Litter	• Litter has the potential to degrade landscape character and can be contained by fencing around the construction camp/ laydown.	1	2	1	2	1	1	7	-	LOW	• Littering should be a finable offence. Fencing around the laydown should be diamond shaped to catch wind blown litter. The fences should be routinely checked for the collection of litter caught on the fence.	1	1	1	1	1	1	5	-	LOW
Alternative LILO, Substation, BESS and Laydown: Fencing	• Long fencing lines has the potential to be visually dominating, degrading the rural landscape sense of place.	1	3	2	2	3	2	22	-	LOW	• Fencing should be simple and appear transparent from a distance and located around the construction camp, not encircle the total project area.	1	1	1	1	1	1	5	-	LOW
Alternative LILO, Substation, BESS and Laydown: Security Light Spillage at night (See Annexure)	• Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	2	3	1	2	1	2	18	-	LOW	• Light spillage mitigation from security lighting should be implemented and monitored by the ECO during construction to ensure that light spillage does not create a glowing effect. No overhead/ flood lighting of structures or areas. No up lighting to be used.	1	2	1	1	1	1	6	-	LOW

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		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S
Risk Assessment – Solid State Lithium-ion Battery Energy Storage System																		
Impact 1: Human Health - chronic exposure to toxic chemical or biological agents	Causes - Construction materials such as cement, paints, solvents, welding fumes, truck fumes etc. Consequences - Employee / contractor illness.	3	1	3	4	4	44	-	MEDIUM	• The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. SHEQ policy in place. A detailed construction Risk Assessment prior to work. SHE procedure in place. PPE to be specified. SHE appointees in place. Contractor's safety files in place and up to date. All necessary health controls/ practices to be in place, e.g., ventilation of welding and painting areas. SHE monitoring and reporting programs in place. Emergency response plan to be in place prior to beginning construction and to include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.	1	1	3	4	2	18	-	LOW
Impact 2: Human Health - exposure to noise	Causes - Drilling, piling, generators, air compressors. Consequences - Adverse impact on hearing of workers. Possible nuisance factor in near-by areas.	3	1	5	5	4	56	-	MEDIUM	• Health Risk Assessment to determine if equipment noise exceeds 85dB at workstation and 61dB at boundary of the site. OHS Act Noise Induced hearing Loss Regulations Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.	2	1	5	5	2	26	-	LOW
Impact 3: Human Health - exposure to temperature extremes and/or humidity	Causes - Heat during the day. Cold in winter. Consequence - Heat stroke. Hypothermia.	3	2	3	1	2	18	-	LOW	• Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. Adequate potable water for employees to be provided during all phases of the project. Bore hole, bowser and tank or small water treatment plant may be required to provide potable water for the BESS installation staff during all phases of the project.	2	2	3	1	1	8	-	LOW
Impact 4: Human Health - exposure to psychological stress	Causes - Large projects bring many contractor workers into a small, isolated community. Consequences – Lack of sufficient accommodation, entertainment etc. Increase in alcohol abuse, violence	2	3	3	2	2	20		LOW	• Refer to Social Specialist Study for this project.	2	3	3	2	2	20		LOW
Impact 5: Human Health - exposure to ergonomic stress	Causes - Lifting heavy equipment. Awkward angles during construction. Consequences - Back and other injuries.	4	1	3	2	3	30		LOW	• Training in lifting techniques. Ensure that despite the isolated location all the necessary equipment is available (and well maintained) during construction. Otherwise employees may revert to unsafe practices. Isolated location, maintenance of construction equipment to ensure safe operation is critical. Utilization of local service providers where possible. Ensure this is in place prior to project beginning. First aid provision on site.	4	1	3	2	2	20		LOW
Impact 6a: Human and Equipment Safety - exposure to fire radiation	Causes – Involvement in an external fire. Fire involving fuels used in construction vehicles or vehicles themselves (e.g., tyre fire). Fire due to uncontrolled welding or other hot-work	4	2	3	5	4	56	-	MEDIUM	• Fuels stored on site in dedicated, demarcated and bunded areas. Suitable fire-fighting equipment on site near source of fuel, e.g., diesel tank, generators, mess, workshops etc.	4	2	3	5	2	28	-	LOW

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		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S
	Consequences - Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire.									• The company responsible for the facility at this particular development stage is to have: 1. Emergency plan to be in place prior to commencement of construction. 2. Fuel spill containment procedures and equipment to be in place. 3. Hot-work permit and management system to be in place.								
Impact 6b: Human and Equipment Safety - exposure to fire radiation	Causes - Solid state battery containers damaged on route e.g., dropped in port (drops do happen about 1/2000 containers) and importing possibly < 30 containers for the site. With this it is possible, although unlikely, that one will be dropped, traffic accident on-route. Involvement in an external fire e.g., at the port or on route. Data indicates installed facility events are 0.001/year. Transport of 700 units per installation assumed to take 4 weeks each so f= 0.05 - once in 20 years so likelihood is moderate. Consequences – Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire (refer to noxious smoke in APPENDIX A below for the major impact).	5	2	5	5	4	68	-	HIGH	• Solid state battery design includes abuse tests such as drop test, impact, rapid discharge etc. Propagation tests for systems, e.g., heat insulating materials between cells/modules. Factory acceptance test prior to prior to leaving manufacture. Batteries are usually stored at 50% charge to prolong life but may be shipped fully discharged. This level of detail should be understood so as to assess the risk during transport and storage. The company responsible for the battery installation should ensure suitably competent transport companies are appointed. The company responsible for transportation should ensure: - Compliance with National Road Traffic Act regulation 8 – dangerous goods. - Port Authorities should be alerted to the overall project and the hazardous nature of the contents of battery containers being imported. Note. If, as per one of the typical suppliers (Tesla) indications, the containers are classified as IMDG Class 9 – the containers will not receive any special care in the ports and may be stored next to flammables. Port emergency response in particular need training on mitigating battery hazards. Prior to bringing any containers into the country, the company responsible for the battery installation (possibly via appointed contractors) should ensure that an Emergency response plan is in place for the full route from the ship to the site. Drivers trained in the hazards of containerized batteries. • The Emergency plan must determine and address: - What gases would be released in a fire and are there inhalation hazards. - Extinguishing has two important elements, put out fire and to provide cooling. Different approaches may be needed for small fire – e.g., put out, and for large fires e.g., cool with copious quantities of water. Note inert gases and foam may put out the initial fire but fail to control thermal runaway or to cool the batteries resulting in reignition. - What initial fire extinguishing medium should be used. - Whether there are any secondary gases or residues from use of extinguishers. - If water is appropriate, determine if the system needs outside connections to sprinklers inside the container. - First responders need to know what media to use, especially if water totally unsuitable and if there are no connection points for water etc. - Must the container be left unopened or opened. - PPE to be specified including possible exposure to chemicals and fumes as well as radiate heat. - Containment of residues/water/damaged equipment. - Suitable safe making and disposal plan for after the event i.e. how do responders deal with partially charged damage units, contaminated surfaces (e.g., HF residues).	5	2	5	5	1	17	-	LOW

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		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S
Impact 7: Human and Equipment Safety - exposure to explosion over pressures	Causes - With solid state lithium containers, flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static. Consequences - Potential fatalities amongst first responders. Damage to container, transport truck or other nearby items, e.g., other container in the port.	5	4	5	5	3	57	-	MEDIUM	• During transport this is only likely to happen due to possible inappropriate emergency response, e.g., opening containers when they may be the type that should be left to burn out. For simplicity one transport route would be preferable. The route needs to be assessed in terms of responding local services, rest places for drivers, refuelling if required, break down services available etc. Once an import route has been chosen, e.g., Richards Bay or Durban and along N2/N3/N11 etc, then the appointed transport company should ensure key emergency services on route could be given awareness training in battery fire/accident response. Emergency response planning and training referred to above may be important for key locations such as the mountain passes / tunnels.	5	4	5	5	1	19	-	LOW
Impact 8a: Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc	4	2	3	2	3	33	-	MEDIUM	• All necessary good hygiene practices to be in place, e.g., provision of toilets, eating areas, infectious disease controls. Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others. Awareness training for persons on site, safety induction to include animal hazards. First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. Due to isolated locations some distance from town, ensure the ability to treat with anti-venom and extreme allergic reactions on site.	3	2	3	2	2	20	-	LOW
Impact 8b: Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes - Damaged solid-state batteries release fumes, leak electrolyte, are completely broken exposing hazardous chemicals. Thermal runaway and hazardous fumes released. Consequences - Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns or lung damage.	4	3	3	5	3	45	-	MEDIUM	• Appointed transport company to ensure transport in accordance with Regulation 8 of the National Road Traffic Act 93 of 1996, Dangerous Goods. Not permitted to transport prescribed goods in manner not consistent with the prescriptions, e.g., consignor and consignee responsibilities. Prescription found in SANS 10228/29 and international codes for battery transport etc. Transport in sealed packages that are kept upright, protected from movement damage etc. Also packaged to ensure no short-circuiting during transport. Transport to prevent excessive vibration considerations as battery internal may be damaged leading to thermal run-away during commissioning. Pre-assembled containers will most likely be supplied. These will be fitted with the necessary protective measures by the supplier considering marine and road transport as well as lifting, setting down etc. Route selection to consider possible incidents along the way and suitable response, e.g., satellite tracking, mobile communication, 24/7 helpline response. Standard dangerous goods requirements for Hazmat labels, Trem cards, driver trained in the hazards of the load. Likelihood similar to fire above.	4	3	3	5	2	30	-	LOW
Impact 9: Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Causes - Construction moving equipment, heavy loaded, elevated loads, working at heights	5	1	5	5	4	64	-	HIGH	• The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. SHEQ policy in place. A detailed construction Risk Assessment prior to work. SHE procedure in place. PPE to be specified. SHE appointees in place. Contractors safety files in place and up to date. SHE monitoring and reporting programs in place. Standard construction site rules	5	1	5	5	1	16	-	LOW

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		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S
	Consequences - Injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses									regarding traffic, reversing sirens, rigging controls, cordoning off excavations etc. Civil and building structures to National Building Regulations and building Standards Act 103 of 1977 SANS 10400 and other relevant codes. Other constructions such as roads, sewers etc also to relevant SANS standards. All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations etc to be in place before construction begins. Emergency response plan to be in place before construction begins.								
Impact 10: Human and Equipment Safety - exposure to electromagnetic waves	Causes - Use of electrical machines, generators etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage electrical equipment.	5	2	5	5	3	51	-	MEDIUM	• Standard maintenance of condition of electrical equipment and safe operating instructions. Ability to shut off power to systems in use on site. If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge, installations to be suitably designed and maintained. Lightning strike rate in the study area is high. Outside work must be stopped during thunderstorms. Lighting conductors may be required for the final installation, to be confirmed during design phase.	5	2	5	5	1	17	-	LOW
Impact 11: Environment - emissions to air	Causes - Dust from construction and generally hot dry area. Consequences - Adverse impact on employee health.	3	2	1	1	4	28	-	LOW	• May need to use dampening on roads etc. as per normal construction practices. May need PPE (dust masks) for specific construction workers.	2	2	1	1	2	12	-	LOW
Impact 12: Environment - emissions to water	Causes - Diesel for equipment, paints and solvents. Transformer oil spills. Sewage and kitchen/mess area wastewater. Consequences - Environmental damage, particularly to the surface and underground water in the area.	2	2	3	2	3	27	-	LOW	• Normal construction site practices for preventing and containing fuels/paint/oil etc spills. Bunding under any temporary tanks, curbing under truck offloading areas and sealed surfaces (e.g., concrete) under truck parking area is particularly important. Spill clean-up procedures to be in place before commencing construction. Sewage and any kitchen liquids - containment and suitable treatment/disposal	2	2	3	2	2	18	-	LOW
Impact 13: Environment - emissions to earth	Causes - Mess area and other solid waste. Consequences - Environmental damage.	2	2	3	3	3	30	-	LOW	• There will be packaging materials that will need to be disposed of after the entire system is connected and commissioned as well as after regular maintenance. There will need to be waste segregation (e.g., electronic equipment, chemicals) and management on the site.	2	2	3	2	2	18	-	LOW
Impact 14: Environment - waste of resources e.g., water, power etc	Causes - Water usage not controlled. Battery containers damaged. Consequences - Delays.	1	1	1	2	4	20	-	LOW	• Water usage to be monitored on site during construction. Handling protocols to be provided by battery supplier. End of Life plan needs to be in place before any battery containers enter the country as there may be damaged battery unit from day 1. Water management plan and spill containment plans to be in place.	1	1	1	2	2	10	-	LOW
Impact 15: Public - Aesthetics	Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	2	2	3	3	3	30	-	LOW	• Refer to visual impact assessment.	2	2	3	3	3	30	-	LOW

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		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S
Impact 16: Investors - Financial	Causes - Defective technology. Extreme project delays. Consequences - Financial loss	5	1	3	4	3	39	-	MEDIUM	• Design by experienced contractors using internationally recognized and proven technology. Project management with deviation monitoring.	3	1	3	4	2	22	-	LOW
Impact 17: Employees and investors - Security	Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	4	1	3	2	4	40	-	MEDIUM	• Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g., Skull and Cross Bones or other signs. Isolated location both helps and hinders security. Night lighting to be provided both indoors and outdoors where necessary.	3	1	3	2	3	27	-	LOW
Impact 18: Emergencies	Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	4	2	3	5	4	56	-	MEDIUM	• Emergency procedures need to be practiced prior to commencement of construction. If batteries are stored at 50% charge, thermal run away can happen while in storage on site waiting for installation. In addition, if involved in an external fire thermal run away can happen even with uncharged batteries. Except during shipping, ideally the units should not be stored any closer to each other than they would be in the final installation so that propagation is prevented, i.e. laydown area needs to be considered. The company in charge of the containers at each stage in the transport process needs to be very clear so that responsibility for the integrity of the load and protection of the persons involved in transfer and coordination of emergency response on-route. E.g., if purchased from Tesla where does hand over occur to the South African contractor / owner, at the factory door in USA, at the port in RSA, at the site fence. For example, who will be accountable if there's thermal runway event on a truck with a container that stops in a small town for driver refreshments	4	2	3	5	2	28	-	LOW
Impact 19: Investors - Legal	Causes Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using "cheaper supplier or less developed technology".	3	1	3	3	4	40	-	MEDIUM	• Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. Ensure only state of the art battery systems are used and not old technologies prone to fires/explosions etc.	2	1	3	3	2	18	-	LOW
Vanadium Redox Flow Battery Energy Storage Systems																		
Impact 1: Human Health - chronic exposure to toxic chemical or biological agents	Causes - Construction materials such as cement, paints, solvents, welding fumes, truck fumes etc. Consequences - Employee / contractor illness.	-	1	3	4	4	44	-	MEDIUM	• The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. SHEQ policy in place. A detailed construction Risk Assessment prior to work. SHE procedure in place. PPE to be specified. SHE appointees in place. Contractor's safety files in place and up to date. All necessary health controls/ practices to be in place, e.g., ventilation of welding and painting areas. SHE monitoring and reporting programs in place. Emergency response plan to be in place prior to beginning construction and to	1	1	3	4	2	18	-	LOW

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		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S
										include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.								
Impact 2: Human Health - exposure to noise	Causes - Drilling, piling, generators, air compressors. Consequences - Adverse impact on hearing of workers. Possible nuisance factor in near-by areas.	3	1	5	5	4	56	-	MEDIUM	• Health Risk Assessment to determine if equipment noise exceeds 85dB at workstation and 61dB at boundary of the site. OHS Act Noise Induced hearing Loss Regulations. Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.	2	1	5	5	2	26	-	LOW
Impact 3: Human Health - exposure to temperature extremes and/or humidity	Causes - Heat during the day. Cold in winter. Consequence - Heat stroke. Hypothermia.	3	2	3	1	2	18	-	LOW	• Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. Adequate potable water to be provided during all phases of the project. Bore hole, bowser and tank or small water treatment plant may be required to provide potable water for the employees during all phases of the project.	2	2	3	1	1	8	-	LOW
Impact 4: Human Health - exposure to psychological stress	Causes - Large projects bring many contractor workers into a small, isolated community. Consequences – Lack of sufficient accommodation, entertainment etc. Increase in alcohol abuse, violence	2	3	3	2	2	20	-	LOW	• Refer to Social Specialist Studies for this project.	2	3	3	2	2	20	-	LOW
Impact 5: Human Health - exposure to ergonomic stress	Causes - Lifting heavy equipment. Awkward angles during construction. Consequences - Back and other injuries.	4	1	3	2	3	30	-	LOW	• Training in lifting techniques. Ensure that despite the isolated location all the necessary equipment is available (and well maintained) during construction. Otherwise employees may revert to unsafe practices. Isolated location, maintenance of construction equipment to ensure safe operation is critical. Utilization of local service providers where possible. Ensure this is in place prior to project beginning. First aid provision on site.	4	1	3	2	2	20	-	LOW
Impact 6: Human and Equipment Safety - exposure to fire radiation	Causes – Involvement in an external fire. Fire involving fuels used in construction vehicles or vehicles themselves (e.g., tyre fire). Fire due to uncontrolled welding or other hot-work Consequences - Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire.	4	2	3	5	4	56	-	MEDIUM	• Fuels stored on site in dedicated, demarcated and bunded areas. Suitable fire-fighting equipment on site near source of fuel, e.g., diesel tank, generators, mess, workshops etc. • The company responsible for the facility at this stage is to have: 1. Emergency plan to be in place prior to commencement of construction. 2.Fuel spill containment procedures and equipment to be in place. 3. Hot-work permit and management system to be in place.	4	2	3	5	2	28	-	LOW
Impact 7: Human and Equipment Safety - exposure to explosion over pressures	No credible causes	1	1	1	1	1	4	-	N/A	• No credible causes, hence no mitigation necessary.	1	1	1	1	1	4	-	N/A

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		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S
Impact 8a: Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc	4	2	3	2	3	33	-	MEDIUM	• All necessary good hygiene practices to be in place, e.g., provision of toilets, eating areas, infectious disease controls. Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others. Awareness training for persons on site, safety induction to include animal hazards. First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. Due to isolated locations some distance from town, ensure the ability to treat with anti-venom and extreme allergic reactions on site.	3	2	3	2	2	20	-	LOW
Impact 9: Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Causes - Construction moving equipment, heavy loaded, elevated loads, working at heights Consequences - Injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses	5	1	5	5	4	64	-	HIGH	• The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. SHEQ policy in place. A detailed construction Risk Assessment prior to work. SHE procedure in place. PPE to be specified. SHE appointees in place. Contractors safety files in place and up to date. SHE monitoring and reporting programs in place. Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations etc. Civil and building structures to National Building Regulations and building Standards Act 103 of 1977 SANS 10400 and other relevant codes. Other constructions such as roads, sewers etc also to relevant SANS standards. All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations etc to be in place before construction begins. Emergency response plan to be in place before construction begins.	5	1	5	5	1	16	-	LOW
Impact 10: Human and Equipment Safety - exposure to electromagnetic waves	Causes - Use of electrical machines, generators etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage electrical equipment.	5	2	5	5	3	51	-	MEDIUM	• Standard maintenance of condition of electrical equipment and safe operating instructions. Ability to shut off power to systems in use on site. If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge, installations to be suitably designed and maintained. Lightning strike rate in the study area is high. Outside work must be stopped during thunderstorms. Lighting conductors may be required for the final installation, to be confirmed during design phase.	5	2	5	5	1	17	-	LOW
Impact 11: Environment - emissions to air	Causes - Dust from construction and generally hot dry area. Consequences - Adverse impact on employee health.	3	2	1	1	4	28	-	LOW	• May need to use dampening on roads etc. as per normal construction practices. May need PPE (dust masks) for specific construction workers.	2	2	1	1	2	12	-	LOW
Impact 12: Environment - emissions to water	Causes - Diesel for equipment, paints and solvents. Transformer oil spills. Sewage and kitchen/mess area wastewater. Consequences - Environmental damage, particularly to the surface and underground water in the area.	2	2	3	2	3	27	-	LOW	• Normal construction site practices for preventing and containing fuels/paint/oil etc spills. Bunding under any temporary tanks, curbing under truck offloading areas and sealed surfaces (e.g., concrete) under truck parking area is particularly important. Spill clean-up procedures to be in place before commencing construction. Sewage and any kitchen liquids - containment and suitable treatment/disposal	2	2	3	2	2	18	-	LOW

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		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	Dx	P	S	TOTAL STATUS (+ OR -)	S
Impact 13: Environment - emissions to earth	Causes - Mess area and other solid waste. Consequences - Environmental damage.	2	2	3	3	3	30	-	LOW	• There will be packaging materials that will need to be disposed of after the entire system is connected and commissioned as well as after regular maintenance. There will need to be waste segregation (e.g., electronic equipment, chemicals) and management on the site.	1	2	3	3	2	18	-	LOW
Impact 14: Environment - waste of resources e.g., water, power etc	Causes - Water usage not controlled. Battery equipment damaged. Consequences - Delays.	1	1	1	2	4	20	-	LOW	• Water usage to be monitored on site during construction. Handling protocols to be provided by battery supplier. Water management plan and spill containment plans to be in place.	1	1	1	2	2	10	-	LOW
Impact 15: Public - Aesthetics	Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	3	2	3	4	4	48	-	MEDIUM	• Visual impact assessment to include BESS installation when design details become available. Confirm any height limitations for VRFB BESS building (if utility scale)	1	2	3	4	2	20	-	LOW
Impact 16: Investors - Financial	Causes - Defective technology. Extreme project delays. Consequences - Financial loss	5	1	3	4	3	39	-	MEDIUM	• Design by experienced contractors using internationally recognized and proven technology. Project management with deviation monitoring.	3	1	3	4	2	22	-	LOW
Impact 17: Employees and investors - Security	Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	4	1	3	2	4	40	-	MEDIUM	• Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g., Skull and Cross Bones or other signs. Isolated location both helps and hinders security. Night lighting to be provided both indoors and outdoors where necessary.	3	1	3	2	3	27	-	LOW
Impact 18: Emergencies	Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	4	2	3	4	3	39	-	MEDUIM	• Emergency procedures need to be practiced prior to commencement of construction.	4	2	3	4	2	26	-	LOW
Impact 19: Investors - Legal	Causes Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using “cheaper supplier or less developed technology”.	3	1	3	3	4	40	-	MEDIUM	• Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. Ensure only state of the art battery systems are used and not old technologies prone to fires/explosions etc.	2	1	3	3	2	18	-	LOW

15.1.3 Operational Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Aquatic																				
Changes in sediment entering and exiting the system.	Changes in sediment regimes of the aquatic ecosystem and its sub -catchment by for example sand movement, meandering river mouth /estuary, changing flooding or sedimentation patterns. Construction and maintenance activities will result in earthworks and soil disturbance as well as the disturbance of natural vegetation. This could result in the loss of topsoil, sedimentation of the watercourses and pan and increase the turbidity of the water. Possible sources of the impacts include: • Earthwork activities during construction • Clearing of surface vegetation will expose the soils, which in rainy events would wash through the watercourse, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees can spread easily into these eroded soil. • Disturbance of soil surface • Disturbance of slopes through creation of roads and tracks adjacent to the watercourse • Erosion (e.g. gully formation, bank collapse)	3	2	2	2	2	2	22	-	MEDIUM	• Sediment control should be effective and not allow any release of sediment pollution downstream. This should be audited on a monthly basis to demonstrate compliance with upstream conditions. • Monitoring should be done to ensure that sediment pollution is timeously addressed	2	2	2	2	2	2	20	-	LOW
Changes in water flow regime	Changes to hydrological function at a landscape level 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). The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary, seasonal, permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). Changes to base flows (e.g. too little/too much water in terms of characteristics and requirements of system). Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal). The sources of this impact include the compaction of soil, the removal of vegetation, surface water redirection, changes to watercourse morphology or input of high energy surface water which could occur during construction and operation of the solar plant	3	2	2	2	2	2	22	-	MEDIUM	• Do not permit vehicular or pedestrian access into natural areas or into seasonally wet areas during and immediately after rainy periods, until such a time that the soil has dried out • Rehabilitation plans must be submitted and approved for rehabilitation of damage during the construction phase and that plan must be implemented immediately upon completion of construction. • Effective control of stormwater from access roads should be undertaken • Effective culverts should be incorporated into the design of access roads. • Where development activities are located upslope from wetlands, effective stormwater management should be a priority during both construction and operational phase. This should be monitored as part of the EMP.	2	2	2	2	2	2	20	-	LOW
Introduction and spread of alien vegetation	The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles. Invasions of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse, and outcompete natural vegetation,	3	2	2	2	2	2	22	-	MEDIUM	• Long-term monitoring for the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish, as specified in the Alien Vegetation Management Pan	2	2	2	2	2	2	20	-	LOW

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		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
	decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plans can easily colonise and impact on downstream users.										• Undertake an Alien Plant Control Plan which specifies actions and measurable targets • Rehabilitate or revegetate disturbed areas • Acquire the necessary equipment for removal and control • Planned sequence of areas to be cleared of invasive plants • A register of the methods used, dates undertaken, as well as herbicides and dosage used must be kept and available on site. The register must also include incidents of poisoning or spillage • Ensure that contractors can identify the relevant plants and are aware of the removal procedures • Construction equipment must be cleaned prior to site access. This will prevent alien invasive seed from other sites to spread into disturbed soils • Manual removal methods are preferred to chemical control • Rehabilitate or revegetate disturbed areas.									
Changes in water quality due to pollution	Construction and operational activities may result in the discharge of solvents and other industrial chemicals, leakage of fuel/oil from vehicles and the disposal of sewage resulting in the loss of sensitive biota in the wetlands/rivers and a reduction in watercourse function. Chemical and Thermal Pollution: Potential risk of chemical pollution from storage and handling of chemicals used for panel cleaning or maintenance. Additionally, solar plants with concentrated solar power (CSP) technology may release heated water into nearby water bodies, leading to thermal pollution and potential impacts on aquatic organisms	3	2	2	2	2	2	22	-	MEDIUM	• Independent water quality analyses should be undertaken annually, or as specified by an aquatic specialist, to demonstrate and audit compliance of effective pollution control measures • A detailed rehabilitation plan should be drawn up with the input from a water quality, soil contamination assessment and ecologist should any spills occur. • It should be ensured that regular maintenance takes place to prevent failure of any infrastructure associated with the proposed decommissioning • Incorporation of phytoremediation into the storm water attenuation systems to facilitate nutrient reduction, sediment regime control and manage toxicants releases. • Provide training to personnel involved in the solar plant's operation and maintenance on best practices for water quality protection. Promote awareness and understanding of the potential impacts of the solar plant on water quality and the importance of adhering to mitigation measures • Ensure that no decommissioning activities impact on the watercourse or buffer area. This includes edge effects.	2	2	2	2	2	2	20	-	LOW
Loss of aquatic biota	Loss of instream habitat, deposition of wind-blown sand, loss of fringing vegetation and erosion, alteration in base flow, natural fire regimes and subsequent loss of non-marginal and marginal vegetation. Increase in invasive species due to disturbance. Change in water quality. Changes in flow. Loss and disturbance of biota due to direct development on the watercourse as well as changes in habitat including water quality, the water column, increased sediment, increased alien vegetation fire regime and habitat fragmentation	3	2	2	2	2	2	22	-	MEDIUM	• Implement weed control in aquatic ecosystem and buffer zones. • Monitor the establishment of alien invasive species within the areas affected by the construction and maintenance of the proposed infrastructure and take immediate corrective action where invasive species are observed to establish. • Identify and protect important habitats for aquatic biota, such as wetlands, rivers, and streams, within and near the solar plant site. Implement habitat restoration projects to enhance and create suitable habitats for aquatic organisms. • Implement measures to maintain and improve water quality, such as implementing erosion control practices, managing stormwater runoff, and reducing the discharge of pollutants into water bodies. Regular monitoring of water quality parameters	2	2	2	2	2	2	20	-	LOW

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											should be conducted to ensure compliance with standards and prompt identification of any issues									
Loss and disturbance of watercourse habitat and fringe vegetation	Loss and disturbance of watercourse habitat and fringe vegetation due to direct development on the watercourse as well as changes in management, fire regime and habitat fragmentation	3	2	2	2	2	2	22	-	MEDIUM	• Monitor rehabilitation and the occurrence of erosion twice during the rainy season for at least two years and take immediate corrective action where needed. • Implement sediment and erosion control measures to prevent sediment runoff from construction activities into watercourses. This can include sediment barriers, sediment ponds, and erosion control blankets to protect the water quality and vegetation along the watercourses • Establish a monitoring program to assess the effectiveness of mitigation measures and monitor the condition of watercourses and fringe vegetation during and after construction	2	2	2	2	2	2	20	-	LOW
Terrestrial																				
Direct faunal impacts	Displacement and/or disturbance of fauna communities	2	4	3	3	3	3	45	-	HIGH	• Reduce the presence of human activity on the project area as far as possible by only focusing on the areas where operational tasks are required, • avoid the presence of people and vehicles in highly sensitive areas as far as possible, • no unauthorised persons should be allowed onto the site, • any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities must be removed to a safe location. A specialist or trained animal handler (especially when working with dangerous animals) must be contacted, • lower the levels of noise whenever possible and avoid the destruction or disturbance of identified important features, • The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone except by individuals with the appropriate permits obtained from the relevant competent authorities, • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill, • fences should be constructed in such a way so that burrowing animals can still gain access, which will allow other animals to also utilise the holes dug under fences to increase connectivity in the area. • The site-specific AIS Management Plan must be implemented for the first year of the operational phase. Thereafter, alien vegetation must continue to be monitored and eradicated annually throughout the life of the project. • Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem species are	1	3	2	2	2	2	20	-	LOW
Alien and invasive plant species	Re-establishment of secondary vegetation cover and establishment of alien species	2	4	3	3	3	3	45	-	HIGH		1	2	2	2	2	2	18	-	LOW

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											already present in the area and are likely to increase rapidly if not controlled. • Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible. • Alien vegetation, within the development footprints, should be removed from the site and disposed of at a registered waste disposal site.									
Agricultural																				
Soil as a Resource	Loss of topsoil as a resource – Contamination, Disturbance, Erosion, and Compaction	2	4	2	3	3	2	28	-	MEDIUM	• Ensure proper storm water management designs are in • place; • If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; • If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; • Only the designated access routes are to be used to reduce any unnecessary compaction; • Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; • Implement land rehabilitation measures; • Follow rehabilitation guidelines; • The topsoil should be moved by means of an excavator bucket, and loaded onto dump trucks; • Topsoil is to be moved when the soil is dry, as to reduce compaction; • Topsoil to be replaced for rehabilitation purposes; • The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; and • Topsoil stockpiles should only be used for the rehabilitation of the area; • Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks; • If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities; • All vehicles are to be serviced in a correctly bunded area or at an off-site location; • Leaking vehicles will have drip trays place under them where the leak is occurring;	2	3	2	3	3	2	26	-	MEDIUM
High Value Land Capability	Loss of Land Capability	2	4	2	2	4	2	28	-	MEDIUM		3	3	2	2	3	2	26	-	MEDIUM
Agricultural Resources	Loss of Agricultural Resources and Infrastructure	2	4	2	1	2	2	22	-	LOW		2	2	2	1	2	2	18	-	LOW
Alternative substation: Soil as a Resource	Loss of topsoil as a resource – Contamination, Disturbance, Erosion, and Compaction	2	4	2	3	3	2	28	-	MEDIUM		2	3	2	3	3	2	26	-	MEDIUM
Alternative substation: High Value Land Capability	Loss of Land Capability	2	4	2	2	4	2	28	-	MEDIUM		3	3	2	2	3	2	26	-	MEDIUM
Alternative substation: Agricultural Resources	Loss of Agricultural Resources and Infrastructure	2	4	2	1	2	2	22	-	LOW		2	2	2	1	2	2	18	-	LOW
Avifauna																				
Disturbance due to noise such as, machinery movements and maintenance operations	Disturbance (including of nesting SCC) due to noise such as, machinery movements and maintenance operations during the construction phase the proposed PV solar farm causing loss of offspring for a generation.	3	3	1	2	1	2	20	-	LOW	No Mitigation Required	3	3	1	2	1	2	20	-	LOW

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Bird mortalities	Bird mortalities during the operational phase due to vehicle collisions, collisions with infrastructure and/or combustion.	3	4	3	4	2	3	48	-	HIGH	Impacts due to bird mortalities during the operational phase are practically unavoidable for any large facility, but with the appropriate mitigation measures these impacts can be minimised. It is likely that most of the avifaunal populations will be largely displaced from the majority of the project infrastructure, although significant risks are associated with the likelihood of project vehicles flushing birds into fencing infrastructure as well as collisions of large bodied species with powerlines. Although the current overall bird activity qualifies the proposed solar development boundary as a high-density area, there are certain times of the year (and day) when it appears that large flocks of birds (such as bustards and large birds of prey) are far more prevalent. All powerline infrastructure must be fitted with approved bird diverters in order to provide visibility for large-bodied birds. In all areas where service road intersects with semi natural or natural habitat, all fences that are constructed (if any) must be set back at least (strictly) 75 metres from the edge of every service road in order to allow for vulnerable species such as coursers, cranes and korhaans to obtain adequate height after being flushed by vehicle traffic. An Alternative mitigation measure and where a 75 metre buffer is not possible, new fences must be set back no more than 2 metres (directly adjacent) from the edge of service roads. Through the essential elimination of habitat, this will limit any chance of vulnerable species foraging on verge side vegetation and causing subsequent fence collisions. Finally, reflective diverters should be attached to new fencing alongside regular maintenance roads every 50 metres.	2	2	2	2	4	3	36	-	MEDIUM
Loss of Bird Foraging Habitat	Loss of Bird Foraging Habitat	3	3	3	3	3	3	45	-	HIGH	Impacts associated with the loss of bird foraging habitat due to operations can be mitigated by avoiding avifaunal specific sensitive areas and their associated buffers, such as the local drainage lines, impoundments, smaller watercourses, sandy dunes, pans and koppies. A green buffer should be maintained around all habitats designated as High Sensitivity or above.	3	2	2	2	2	2	22	-	LOW
Disruption of bird migratory pathways	Disruption of bird migratory pathways during the operational phase	2	2	2	2	4	3	36	-	MEDIUM	Migratory pathways of birds cannot be changed and the resulting impacts are unavoidable. However, severity of the impacts can be reduced with appropriate mitigation measures. Some significant discernible migratory flight pathways were able to be established which could be explained by large areas of generic habitats punctuated by some distinguishing geographic features in the landscape, such as large ridges, large impoundments, wetlands and drainage lines. The linear Drainage line habitats must be buffered by a minimum of 50 metres from the edge of the demarcated wetland.	3	2	2	2	2	2	22	-	LOW
The attraction of some novel bird species due to the development of a solar farm with associated infrastructure such as lake effect,	The attraction of some novel bird species due to the development of a solar farm with associated infrastructure such as lake effect perches, nest and shade opportunities may cause both damage to the infrastructure through acidic defecation by certain species but also draw birds closer to infrastructure and cause significant direct mortality risks.	2	2	2	2	4	3	36	-	MEDIUM	Essentially, all habitat attractants should be eliminated so that avifaunal populations will not embedded themselves within the infrastructure over time. This includes bird diverters, perch deterrents and the application of non-polarising white tape can be used around and/or across panels to minimise reflection which can attract aquatic birds and insects (food) as panels mimic reflective surfaces of waterbodies. An ECO can advise on the mitigations during operations.	3	2	2	2	3	2	24	-	MEDIUM

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perches, nest and shade opportunities																				
Chemical pollution spills	Chemicals being used to keep the PV panels clean from dust (suppressants) etc.	3	3	2	2	4	3	42	-	HIGH	Application of strict chemical control procedures as per the EMPr. Zero spills should be targeted and full clean up kits available in the event of any chemical spill. Soil testing subject to EMPr.	1	2	2	2	3	2	20	-	LOW
Heritage																				
Impacts to archaeological heritage resources	Operational activities that take place near to archaeological resources may result in their destruction	1	2	4	4	4	3	45	-	HIGH	No operational activities should take place within the high archaeological sensitivity area identified Should any previously unknown archaeological resources be impacted during construction, work must cese in the vicinity of the find and the relevant heritage authority must be contacted	1	1	4	1	4	1	11	-	LOW
Impacts to palaeontological resources	Operational activities that take place near to palaeontological resources may result in their destruction	1	2	4	4	4	1	15	-	LOW	Implementation of the Chance Fossil Finds Protocol	1	1	4	1	4	1	11	-	LOW
Impacts to the cultural landscape	Operational activities that take place near to cultural landscape elements may result in their destruction	1	2	1	3	1	3	24	-	MEDIUM	Implementation of the recommendations included in the VIA	1	1	4	1	4	1	11	-	LOW
Social																				
Avoidance of Climate Impacts	The use of renewable energy technology reduces long-term economic losses from extreme weather events, worsened air quality, rising sea levels and other effects. Switching from fossil fuels to renewables could help slow down climate change and avoid some of these potential economic losses.	4	3	1	1	3	3	36	+	MEDIUM	Not Applicable	4	3	1	1	3	3	36	+	MEDUIM
Creation of direct and indirect employment coupled with skills development	Creation of direct and indirect employment, and skills development opportunities and skills development because of the operation of the project. Employment opportunities include safety and security staff, operation and monitoring, and maintenance crew. Maintenance activities are carried out throughout the lifespan of the project and include washing of solar panels, vegetation control, and general maintenance around the solar energy facility. Coupled to employment creation are increased household income and standard living.	2	4	1	1	3	2	22	+	LOW	Benefits to the local area from Socio-Economic Development (SED) / Enterprise Development (ED) programmes and community trusts from REIPPP Programme social responsibilities. Under the REIPPP Programme renewable energy projects are required to contribute to local economic development in the area. Awarded projects are required to spend a certain amount of generated revenue (as defined in the agreement with DOE) on Socio-Economic Development (SED) and Enterprise Development (ED) and share ownership in the project company with local communities.	2	4	1	1	3	3	33	+	MEDIUM
Revenue for the fiscus and local municipality	Income tax and Municipal rates increase above that gained from the agricultural use of the land.	3	4	1	1	3	2	24	+	MEDIUM	Not Applicable	3	4	1	1	3	2	24	+	MEDIUM
Visual and sense of place impacts and	Sense of place impacts associated with the operation phase of the solar energy facility and associated infrastructure. The presence of the solar energy facility	2	3	3	1	3	2	24	-	MEDIUM	Landscaping to visually screen the project	2	2	2	1	3	2	20	-	LOW

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related impacts on tourism	could impact the “sense of place” for the local community. This may have an impact on tourism in the area.																			
Removed of productive agricultural land	The development footprint on which the solar energy facility will be developed will be removed from agricultural production. The development of the proposed project on an agricultural property would result in an area of land required to support the development footprint being removed from potential agricultural production. If the land is currently used for agricultural production the farm jobs may be threatened.	1	4	3	3	3	2	28	-	MEDIUM	See the specialist report	1	4	3	3	3	2	28	-	MEDIUM
Transportation																				
Normal Load Traffic	Increase in normal load traffic	2	1	1	2	3	1	9	-	LOW	• The increase in traffic for this phase of the development is negligible and will not have a significant impact	2	1	1	2	3	1	9	-	LOW
	Increase of Incidents with pedestrians	2	1	1	2	3	1	9	-	LOW	• The increase in traffic for this phase of the development is negligible and will not have a significant impact	2	1	1	2	3	1	9	-	LOW
	Increased need for road maintenance	2	1	1	2	3	1	9	-	LOW	• The increase in traffic for this phase of the development is negligible and will not have a significant impact	2	1	1	2	3	1	9	-	LOW
Abnormal Loads	Additional Abnormal Loads	3	1	1	2	3	1	10	-	LOW	• The increase in traffic for this phase of the development is negligible and will not have a significant impact	3	1	1	2	3	1	10	-	LOW
Access and Internal Roads	New / Upgraded Access points	1	1	1	2	3	1	8	-	LOW	• Regular maintenance of upgraded accesses • Adequate road signage according to the SARTSM	1	1	1	2	3	1	8	-	LOW
Glint and Glare																				
None identified																				
Visual																				
Soil sterilisation by compaction	Compaction of larger areas can result in soil sterilisation and landscape degradation.	1	3	3	2	3	2	24	-	LOW	Laydown areas and other construction areas no longer needed post construction for operational management, should be ripped (0.5m depth) to restore compacted topsoil, and then rehabilitated to natural vegetation under the supervision of the rehabilitation specialist.	1	2	2	2	2	1	9	-	LOW
Security Light Spillage at night	Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	3	3	1	2	1	2	20	-	LOW	Light spillage mitigation from security lighting should be implemented and monitored by the ECO during operational phase to ensure that light spillage does not create a glowing effect. No overhead/ flood lighting of structures or areas. No up lighting to be used.	1	2	1	1	1	1	6	-	LOW
Alternative LILO, Substation, BESS and Laydown : Soil sterilisation by compaction	Compaction of larger areas can result in soil sterilisation and landscape degradation.	1	3	3	2	3	2	24	-	LOW	Laydown areas and other construction areas no longer needed post construction for operational management, should be ripped (0.5m depth) to restore compacted topsoil, and then rehabilitated to natural vegetation under the supervision of the rehabilitation specialist.	1	2	2	2	2	1	9	-	LOW

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Alternative LILO, Substation, BESS and Laydown: Security Light Spillage at night	Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	3	3	1	2	1	2	20	-	LOW	Light spillage mitigation from security lighting should be implemented and monitored by the ECO during operational phase to ensure that light spillage does not create a glowing effect. No overhead/ flood lighting of structures or areas. No up lighting to be used.	1	2	1	1	1	1	6	-	LOW

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		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S
Risk Assessment Solid State Lithium-ion Battery Energy Storage System																		
Impact 1a: Human Health - chronic exposure to toxic chemical or biological agents	Causes - Operation and maintenance materials spare parts, paints, solvents, welding fumes, transformers oils, lubricating oils and greases etc. Consequences - Occupational illness.	2	1	3	4	5	50	-	MEDIUM	• The operation and maintenance phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993. SHEQ policy in place. A detailed Risk Assessment of all normal operating and maintenance activities on site to be compiled, and form the basis of operating instructions, prior to commencing commissioning. SHE procedure in place, e.g., PPE specified, management of change, integrity monitoring. SHE appointees in place. Training of staff in general hazards on site. All necessary health controls/ practices to be in place, e.g., ventilation of confined areas, occupational health monitoring if required and reporting programs in place. Emergency response plan for full operation and maintenance phase to be in place prior to beginning commissioning and to include aspects such as: - appointment of emergency controller, - emergency isolation systems for electricity, - -emergency isolation and containment systems for electrolyte, - provision of PPE for hazardous materials response, - provision of emergency facilities for staff at the main office building, - provision of first aid facilities, - first responder contact numbers etc.	1	1	3	4	2	18	-	LOW
Impact 1b: Human Health - chronic exposure to toxic chemical or biological agents	Causes - Compromised battery compartments vapours accumulate in the containers, solids/liquids on surfaces. Maintenance of battery components, corrosive and mildly toxic liquid on surfaces. Consequences - Dermatitis, skin /eye/lung irritation.	3	1	3	5	4	48	-	MEDIUM	• Solid state batteries sealed, individual batteries in modules which are also sealed, pre-packed in the container. Maintenance procedures will be in place should equipment need to be opened, e.g., pumps drained and decontaminated prior to repair in workshop etc. PPE will be specified for handling battery parts and other equipment on site. Training of staff in hazards of chemicals on site. Possible detectors with local alarms if regulated occupational exposure limits are exceeded etc prior to entry for inspection of battery containers. Labelling of all equipment. Confined space entry procedures if entering tanks. There needs to be careful thought given	1	1	3	5	2	20	-	LOW

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										to procedures to be adopted before entering into the BESS or a container particularly after a BMS shut down where there may be flammable or toxic gases present, a fire etc. Safety Data Sheets (SDSs) to be available on site. Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements. Maintenance manuals with make safe, decontamination and repair procedures. Proposed maintenance schedules e.g., checklists for weekly, monthly, annual etc. Provided portable equipment for calibration and for testing/verification of defective equipment, e.g., volt/current meters, infrared camera								
Impact 2: Human Health - exposure to noise	Causes - Moving parts inside containers, buildings, pumps, compressors, cooling systems etc. Consequences - Adverse impact on hearing of workers. Nuisance factor at near -by residences or other activities.	2	1	5	5	4	52	-	MEDIUM	• Design to ensure continuous noise does not exceed 85dB within the facilities or at any other location on site or 61 dB at the site boundary, e.g., emergency generator, air compressor etc. OHS Act Noise Induced hearing Loss Regulations Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.	2	1	5	5	2	26	-	LOW
Impact 3: Human Health - exposure to temperature extremes and/or humidity	Causes - Heat during the day. Batteries generate heat within enclosed building / containers. Cold in winter. Night work requires lighting. Consequences - Heat stroke. Hypothermia.	4	2	3	1	2	20	-	LOW	• Building and container facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. Ensure containers are temperature controlled as required to remain within the optimal battery operating temperature range. • Lighting to be provided inside any buildings, inside the containers, possibly linked to the door opening and outdoors where necessary. Adequate potable water to be provided during all phases of the project. Suitable lighting to be provided including emergency lighting for safe building exit in the event of power failure. PPE for operations and maintenance staff to be suitable for the weather conditions.	3	2	3	1	1	9	-	LOW
Impact 4: Human Health - exposure to psychological stress	Causes - Isolated workstation and monotonous repetitive work. Consequences - Low performance, system productivity suffers.	2	3	3	2	2	20	-	LOW	• Staff rotation to other activities within the site may be necessary. Performance monitoring of inspections / maintenance tasks in particular will be necessary.	1	3	3	2	1	9	-	LOW
Impact 5: Human Health - exposure to ergonomic stress	Causes - Lifting heavy equipment. Awkward angles during maintenance, stretching reaching to high level and bending to low level. Working at height if equipment located on top of roofs or elevated electrical equipment (e.g., pylons). Consequences - Back and other injuries.	5	1	3	2	3	33	-	MEDIUM	• Training in lifting techniques. Training in working at heights. If equipment is at height (see OHS Act General Safety Regulation 6), ensure suitable safe (electrically and physically) ladders / harnesses etc. are available. Working at height procedure to be in place.	4	1	3	2	2	20	-	LOW

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Impact 6a: Human and Equipment Safety - exposure to fire radiation	Causes – Involvement in an external fire e.g., veld fire, maintenance vehicle fire, electrical systems fire. Manufacturing defects or damage to battery leading to shorting and heating. High humidity condensation of water or ingress of water or flooding leading to shorting. Dust accumulation on electrical parts leading to overheating. Excessive electrical loads - surges Operator abuse BMS failure or software failure. Incorrect extinguishing medium, escalate the fire. Consequences - Contaminated run off. Radiation burns unlikely to be severe as no highly flammable materials on site. Damaged equipment. Fire spreads to other units or offsite if grass/vegetation not controlled.	5	1	5	5	4	64	-	HIGH	Grass cutting and fire breaks around the BESS installations to prevent veld fires. No combustible materials to be stored in or near the batteries or electrical infrastructure. Separation of site diesel tank, transformers from BESS and vice versa. There are BESS design codes from the USA and standards of practice that can be used e.g., UL9540, NFPA 855 and DNV GL RP 43. • Detailed FMEA/Hazop/Bowtie to done during design at the component level and system levels. Safety integrity level rating of equipment (failure probably) with suitable redundancy if required. Site Acceptance Testing as part of commissioning of each unit and the overall system. Abuse tests conducted by supplier. BMS should be checking individual cell voltage as well as stack, module, container, system voltages/current etc. BMS tripping the cell and possibly the stack/ building unit or module/rack/container, if variations in voltage. Diagnostics easily accessible. Diagnostics able to distinguish cell from stack or cell from module faults. Protective systems are only as good as their reliability and functionality testing is important, e.g., testing that all battery trips actually work. Fire resistant barrier between the batteries and the PCS side if in the same container, or separate containers. Suitable ingress protection level provided for electrical equipment, e.g., IP55 - 66. If air cooling into container, suitable dust filters to be provided. Smoke detectors linked to BMS & alerts in control room. Effects of battery aging to be considered. Solid state battery life starts to be impacted above 40 deg C and significant impacts above 50 deg C with thermal run away starting at 65-70 deg C. BMS trips system at 50 deg C. Temperature monitoring to be in place. Regular infrared scanning. Data needs to be stored for trend analysis. Data indicates an event frequency of 0.001 per installation and with 700 units this would mean an event once 2 years, i.e. a high probability event. Most events will be small not resulting in injuries, but this is possible if the event is not controlled. Prior to commencement of cold commissioning, emergency plan from transport and construction phase to be extended to operational phase and to include the hazards of the electrically live system. Procedure to address solid state container fires - extinguishing, ventilating, entering as appropriate or not. PPE for container firefighting include fire retardant, chemically resistant, nitrile gloves, antistatic acid resistant boots, fill face shields, BA sets. A planned fire response to prevent escalation to an explosion or an environmental event. Suitable supply of fire extinguishing medium and cooling medium Consider fire water for cooling adjacent equipment – BESS units. Can use fogging nozzles to direct smoke. Ensure procedures in place for clean up after event Lingering HF and other toxic residues in the soil and on adjacent structures. Procedures to be in place for IR scanning (or other suitable method) to determine if batteries are still smouldering / are sufficient cooled to handle as batteries may still be active some weeks after an event. Smoke or gas detector systems that are not part of the original battery container package, need to be linked to the main	5	1	5	5	1	16	-	LOW

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										control panel for the entire system so that issues can be detected and responded to rapidly.								
Impact 6b: Human and Equipment Safety - exposure to fire radiation	Causes - Power Conversion System (PCS – DC to AC) cooling failure electrical fire. Consequences - Fire starts in PCS or another section or room and spreads to battery area.	5	2	5	5	4	68	-	HIGH	• Modern lithium container design put the PCS in another part of the container with a fire rated wall separating it from the battery. Alternately the PCS is another container altogether.	5	2	5	5	1	17	-	LOW
Impact 7: Human and Equipment Safety - exposure to explosion over pressures	Cause 1 - Transformer shorting / overheating / explosion. Cause 2 - Flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static. Lithium Cobalt Oxide generates O2 during decomposition – escalation. Consequences - Potential fatalities amongst first responders. Damage to container or other nearby items, e.g., other container.	5	1	5	5	2	32	-	MEDIUM	• Electrical equipment will be specified to suit application. Emergency response plan and employee training referred to above is to be in place. This is only really likely to happen due to possible inappropriate emergency response, e.g., opening containers when they may be the type that should be left to burn out. Modern state of the art containers have ventilation systems for vapours. Undertake a hazardous area classification of the inside of the container to confirm the rating of electrical equipment, due to possible leaks of electrolyte or generation of flammable gases under thermal run away. Emergency response plan and employee training referred to above is critical. Suitable training of selected emergency responders who may be called out to the facilities is critical. NOTE. Refer to Appendix A for an initial approximation of worst-case possible explosion impact zones.	5	1	5	5	1	16	-	LOW
Impact 8a: Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc	4	1	3	2	3	30	-	LOW	• All necessary good hygiene practices to be in place, e.g., provision of toilets, eating areas, infectious disease controls. Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others. Awareness training for persons on site, safety induction to include animal hazards. First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. Due to isolated locations some distance from town, ensure the ability to treat with anti-venom and extreme allergic reactions on site.	3	1	2	2	2	16	-	LOW
Impact 8b: Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes - Damaged batteries components, leak electrolyte, are completely broken exposing hazardous chemicals. Hazardous fumes released on thermal run away see fire above. Consequences - Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns for large exposure. In the case of toxic fumes, serious lung damage.	4	3	3	5	3	45	-	MEDIUM	• Acid resistant PPE (e.g., overalls, gloves, eyeglasses) to be specified for all operations in electrolyte areas. PPE to be increased (e.g., full-face shield, aprons, chemical suits) for operations that involve opening equipment and potential exposure, e.g., sampling, maintenance. All operators/maintenance staff trained in the hazards of chemicals on site. Batteries contained, modules contained and all inside a container that acts as bund. Refer to fire above as all the protective measures apply to prevent toxic smoke. Refer to fire above as all the measures apply to mitigate toxic smoke. 24/7 helpline response. Standard dangerous goods requirements for Hazmat labels. All operators/maintenance staff trained in the hazards. NOTE Refer to Appendix A for an initial approximation of worst case possible noxious smoke impact zones.	3	3	3	5	2	28	-	LOW

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Impact 9: Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Causes - Moving equipment, pumps, heavy equipment at elevation, nip points, working at heights. Traffic accidents. Earthquake / tremor. Consequences - Injury. Fatality in unlikely worst case, e.g., traffic accidents or fall from heights. Damage to equipment, spills, environment pollution	5	1	5	5	3	48	-	MEDIUM	• Apart from pumps, no major moving parts during operation. Maintenance equipment to be serviced and personnel suitably trained in the use thereof. Normally just small vehicles on site, bakkies, grass cutting, cherry-pickers etc. Possibly large cranes if large equipment or elevated structure removed/replaced. Traffic signs, rules etc in place on site. All normal working at heights, hot work permits, confined space entry, cordon off unsafe areas/works etc to be in place. Emergency response plan. Civil design to take seismic activity into account.	5	1	5	5	1	16	-	LOW
Impact 10: Human and Equipment Safety - exposure to electromagnetic waves	Causes - Use of electrical machines, generators etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage electrical equipment.	5	2	5	5	3	51	-	MEDIUM	• Codes and guidelines for electrical insulation. Suitable PPE to be specified. Low voltage equipment (e.g., batteries) separated from high voltage (e.g., transmission to grid). Ensure trained personnel and refer to guideline – IEE 1657 – 2018. Ensure compliance with Eskom Operating Regulations for high voltage systems including access control, permit to work, safe work procedures, live work, abnormal and emergency situations, keeping records. Electromagnetic fields, impact on other equipment e.g., testing devices, mobile phones – malfunction, permanent damage. Software also need to be kept as update to date as reasonably practicable. Consider suitably located Emergency stop buttons for the facility and the other equipment on site. PPE to consider static accumulation for entering the facility, and particularly the battery containers especially after a high temperature shut down where there could possibly be flammable materials. The procedures for responding to alarm and auto shut down on containers, needs to consider that there may be a dangerous environment inside and how to protect personnel who may enter to respond. Lightning strike rate in proposed development area is high. All outside work must be stopped during thunder storms. Lighting conductors may be required for the installation, to be confirmed during design	5	2	5	5	1	17	-	LOW
Impact 11: Environment - emissions to air	Not expected on a normal basis. Refrigerant may be an asphyxiant if accidentally released indoors it can accumulate and displace oxygen.	3	1	1	1	3	18	-	LOW	• Especially after any warning alarms have gone off, but possibly even normally the container could be treated as entering a confined space and similar procedures could be in place, e.g., do not enter alone, gas testing prior to entering, ensure adequate ventilation	3	1	1	1	1	6	-	LOW
Impact 12: Environment - emissions to water	Causes - Cooling water blow-down. Laboratory waste (if included in the design). Maintenance waste, e.g., oils. Spills from batteries, coolant system, diesel trucks, transformers. Parked vehicles – oil drips. Fire water runoff control. Kitchen waste and sewage. Refrigerant release. Consequences - Pollution if not contained. Excessive disposal costs if emissions not limited.	2	2	3	2	3	27	-	LOW	• Bunding under any outdoors tanks, curbing under truck offloading areas and sealed surfaces (e.g., concrete) under truck parking area is particularly important. Sewage and any kitchen liquids - containment and suitable treatment/disposal. Procedures for dealing with damaged/leaking equipment as well as clean-up of spills. Normal site practices for preventing and containing diesel/paint etc spills. Waste management plan to be in place e.g., liquid waste treatment or suitable removal and disposal will be provided. Spill clean-up procedures to be in place before bringing container on site, including spill kits – non-combustible materials, hazmat disposal. The National Environment Management Act (NEMA) has a list of substances with Reportable spill Quantities, ensure compliance with this.	2	2	3	2	2	18	-	LOW

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Impact 13: Environment - emissions to earth	Causes - Mess area and other solid waste. Disposal of solid-state batteries. Consequences - Environmental damage.	2	2	3	3	3	30	-	LOW	• Implement waste segregation (e.g., electronic equipment, chemicals, domestic) and management on the site.	2	2	3	3	1	10	-	LOW
Impact 14: Environment - waste of resources e.g., water, power etc	Causes - Similar to construction phase. Disposal of batteries or components. Disposal of containers. Water usage not controlled. Consequences - Delays. Excessive costs and disposal of large volumes of hazardous waste.	1	1	1	2	4	20	-	LOW	• Water usage to be monitored on site. Handling protocols to be provided by supplier of batteries. Water management plan and spill containment plans to be in place. Investigate end of Life plan for solid state batteries - reuse / recovery / reconditioning. Similarly, for decommissioned containers – reuse / recovery / repurpose	1	1	1	2	2	10	-	LOW
Impact 15: Public - Aesthetics	Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	1	2	4	4	2	22	-	LOW	• Refer to Visual Impact Assessment which is to include the BESS installation once design details are available	3	1	3	4	2	22	-	LOW
Impact 16: Investors - Financial	Causes - Defective technology. Extreme project delays. Consequences - Financial loss	5	1	3	4	3	39	-	MEDIUM	• Design by experienced contractors using internationally recognized and proven technology. Project management with deviation monitoring.	3	1	3	4	2	22	-	LOW
Impact 17a: Employees and investors - Security	Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	3	1	3	2	4	36	-	MEDIUM	• Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. Consider motion detection lights and CCTV. The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g., Skull and Cross Bones or other signs. Isolated location both helps and hinders security. Night lighting to be provided both indoors and outdoors where necessary.	3	1	3	2	2	18	-	LOW
Impact 17b: Employees and investors - Security	Causes - Cyber security attacks aimed at the National Electricity Grid. Consequences - Ransom of the National Electricity Grid.	4	4	3	1	4	48	-	MEDIUM	• Cyber security needs monitoring. Remote access to system needs to be negotiated and controlled. Password controls, levels of authority etc. Protection of the National Electricity Grid from Cyber-attacks accessing through the BESS. Cyber emergency procedures – should be in place prior to commissioning.	4	4	3	1	2	24	-	LOW
Impact 18: Emergencies	Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	4	2	3	4	3	39	-	MEDIUM	• Emergency procedures need to be practiced prior to commencement of operations. Escape doors should swing open outwards and not into the container. Doors should be able to be hooked open when persons are inside the container, i.e. they should not be automatically self-closing. More than one exit from buildings. Storage of spare batteries (e.g., in stores on site or Emergency procedures need to be practiced prior to commencement of operations. Escape doors should swing open outwards and not into the container. Doors should be able to be hooked open when persons are inside the container, i.e. they should not be automatically self-closing. More than one exit from buildings. Storage of spare batteries (e.g., in stores on site or	4	2	3	4	2	26	-	LOW

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Impact 19: Investors - Legal	Causes Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using “cheaper supplier or less developed technology”.	3	1	3	3	4	40	-	MEDIUM	• Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. Ensure only state of the art battery systems are used and not old technologies prone to fires/explosions etc.	3	1	3	3	2	20	-	LOW
Vanadium Redox Flow Battery Energy Storage Systems																		
Impact 1: Human Health - chronic exposure to toxic chemical or biological agents	Causes - Construction materials such as cement, paints, solvents, welding fumes, truck fumes etc. Consequences - Employee / contractor illness.	-	1	3	4	4	44	-	MEDIUM	• The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. SHEQ policy in place. A detailed construction Risk Assessment prior to work. SHE procedure in place. PPE to be specified. SHE appointees in place. Contractor’s safety files in place and up to date. All necessary health controls/ practices to be in place, e.g., ventilation of welding and painting areas. SHE monitoring and reporting programs in place. Emergency response plan to be in place prior to beginning construction and to include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.	1	1	3	4	2	18	-	LOW
Impact 2: Human Health - exposure to noise	Causes - Drilling, piling, generators, air compressors. Consequences - Adverse impact on hearing of workers. Possible nuisance factor in near-by areas.	3	1	5	5	4	56	-	MEDIUM	• Health Risk Assessment to determine if equipment noise exceeds 85dB at workstation and 61dB at boundary of the site. OHS Act Noise Induced hearing Loss Regulations. Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.	2	1	5	5	2	26	-	LOW
Impact 3: Human Health - exposure to temperature extremes and/or humidity	Causes - Heat during the day. Cold in winter. Consequence - Heat stroke. Hypothermia.	3	2	3	1	2	18	-	LOW	• Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. Adequate potable water to be provided during all phases of the project. Bore hole, bowser and tank or small water treatment plant may be required to provide potable water for the employees during all phases of the project.	2	2	3	1	1	8	-	LOW
Impact 4: Human Health - exposure to psychological stress	Causes - Large projects bring many contractor workers into a small, isolated community. Consequences – Lack of sufficient accommodation, entertainment etc. Increase in alcohol abuse, violence	2	3	3	2	2	20	-	LOW	• Refer to Social Specialist Studies for this project.	2	3	3	2	2	20	-	LOW
Impact 5: Human Health - exposure to ergonomic stress	Causes - Lifting heavy equipment. Awkward angles during construction. Consequences - Back and other injuries.	4	1	3	2	3	30	-	LOW	• Training in lifting techniques. Ensure that despite the isolated location all the necessary equipment is available (and well maintained) during construction. Otherwise employees may revert to unsafe practices. Isolated location, maintenance of construction equipment to ensure safe operation is critical. Utilization of local service providers where possible. Ensure this is in place prior to project beginning. First aid provision on site.	4	1	3	2	2	20	-	LOW
Impact 6: Human and Equipment Safety - exposure to fire radiation	Causes – Involvement in an external fire. Fire involving fuels used in construction vehicles or vehicles themselves (e.g., tyre fire). Fire due to uncontrolled welding or other hot-work Consequences - Injuries	4	2	3	5	4	56	-	MEDIUM	• Fuels stored on site in dedicated, demarcated and bunded areas. Suitable fire-fighting equipment on site near source of fuel, e.g., diesel tank, generators, mess, workshops etc. • The company responsible for the facility at this stage is to have: 1. Emergency plan to be in place prior to commencement of construction.	4	2	3	5	2	28	-	LOW

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	due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire.									2.Fuel spill containment procedures and equipment to be in place. 3. Hot-work permit and management system to be in place.								
Impact 7: Human and Equipment Safety - exposure to explosion over pressures	No credible causes	1	1	1	1	1	4	-	N/A	• No credible causes, hence no mitigation necessary.	1	1	1	1	1	4	-	N/A
Impact 8a: Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc	4	2	3	2	3	33	-	MEDIUM	• All necessary good hygiene practices to be in place, e.g., provision of toilets, eating areas, infectious disease controls. Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others. Awareness training for persons on site, safety induction to include animal hazards. First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. Due to isolated locations some distance from town, ensure the ability to treat with anti-venom and extreme allergic reactions on site.	3	2	3	2	2	20	-	LOW
Impact 9: Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Causes - Construction moving equipment, heavy loaded, elevated loads, working at heights Consequences - Injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses	5	1	5	5	4	64	-	HIGH	• The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. SHEQ policy in place. A detailed construction Risk Assessment prior to work. SHE procedure in place. PPE to be specified. SHE appointees in place. Contractors safety files in place and up to date. SHE monitoring and reporting programs in place. Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations etc. Civil and building structures to National Building Regulations and building Standards Act 103 of 1977 SANS 10400 and other relevant codes. Other constructions such as roads, sewers etc also to relevant SANS standards. All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations etc to be in place before construction begins. Emergency response plan to be in place before construction begins.	5	1	5	5	1	16	-	LOW
Impact 10: Human and Equipment Safety - exposure to electromagnetic waves	Causes - Use of electrical machines, generators etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage electrical equipment.	5	2	5	5	3	51	-	MEDIUM	• Standard maintenance of condition of electrical equipment and safe operating instructions. Ability to shut off power to systems in use on site. If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge, installations to be suitably designed and maintained. Lightning strike rate in the study area is high. Outside work must be stopped during thunderstorms. Lighting conductors may be required for the final installation, to be confirmed during design phase.	5	2	5	5	1	17	-	LOW
Impact 11: Environment - emissions to air	Causes - Dust from construction and generally hot dry area. Consequences - Adverse impact on employee health.	3	2	1	1	4	28	-	LOW	• May need to use dampening on roads etc. as per normal construction practices. May need PPE (dust masks) for specific construction workers.	2	2	1	1	2	12	-	LOW

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Impact 12: Environment - emissions to water	Causes - Diesel for equipment, paints and solvents. Transformer oil spills. Sewage and kitchen/mess area wastewater. Consequences - Environmental damage, particularly to the surface and underground water in the area.	2	2	3	2	3	27	-	LOW	• Normal construction site practices for preventing and containing fuels/paint/oil etc spills. Bunding under any temporary tanks, curbing under truck offloading areas and sealed surfaces (e.g., concrete) under truck parking area is particularly important. Spill clean-up procedures to be in place before commencing construction. Sewage and any kitchen liquids - containment and suitable treatment/disposal	2	2	3	2	2	18	-	LOW
Impact 13: Environment - emissions to earth	Causes - Mess area and other solid waste. Consequences - Environmental damage.	2	2	3	3	3	30	-	LOW	• There will be packaging materials that will need to be disposed of after the entire system is connected and commissioned as well as after regular maintenance. There will need to be waste segregation (e.g., electronic equipment, chemicals) and management on the site.	1	2	3	3	2	18	-	LOW
Impact 14: Environment - waste of resources e.g., water, power etc	Causes - Water usage not controlled. Battery equipment damaged. Consequences - Delays.	1	1	1	2	4	20	-	LOW	• Water usage to be monitored on site during construction. Handling protocols to be provided by battery supplier. Water management plan and spill containment plans to be in place.	1	1	1	2	2	10	-	LOW
Impact 15: Public - Aesthetics	Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	3	2	3	4	4	48	-	MEDIUM	• Visual impact assessment to include BESS installation when design details become available. Confirm any height limitations for VRFB BESS building (if utility scale)	1	2	3	4	2	20	-	LOW
Impact 16: Investors - Financial	Causes - Defective technology. Extreme project delays. Consequences - Financial loss	5	1	3	4	3	39	-	MEDIUM	• Design by experienced contractors using internationally recognized and proven technology. Project management with deviation monitoring.	3	1	3	4	2	22	-	LOW
Impact 17: Employees and investors - Security	Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	4	1	3	2	4	40	-	MEDIUM	• Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g., Skull and Cross Bones or other signs. Isolated location both helps and hinders security. Night lighting to be provided both indoors and outdoors where necessary.	3	1	3	2	3	27	-	LOW
Impact 18: Emergencies	Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	4	2	3	4	3	39	-	MEDUIM	• Emergency procedures need to be practiced prior to commencement of construction.	4	2	3	4	2	26	-	LOW
Impact 19: Investors - Legal	Causes Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using “cheaper supplier or less developed technology”.	3	1	3	3	4	40	-	MEDIUM	• Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. Ensure only state of the art battery systems are used and not old technologies prone to fires/explosions etc.	2	1	3	3	2	18	-	LOW

15.1.4 Decommissioning

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Aquatic																				
Changes in sediment entering and exiting the system.	Changes in sediment regimes of the aquatic ecosystem and its sub -catchment by for example sand movement, meandering river mouth /estuary, changing flooding or sedimentation patterns. Construction and maintenance activities will result in earthworks and soil disturbance as well as the disturbance of natural vegetation. This could result in the loss of topsoil, sedimentation of the watercourses and pan and increase the turbidity of the water. Possible sources of the impacts include: • Earthwork activities during construction • Clearing of surface vegetation will expose the soils, which in rainy events would wash through the watercourse, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees can spread easily into these eroded soil. • Disturbance of soil surface • Disturbance of slopes through creation of roads and tracks adjacent to the watercourse • Erosion (e.g. gully formation, bank collapse)	3	3	2	2	2	2	24	-	MEDIUM	• Retain vegetation and soil in position for as long as possible, removing it immediately ahead of earthworks in that area. • Sediment traps should be installed • Sediment control should be effective and not allow any release of sediment pollution downstream. This should be audited on a monthly basis to demonstrate compliance with upstream conditions. • Any excavated soil/ should not be stored close to watercourses. Mixture of the lower and upper layers of the excavated soil should be kept to a minimum, so as for later usage as backfill material. • Monitoring should be done to ensure that sediment pollution is timeously addressed • Where structures are removed from nearby watercourses care should be taken not to disturb a larger footprint than needed. • Vehicle movement should be restricted to the minimum that is required for decommissioning. Unnecessary movement of vehicles will increase the degradation of paths and dirt roads leading to increased erosion risk. • Progressive rehabilitation must occur. Rehabilitation has to be take place as soon as decommissioning commences to prevent soil erosion. • Monitoring should be done to ensure that sediment pollution is timeously dressed.	2	2	2	2	2	2	20	-	LOW
Changes in water flow regime	Changes to hydrological function at a landscape level 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). The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary, seasonal, permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). Changes to base flows (e.g. too little/too much water in terms of characteristics and requirements of system). Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal). The sources of this impact include the compaction of soil, the removal	3	3	3	2	2	2	26	-	MEDIUM	• Effective control of stormwater from access roads should be undertaken • Implement Best Practice with regards to concrete mixing on site and control of waste and pollution • Where structures are removed from nearby watercourses care should be taken not to disturb a larger footprint than needed. • Do not increase hardened surfaces and compaction of the soils after the removal of the solar panels and related infrastructure. • Rehabilitation of exposed soil surfaces should commence as soon as practical after completion of removal of removal of the solar panels and related infrastructure. • Culverts must remain in place and must not be removed if the given road is not removed during the decommissioning phase.	2	2	2	2	2	2	20	-	LOW

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		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
	of vegetation, surface water redirection, changes to watercourse morphology or input of high energy surface water which could occur during construction and operation of the solar plant.										• Vehicle movement should be restricted to designated decommissioning areas to prevent the increase in hardened surfaces and subsequent increase in runoff.									
Introduction and spread of alien vegetation	The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles. Invasions of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plans can easily colonise and impact on downstream users.	3	3	2	2	2	2	24	-	MEDIUM	• Long-term monitoring for the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish, as specified in the Alien Vegetation Management Pan • Undertake an Alien Plant Control Plan which specifies actions and measurable targets • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of decommissioning /earthworks in that area and returning it where possible afterwards. • Rehabilitation must occur concurrently with decommissioning. • The mixture of vegetation seed must be used during rehabilitation. The mix must include: Annual and perennial species, pioneer species, species which are indigenous to the area to ensure there is no ecological imbalance in the area.	2	2	2	2	2	2	20	-	LOW
Changes in water quality due to pollution	Decommissioning activities may result in the discharge of solvents and other industrial chemicals, leakage of fuel/oil from vehicles and the disposal of sewage resulting in the loss of sensitive biota in the wetlands/rivers and a reduction in watercourse function.	3	3	3	2	2	2	26	-	MEDIUM	A detailed rehabilitation plan should be drawn up with the input from a water quality assessment	2	2	2	2	2	2	20	-	LOW
Loss of aquatic biota	Loss of instream habitat, deposition of wind-blown sand, loss of fringing vegetation and erosion, alteration in base flow, natural fire regimes and subsequent loss of non-marginal and marginal vegetation. Increase in invasive species due to disturbance. Change in water quality. Changes in flow. Loss and disturbance of biota due to direct development on the watercourse as well as changes in habitat including water quality, the water column, increased sediment, increased alien vegetation fire regime and habitat fragmentation.	3	3	3	2	2	2	26	-	MEDIUM	Monitor the establishment of alien invasive species within the areas affected during decommissioning	2	2	2	2	2	2	20	-	LOW
Loss and disturbance of watercourse habitat and fringe vegetation	Loss and disturbance of watercourse habitat and fringe vegetation due to direct development on the watercourse as well as changes in management, fire regime and habitat fragmentation.	3	3	3	2	2	2	26	-	MEDIUM	• Monitor rehabilitation and the occurrence of erosion twice during the rainy season for at least two years and take immediate corrective action where needed. • Rehabilitate any impacted areas • Where structures are removed from nearby watercourses care should be taken not to disturb a larger footprint than needed. • Vehicle movement should be restricted to the minimum that is required for decommissioning.	2	2	2	2	2	2	20	-	LOW

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		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											• Rehabilitation of decommissioned areas must commence concurrently with decommissioning. • Monitor the establishment of alien invasive species within the areas affected by the decommissioning and take immediate corrective action where invasive species are observed to establish. • Monitor rehabilitation and the occurrence of erosion twice during the rainy season for at least two years and take immediate corrective action where needed									
Terrestrial																				
Vegetation loss and disturbance of fauna communities	Dismantling and removal of infrastructure	1	3	2	3	2	3	33	-	MEDIUM	All machinery and related installations must be dismantled and removed, and the site should, as far as is reasonably possible, be restored to its original condition. All recyclable materials must be repurposed in an environmentally friendly way.	1	2	2	2	2	2	18	-	LOW
Waste generated	Repurpose all recyclable materials	2	3	3	3	3	4	56	-	HIGH		2	3	2	2	2	3	33	-	MEDIUM
Agricultural																				
None identified.																				
Avifaunal																				
Disruption of bird migratory pathways	Disruption of bird migratory pathways during the decommissioning phase	3	2	2	2	3	2	24	-	MEDIUM	Decommissioning of panels must not commence during the peak wet season months on November, December and January.	3	2	2	2	2	2	22		LOW
Habitat destruction post decommissioning	Destruction of habitats and scarring	3	3	2	2	4	3	42	-	HIGH	• A rehabilitation plan must be commissioned before construction commences. • All topsoil harvesting must take place in the dry season (late dry season). • Returning the wetlands to their original grade must take place as minor differences in the final surface elevation can produce significant impacts on the type of vegetation that re-establishes itself (alien invasive species). • When topsoil is salvaged and returned, it is anticipated without reseeding that dense vegetative communities of native species can regenerate within two growing seasons. • As emergent wetlands will recover more quickly than others, artificial seeding is not advised as it creates competition for	3	2	2	2	3	2	24	-	MEDIUM

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		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											reestablishment of native facultative and obligate wetland vegetation.									
Heritage																				
Impacts to archaeological heritage resources	Decommissioning activities that take place near to archaeological resources may result in their destruction	1	2	4	4	4	3	45	-	HIGH	No operational activities should take place within the high archaeological sensitivity area identified Should any previously unknown archaeological resources be impacted during construction, work must cese in the vicinity of the find and the relevant heritage authority must be contacted	1	1	4	1	4	1	11	-	LOW
Impacts to palaeontological resources	Decommissioning activities that take place near to palaeontological resources may result in their destruction	1	2	4	4	4	1	15	-	LOW	Implementation of the Chance Fossil Finds Protocol	1	1	4	1	4	1	11	-	LOW
Impacts to the cultural landscape	Decommissioning activities that take place near to cultural landscape elements may result in their destruction	1	2	1	3	1	3	24	-	MEDIUM	Implementation of the recommendations included in the VIA	1	1	4	1	4	1	11	-	LOW
Social																				
Direct and Indirect economic benefits due to the investment in construction and manufacturing of the infrastructure and installations.	Economic multiplier effects from the use of local goods and services during the construction phase. The economic benefits through investment into capital construction and infrastructure and equipment manufacturing leads to growth in the national GGP, Income and production output of the private and government sectors.	4	4	1	1	1	2	22	+	LOW	Not applicable	4	4	1	1	1	2	22	+	LOW
Employment opportunities during construction with accompanying skills development.	Construction of the project will result in the creation of several direct and indirect employment opportunities, which will contribute towards lessening the unemployment levels within the area and aid in skills development of communities in the area.	2	4	1	1	1	2	18	+	LOW	Skills development during construction of local employees	2	4	1	1	3	2	22	+	LOW
Influx of job seekers	An influx of people into the area leading to a temporary increase in social disruption, pressures on basic services change in social dynamics, increase in HIV, pregnancies, and drug abuse.	2	2	2	1	1	2	16	-	LOW	Management of the recruitment practices to avoid an influx of persons seeking employment. Community information and training concerning the project and recruitment requirements.	2	2	2	1	1	2	16	-	LOW
Temporary increase in safety, security and uncontrolled fire risks	Temporary increase in safety and security concerns associated with the influx of people during the construction phase. An influx of job seekers, and or construction workers to an area is a contributor to increased criminal activities in an area, such as increased safety and security risk for neighbouring	2	3	2	1	1	2	18	-	LOW	Integrate the site security systems in the regional and farmer security processes, systems and networks.	2	3	2	1	1	2	18	-	LOW

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		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
	properties and damage to property, increased risk of veld fire, stock theft and crime etc.																			
Temporary increase in traffic disruptions and movement patterns	Temporary increase in traffic disruptions and movement patterns during construction. Increased traffic due to construction vehicles and heavy vehicles could cause disruptions to road users and increase safety hazards. The use of local roads and transportation systems may cause road deterioration and congestion.	2	3	2	1	1	2	18	-	LOW	Driver training and local traffic management systems	2	3	2	1	1	2	18	-	LOW
Nuisance impacts in terms of temporary increase in noise and dust	Nuisance impacts in terms of temporary increase in noise and dust, and wear and tear on access roads to the site. Impacts associated with construction related activities include noise, dust and disruption or damage to adjacent properties. Site clearing activities increase that risk of dust and noise being generated, which can in turn negatively impact on adjacent properties.	2	3	2	1	1	2	18	-	LOW	Use of dust management practices during construction	2	3	2	1	1	2	18	-	LOW
Transportation																				
Normal Load Traffic	Increase in normal load traffic	2	4	1	2	1	3	30	-	LOW	• Group transportation of staff and labour • Stagger the transportation of materials, plant and components	2	4	1	2	1	2	20	-	LOW
	Increase of Incidents with pedestrians	2	4	2	4	1	2	26	-	MEDIUM	• Maintain verges of access and internal roads to provide safe walking space • Implementation of pedestrian safety initiatives	2	3	2	4	1	1	12	-	LOW
	Increased need for road maintenance	2	3	2	2	2	2	22	-	LOW	• Implement a road maintenance program under the auspices of the Mpumalanga Department of Transport	2	3	2	2	1	2	20	-	LOW
Abnormal Loads	Additional Abnormal Loads	3	2	1	2	1	1	9	-	LOW	• Schedule abnormal load transportation for off-peak periods • Stagger the delivery of abnormal loads • Adequate enforcement of traffic laws and Abnormal Load permit conditions	3	2	1	2	1	1	9	-	LOW
Access and Internal Roads	New / Upgraded Access points	1	4	1	2	1	1	9	-	LOW	• Regular maintenance of upgraded accesses • Adequate road signage according to the SARTSM	1	4	1	2	1	1	9	-	LOW
Glint and Glare																				
None identified																				
Visual																				

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		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Windblown dust and dust from moving vehicles	Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	2	3	2	2	1	3	30	-	MEDIUM	Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC.	2	2	1	2	1	1	8	-	LOW
Abandoning of old structures	Old, unused structures have the potential to significantly degrade the landscape character.	2	2	2	3	3	3	36	-	MEDIUM	All structures not required for agricultural purposes post-closure should be removed and where possible, recycled or reused. Building structures should be broken down (including building foundations).	1	2	2	2	1	1	8	-	LOW
Alternative LILO, Substation, BESS and Laydown																				
Windblown dust and dust from moving vehicles	Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	2	3	2	2	1	3	30	-	MEDIUM	Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC.	2	2	1	2	1	1	8	-	LOW
Abandoning of old structures	Old, unused structures have the potential to significantly degrade the landscape character.	2	2	2	3	3	3	36	-	MEDIUM	All structures not required for agricultural purposes post-closure should be removed and where possible, recycled or reused. Building structures should be broken down (including building foundations).	1	2	2	2	1	1	8	-	LOW

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		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S
Risk Assessment: Solid State Lithium-ion Battery Energy Storage System																		
Impact 1: Human Health - chronic exposure to toxic chemical or biological agents	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 2: Human Health - exposure to noise	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A

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		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S
Impact 3: Human Health - exposure to temperature extremes and/or humidity	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 4: Human Health - exposure to psychological stress	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 5: Human Health - exposure to ergonomic stress	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 6: Human and Equipment Safety - exposure to fire radiation	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 7: Human and Equipment Safety - exposure to explosion over pressures	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 8: Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 9: Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 10: Human and Equipment Safety - exposure to electromagnetic waves	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A

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		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S
Impact 11: Environment - emissions to air	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 12: Environment - emissions to water	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 13: Environment - emissions to earth	Causes - Batteries / electrolyte / equipment reached end of life and may leak. Consequences - Environment damage from heavy metal ions.	4	3	3	5	4	60	-	MEDIUM	End of Life shutdown procedure including a Risk Assessment of the specific activities involved. Where possible re-purpose the solid-state batteries / containers and equipment with associated Environmental impact considered. Disposal according to local regulations and other directives such as the European Batteries Directive. End of life, which is affected by temperature and time, cycles etc, should be predefined and the monitoring should be in place to determine if it has been reached.	4	3	3	5	2	30	-	LOW
Impact 14: Environment - waste of resources e.g., water, power etc	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 15: Public - Aesthetics	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 16: Investors - Financial	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 17: Employees and investors - Security	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 18: Emergencies	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 19: Investors - Legal	Disposal of hazardous “waste” is rife with difficulties and numerous regulations that need to be complied with.	3	1	3	3	4	40	-	MEDIUM	Applicants should seek the opinion from a waste consultant on how to correctly dispose of hazardous waste.	3	1	3	3	3	30	-	LOW
Vanadium Redox Flow Battery Energy Storage Systems																		
Impact 1: Human Health - chronic exposure to toxic	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A

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		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S
chemical or biological agents																		
Impact 2: Human Health - exposure to noise	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 3: Human Health - exposure to temperature extremes and/or humidity	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 4: Human Health - exposure to psychological stress	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 5: Human Health - exposure to ergonomic stress	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 6: Human and Equipment Safety - exposure to fire radiation	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 7: Human and Equipment Safety - exposure to explosion over pressures	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 8: Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 9: Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S
Impact 10: Human and Equipment Safety - exposure to electromagnetic waves	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 11: Environment - emissions to air	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 12: Environment - emissions to water	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 13: Environment - emissions to earth	Causes - Batteries / electrolyte / equipment reached end of life and may leak. Consequences - Environment damage from heavy metal ions.	4	3	3	5	4	60	-	MEDIUM	End of Life shutdown procedure including a Risk Assessment of the specific activities involved. Where possible re-purpose the solid-state batteries / containers and equipment with associated Environmental impact considered. Disposal according to local regulations and other directives such as the European Batteries Directive. End of life, which is affected by temperature and time, cycles etc, should be predefined and the monitoring should be in place to determine if it has been reached.	4	3	3	5	2	30	-	LOW
Impact 14: Environment - waste of resources e.g., water, power etc	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 15: Public - Aesthetics	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 16: Investors - Financial	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 17: Employees and investors - Security	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A
Impact 18: Emergencies	Similar to the construction and operational phases - no new hazards.	1	1	1	1	1	4	-	N/A	As per construction and operational phases.	1	1	1	1	1	4	-	N/A

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S		M	E	R	D x	P	S	TOTAL STATUS (+ OR -)	S
Impact 19: Investors - Legal	Disposal of hazardous “waste” is rife with difficulties and numerous regulations that need to be complied with.	3	1	3	3	4	40	-	MEDIUM	Applicants should seek the opinion from a waste consultant on how to correctly dispose of hazardous waste.	3	1	3	3	3	30	-	LOW

15.1.5 Cumulative

The proposed SEF is located adjacent to several other renewable projects within 35km of Roos SEF. SiVEST undertook every effort to obtain the information (including specialist studies, BA / EIA / Scoping and EMPr Reports) for the surrounding developments, however, many of the documents are not currently publicly available to download. The information that could be obtained for the surrounding planned renewable energy developments was taken into account as part of the cumulative impact assessment.

The SEFs that were considered are indicated in the figure below:

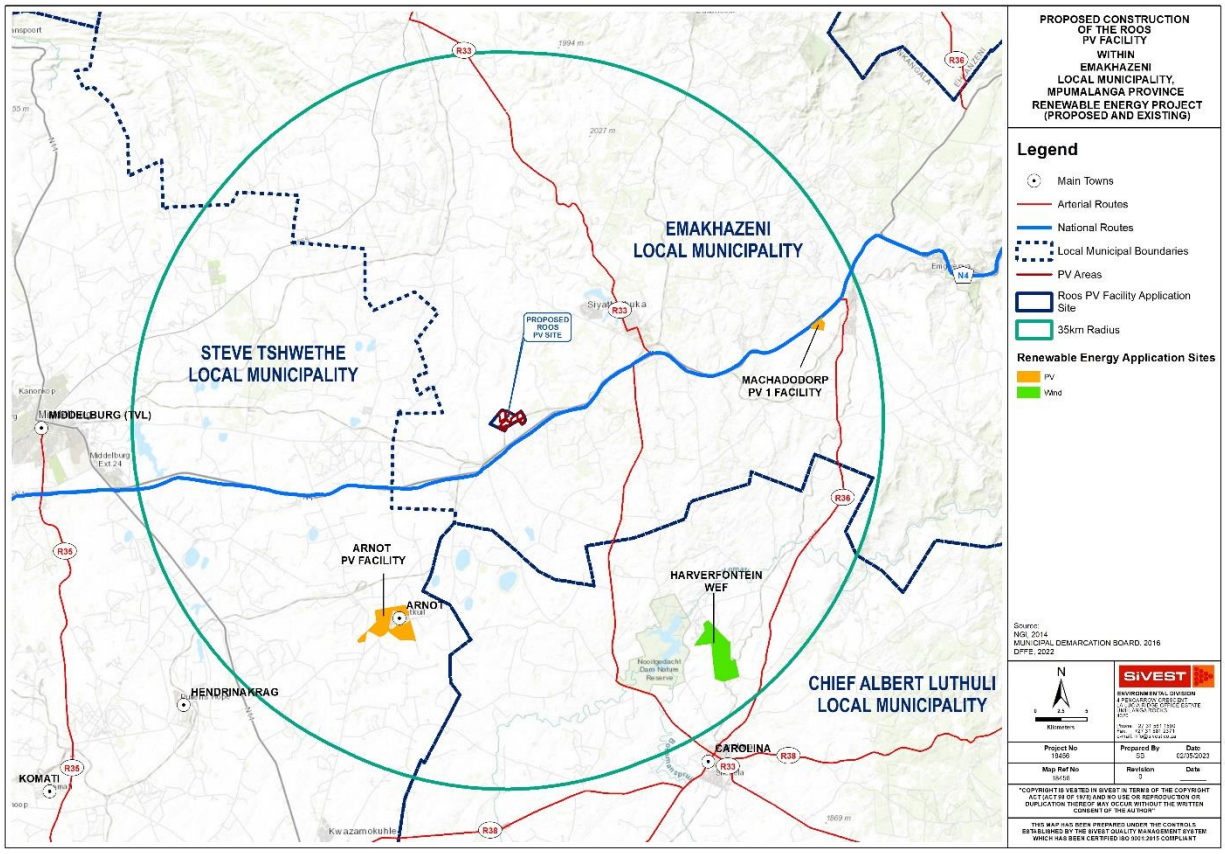

Figure 47: Renewable Energy Projects within 35km of the Roos SEF and Grid Connection infrastructure

Construction

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	I	D	L / M	TOTAL	STATUS (+ OR -)	S		E	P	R	I	D	L / M	TOTAL	STATUS (+ OR -)	S
Aquatic / Freshwater																				
None identified																				
Terrestrial Ecology																				
None identified																				
Agricultural																				
None identified																				
Avifaunal																				
Habitat loss	Regional Saturation of SEF facilities causing habitat loss	3	4	3	3	4	4	68	-	VERY HIGH	Not able to be mitigated quantitatively. Mitigation measures are similar to SEF facility. Where possible, apply necessary buffers for roost sites and other sensitive bird habitat features, avoiding the construction of panels and access roads in these areas. Roads	-	-	-	-	-	-	-	-	N/A

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S
											must utilise or upgrade existing farm roads as far as possible. All underground cables bisecting sensitive habitats must be placed below the subsurface flow of the ephemeral wetlands with the linear construction pits subjected to full rehabilitation in order to maintain normal subsurface slow. All roads and crossings must be engineered not to impede surface or subsurface flow in any way.									
Collison mortality (vehicle)	Increased roadkill due to higher traffic volumes	3	3	3	3	4	3	48	-	HIGH	Strict enforcement of speed limits in the PAOI as well saturation of fence infrastructure with reflective diverters and maintaining fence set aside distances (75/ 5 metres).	3	2	1	1	2	2	18	-	LOW
Collison mortality (infrastructure)	Increased mortalities due to collisions with SEF infrastructure, especially powerlines and fences	3	3	3	3	4	3	48	-	HIGH	Impacts due to bird mortalities during the operational phase are practically unavoidable for any large facility, but with the appropriate mitigation measures these impacts can be minimised. All powerline infrastructure must be fitted with approved bird	2	2	2	2	4	3	36	--	MEDIUM

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S
											diverters in order to provide visibility for large-bodied birds. Positive Cumulative Mitigation will be the retrofitting of existing powerline infrastructure (in consultation with Eskom) which currently does not have diverter infrastructure in place.									
Collison mortality (powerlines)	Increased collision related mortalities due to increased powerlines	3	3	3	3	4	3	48		HIGH	Saturation of powerline infrastructure with approved bird diverters	3	2	2	2	3	4	48		HIGH
Heritage																				
Impacts to archaeological heritage resources	Cumulative destruction of significant archaeological heritage	1	2	4	3	4	3	42	-	MEDIUM	No development activities should take place within the high archaeological sensitivity area identified Should any previously unknown archaeological resources be impacted during construction, work must cese in the vicinity of the find and the relevant heritage authority must be contacted	1	1	4	1	4	1	11	-	LOW

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S
Impacts to paleontological resources	Cumulative destruction of significant paleontological heritage	1	2	4	3	4	3	42	-	MEDIUM	Implementation of the Chance Fossil Finds Protocol	1	1	4	1	4	1	11	-	LOW
Impacts to the cultural landscape	Cumulative impact to the cultural landscape	1	2	4	3	4	3	42	-	MEDIUM	Implementation of the recommendations included in the VIA	1	1	4	1	4	1	11	-	LOW
Social																				
None identified																				
Heritage																				
None identified																				
Glint and Glare																				
None identified																				
Transportation																				
a1) Normal Load Traffic	▪ Increase in normal load traffic	2	4	1	2	1	3	30	-	MEDIUM	▪ Group transportation of staff and labour	2	4	1	2	1	2	20	-	LOW

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S
											▪ Stagger the delivery of materials, plant and components ▪ Construction of an on-site concrete batching plant to reduce trips.									
	▪ Increase of incidents with pedestrians	2	4	2	4	1	2	26	-	MEDIUM	▪ Maintain verges of access and internal roads to provide safe walking space ▪ Implementation of pedestrian safety initiatives	2	3	2	4	1	1	12	-	LOW
	▪ Increased need for road maintenance	2	3	2	2	2	2	22	-	MEDIUM	▪ Schedule abnormal load transportation for off-peak periods ▪ Stagger the delivery of abnormal loads ▪ Adequate enforcement of traffic laws and Abnormal Load permit conditions	2	3	2	2	1	2	20	-	LOW
a2) Abnormal Loads	▪ Additional Abnormal Loads	3	2	1	2	1	1	9	-	MEDIUM	▪ Schedule abnormal load transportation for off-peak periods ▪ Stagger the delivery of abnormal loads ▪ Adequate enforcement of traffic laws and Abnormal Load permit conditions	3	2	1	2	1	1	9	-	LOW

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S
a3) Access and Internal Roads	▪ Need for new / Upgraded Access points	1	4	1	2	1	1	9	-	LOW	▪ Adequate road signage according to the SARTSM ▪ Designs to be undertaken by a registered civil engineering professional ▪ Approval from the Mpumalanga Department of Transport and SANRAL	1	4	1	2	1	1	9	-	LOW
Visual																				
Intervisibility of other RE Projects	▪ Intervisibility of the proposed project with surrounding PV projects could result in massing effects degrading landscape resources. No other RE projects are located in the ZVI with limited residential receptors in mainly Medium to Low Visual Exposure distances.	2	4	2	3	3	2	28	-	LOW	▪ Effective management of security lighting to ensure that a pool/ glow of light is not emitted from the collective projects (See Annexure). Exclusion of PV from steep slopes and from the ridgeline.	2	3	2	3	3	1	13	-	LOW

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	I	D	I / M	TOTAL	STATUS (+ OR -)	S
Alternative LILO, Substation, BESS and Laydown																				
Intervisibility of other RE Projects	▪ Intervisibility of the proposed project with surrounding PV projects could result in massing effects degrading landscape resources. No other RE projects are located in the ZVI with limited residential receptors in mainly Medium to Low Visual Exposure distances.	2	3	2	3	3	2	26	-	LOW	▪ Effective management of security lighting to ensure that a pool/ glow of light is not emitted from the collective projects (See Annexure). Exclusion of PV from steep slopes and from the ridgeline.	2	3	2	3	3	1	13	-	LOW

Operational

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Aquatic / Freshwater																				
None identified																				
Terrestrial Ecology																				
None identified																				
Agricultural																				
None identified																				
Avifaunal																				
Habitat loss	Regional Saturation of SEF facilities causing habitat loss	3	4	3	3	4	4	68	-	VERY HIGH	Not able to be mitigated quantitatively. Mitigation measures are similar to SEF facility. Where possible, apply necessary buffers for roost sites and other sensitive bird habitat features, avoiding the construction of panels and access roads in these areas. Roads must utilise or upgrade existing farm roads as far as possible. All	-	-	-	-	-	-	-	-	N/A

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											underground cables bisecting sensitive habitats must be placed below the subsurface flow of the ephemeral wetlands with the linear construction pits subjected to full rehabilitation in order to maintain normal subsurface slow. All roads and crossings must be engineered not to impede surface or subsurface flow in any way.									
Collison mortality (vehicle)	Increased roadkill due to higher traffic volumes	3	3	3	3	4	3	48	-	HIGH	Strict enforcement of speed limits in the PAOI as well saturation of fence infrastructure with reflective diverters and maintaining fence set aside distances (75/ 5 metres).	3	2	1	1	2	2	18	-	LOW
Collison mortality (infrastructure)	Increased mortalities due to collisions with SEF infrastructure, especially powerlines and fences	3	3	3	3	4	3	48	-	HIGH	Impacts due to bird mortalities during the operational phase are practically unavoidable for any large facility, but with the appropriate mitigation measures these impacts can be minimised. All powerline infrastructure must be fitted with approved bird diverters in order to provide visibility for large-bodied birds. Positive Cumulative Mitigation will be the retrofitting of existing powerline infrastructure (in consultation with Eskom) which	2	2	2	2	4	3	36	--	MEDIUM

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											currently does not have diverter infrastructure in place.									
Collison mortality (powerlines)	Increased collision related mortalities due to increased powerlines	3	3	3	3	4	3	48		HIGH	Saturation of powerline infrastructure with approved bird diverters	3	2	2	2	3	4	48		HIGH
Heritage																				
Impacts to archaeological heritage resources	Cumulative destruction of significant archaeological heritage	1	2	4	3	4	3	42	-	MEDIUM	No development activities should take place within the high archaeological sensitivity area identified Should any previously unknown archaeological resources be impacted during construction, work must cese in the vicinity of the find and the relevant heritage authority must be contacted	1	1	4	1	4	1	11	-	LOW
Impacts to paleontological resources	Cumulative destruction of significant paleontological heritage	1	2	4	3	4	3	42	-	MEDIUM	Implementation of the Chance Fossil Finds Protocol	1	1	4	1	4	1	11	-	LOW

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Impacts to the cultural landscape	Cumulative impact to the cultural landscape	1	2	4	3	4	3	42	-	MEDIUM	Implementation of the recommendations included in the VIA	1	1	4	1	4	1	11	-	LOW
Social																				
None identified																				
Heritage																				
None identified																				
Glint and Glare																				
None identified																				
Transportation																				
b1) Normal Load Traffic	▪ Increase in normal load traffic	2	1	1	2	3	1	9	-	LOW	▪ The increase in traffic for this phase of the development is negligible and will not have a significant impact	2	1	1	2	3	1	9	-	LOW

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
	▪ Increase of Incidents with pedestrians	2	1	1	2	3	1	9	-	LOW	▪ The increase in traffic for this phase of the development is negligible and will not have a significant impact	2	1	1	2	3	1	9	-	LOW
	▪ Increased need for road maintenance	2	1	1	2	3	1	9	-	LOW	▪ The increase in traffic for this phase of the development is negligible and will not have a significant impact	2	1	1	2	3	1	9	-	LOW
b2) Abnormal Loads	▪ Additional Abnormal Loads	3	1	1	2	3	1	10	-	LOW	▪ The increase in traffic for this phase of the development is negligible and will not have a significant impact	3	1	1	2	3	1	10	-	LOW
b3) Access and Internal Roads	▪ New / Upgraded Access points	1	1	1	2	3	1	8	-	LOW	▪ Regular maintenance of upgraded accesses ▪ Adequate road signage according to the SARTSM	1	1	1	2	3	1	8	-	LOW

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Visual																				
Intervisibility of other RE Projects	▪ Intervisibility of the proposed project with surrounding PV projects could result in massing effects degrading landscape resources. No other RE projects are located in the ZVI with limited residential receptors in mainly Medium to Low Visual Exposure distances	2	4	2	3	3	2	28	-	LOW	▪ Effective management of security lighting to ensure that a pool/ glow of light is not emitted from the collective projects (See Annexure). Exclusion of PV from steep slopes and from the ridgeline.	2	3	2	3	3	1	13	-	LOW
Alternative LILO, Substation, BESS and Laydown																				
Intervisibility of other RE Projects	▪ Intervisibility of the proposed project with surrounding PV projects could result in massing effects degrading landscape resources. No other RE projects are located in the ZVI with limited residential receptors in mainly Medium to Low Visual Exposure distances.	2	3	2	3	3	2	26	-	LOW	▪ Effective management of security lighting to ensure that a pool/ glow of light is not emitted from the collective projects (See Annexure). Exclusion of PV from steep slopes and from the ridgeline.	2	3	2	3	3	1	13	-	LOW

Decommissioning

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Aquatic / Freshwater																				
None identified																				
Terrestrial Ecology																				
None identified																				
Agricultural																				
None identified																				
Avifaunal																				
Collison mortality (powerlines)	Increased collision related mortalities due to increased powerlines	3	3	3	3	4	3	48		HIGH	Saturation of powerline infrastructure with approved bird diverters	3	2	2	2	3	4	48		HIGH

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Heritage																				
Impacts to archaeological heritage resources	Cumulative destruction of significant archaeological heritage	1	2	4	3	4	3	42	-	MEDIUM	No development activities should take place within the high archaeological sensitivity area identified Should any previously unknown archaeological resources be impacted during construction, work must cese in the vicinity of the find and the relevant heritage authority must be contacted	1	1	4	1	4	1	11	-	LOW
Impacts to paleontological resources	Cumulative destruction of significant paleontological heritage	1	2	4	3	4	3	42	-	MEDIUM	Implementation of the Chance Fossil Finds Protocol	1	1	4	1	4	1	11	-	LOW
Impacts to the cultural landscape	Cumulative impact to the cultural landscape	1	2	4	3	4	3	42	-	MEDIUM	Implementation of the recommendations included in the VIA	1	1	4	1	4	1	11	-	LOW
Social																				
None identified																				

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Heritage																				
None identified																				
Glint and Glare																				
None identified																				
Transportation																				
c1) Normal Load Traffic	▪ Increase in normal load traffic	2	4	1	2	1	3	30	-	MEDIUM	▪ Group transportation of staff and labour ▪ Stagger the transportation of materials, plant and components	2	4	1	2	1	2	20	-	LOW
	▪ Increase of Incidents with pedestrians	2	4	2	4	1	2	26	-	MEDIUM	▪ Maintain verges of access and internal roads to provide safe walking space ▪ Implementation of pedestrian safety initiatives	2	3	2	4	1	1	12	-	LOW
	▪ Increased need for road maintenance	2	3	2	2	2	2	22	-	MEDIUM	▪ Implement a road maintenance program under the auspices of the	2	3	2	2	1	2	20	-	LOW

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											Mpumalanga Department of Transport									
c2) Abnormal Loads	▪ Additional Abnormal Loads	3	2	1	2	1	1	9	-	MEDIUM	▪ Schedule abnormal load transportation for off-peak periods ▪ Stagger the delivery of abnormal loads ▪ Adequate enforcement of traffic laws and Abnormal Load permit conditions	3	2	1	2	1	1	9	-	LOW
c3) Access and Internal Roads	▪ New / Upgraded Access points	1	4	1	2	1	1	9	-	LOW	▪ Regular maintenance of upgraded accesses ▪ Adequate road signage according to the SARTSM	1	4	1	2	1	1	9	-	LOW
Visual																				
Intervisibility of other RE Projects	▪ Intervisibility of the proposed project with surrounding PV projects could result in massing effects degrading landscape resources. No other RE projects are located in the ZVI with limited	2	4	2	3	3	2	28	-	LOW	▪ Effective management of security lighting to ensure that a pool/ glow of light is not emitted from the collective projects (See Annexure). Exclusion of PV from steep slopes and from the ridgeline.	2	3	2	3	3	1	13	-	LOW

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
	residential receptors in mainly Medium to Low Visual Exposure distances.																			
Alternative LILO, Substation, BESS and Laydown																				
Intervisibility of other RE Projects	▪ Intervisibility of the proposed project with surrounding PV projects could result in massing effects degrading landscape resources. No other RE projects are located in the ZVI with limited residential receptors in mainly Medium to Low Visual Exposure distances.	2	3	2	3	3	2	26	-	LOW	▪ Effective management of security lighting to ensure that a pool/ glow of light is not emitted from the collective projects (See Annexure). Exclusion of PV from steep slopes and from the ridgeline.	2	3	2	3	3	1	13	-	LOW

16. POSITIVE AND NEGATIVE IMPACTS OF THE ROOS PV FACILITY AND ASSOCIATED INFRASTRUCTURE PROJECT

A summary of the impacts pre-mitigation and post-mitigation are provided below:

16.1 Mitigation measures

Refer to Section 15 above. The assessment of each issue/ impact is included in Section 15 above and mitigation measures are provided for each impact identified in **Table 20**.

Table 20: Summary of impacts pre-mitigation and post-mitigation

Impact	Pre-mitigation	Post-mitigation
PLANNING		
Impacts to Biophysical Systems		
CONSTRUCTION		
Impacts to Biophysical Systems		
Aquatic		
Changes in sediment regimes of the aquatic ecosystem and its sub -catchment by for example sand movement, meandering river mouth /estuary, changing flooding or sedimentation patterns. Construction and maintenance activities will result in earthworks and soil disturbance as well as the disturbance of natural vegetation. This could result in the loss of topsoil, sedimentation of the watercourses and pan and increase the turbidity of the water. Possible sources of the impacts include: • Earthwork activities during construction • Clearing of surface vegetation will expose the soils, which in rainy events would wash through the watercourse, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees can spread easily into these eroded soil. • Disturbance of soil surface • Disturbance of slopes through creation of roads and tracks adjacent to the watercourse • Erosion (e.g. gully formation, bank collapse)	Medium	Low
Changes to hydrological function at a landscape level 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). The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary, seasonal, permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). Changes to base flows (e.g. too little/too much water in terms of characteristics and requirements of system). Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal). The sources of this impact include the compaction of soil, the removal of vegetation, surface water redirection, changes to watercourse morphology or input of high energy surface water which could occur during construction	Medium	Low
The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles. Invasions of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plans can easily colonise and impact on downstream users.	Medium	Low

Impact	Pre-mitigation	Post-mitigation
Construction and operational activities may result in the discharge of solvents and other industrial chemicals, leakage of fuel/oil from vehicles and the disposal of sewage resulting in the loss of sensitive biota in the wetlands/rivers and a reduction in watercourse function. Chemical and Thermal Pollution: Potential risk of chemical pollution from storage and handling of chemicals used for panel cleaning or maintenance. Additionally, solar plants with concentrated solar power (CSP) technology may release heated water into nearby water bodies, leading to thermal pollution and potential impacts on aquatic organisms	Medium	Low
Loss of instream habitat, deposition of wind-blown sand, loss of fringing vegetation and erosion, alteration in base flow, natural fire regimes and subsequent loss of non-marginal and marginal vegetation. Increase in invasive species due to disturbance. Change in water quality. Changes in flow. Loss and disturbance of biota due to direct development on the watercourse as well as changes in habitat including water quality, the water column, increased sediment, increased alien vegetation fire regime and habitat fragmentation	Medium	Low
Loss and disturbance of watercourse habitat and fringe vegetation due to direct development on the watercourse as well as changes in management, fire regime and habitat fragmentation	Medium	Low
Terrestrial		
Vegetation clearing for access roads, solar arrays and their service areas and other infrastructure will impact on vegetation	Very High	Medium
Vegetation clearing for access roads, solar arrays and their service areas and other infrastructure will impact on SCC	Very High	Medium
Vegetation clearing for access roads, solar arrays and their service areas and other infrastructure will impact on provincially protected species	High	Low
Disturbance could see an increase of alien invasive plant species at disturbed areas	High	Low
Disturbance would leave the site vulnerable to wind and water erosion.	Medium	Low
Could result in an increase in noise and dust within the proposed site and surrounds which could have negative impacts on faunal activity including breeding and feeding	Medium	Low
Agricultural		
Loss of topsoil as a resource – Contamination, Disturbance, Erosion, and Compaction	Medium	Medium
Loss of Land Capability	Medium	Medium
Loss of Agricultural Resources and Infrastructure	Low	Low
Loss of topsoil as a resource – Contamination, Disturbance, Erosion, and Compaction	High	Medium
Loss of Land Capability	High	Medium
Loss of Agricultural Resources and Infrastructure	Medium	Low
Avifauna		
Significant habitat loss (including foraging and breeding) and fragmentation due to displacement (avoidance of disturbance) because of infrastructure installation (panels, powerlines, roads, fences and sub surface cables) and associated dust effects. Habitat loss has the tendency to not only destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.	High	Medium
The destruction or disturbance of bird roosts during the construction phase	High	Low
Disturbance (including of nesting SCC) due to noise such as, machinery movements and maintenance operations during the construction phase the proposed PV solar farm causing loss of offspring for a generation.	Medium	Low
Heritage		
Construction activities that take place near to archaeological resources may result in their destruction.	Very High	Low
Construction activities that take place near to palaeontological resources may result in their destruction.	Low	Low
Construction activities that take place near to cultural landscape elements may result in their destruction.	Medium	Low
Social		
Economic multiplier effects from the use of local goods and services during the construction phase. The economic benefits through investment into capital construction and infrastructure and equipment manufacturing leads to growth in the national GGP, Income and production output of the private and government sectors.	Low	Low

Impact	Pre-mitigation	Post-mitigation
Construction of the project will result in the creation of several direct and indirect employment opportunities, which will contribute towards lessening the unemployment levels within the area and aid in skills development of communities in the area.	Low	Low
An influx of people into the area leading to a temporary increase in social disruption, pressures on basic services change in social dynamics, increase in HIV, pregnancies, and drug abuse.	Low	Low
Temporary increase in safety and security concerns associated with the influx of people during the construction phase. An influx of job seekers, and or construction workers to an area is a contributor to increased criminal activities in an area, such as increased safety and security risk for neighbouring properties and damage to property, increased risk of veld fire, stock theft and crime etc.	Low	Low
Temporary increase in traffic disruptions and movement patterns during construction. Increased traffic due to construction vehicles and heavy vehicles could cause disruptions to road users and increase safety hazards. The use of local roads and transportation systems may cause road deterioration and congestion.	Low	Low
Nuisance impacts in terms of temporary increase in noise and dust, and wear and tear on access roads to the site. Impacts associated with construction related activities include noise, dust and disruption or damage to adjacent properties. Site clearing activities increase that risk of dust and noise being generated, which can in turn negatively impact on adjacent properties.	Low	Low
Transportation		
Increase in normal load traffic	Medium	Low
Increase of incidents with pedestrians	Medium	Low
Increased need for road maintenance	Low	Low
Additional Abnormal Loads	Low	Low
Need for new / Upgraded Access points	Low	Low
Visual		
Drainage lines and wetland features are located on the site that are a key factor that define the local landscape resources. As these areas are excluded, the rural agrarian landscape integrity is retained.	Medium	Low
Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	Low	Low
Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site.	Medium	Low
Buildings painted bright colours can increase the visual presence of the structures in a rural landscape, creating higher levels of visual contrast and attracting the attention of the causal observer.	Low	Low
Litter has the potential to degrade landscape character and can be contained by fencing around the construction camp/ laydown.	Low	Low
Long fencing lines has the potential to be visually dominating, degrading the rural landscape sense of place.	Low	Low
Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	Low	Low
Un-necessary roads have the potential to create a visual disturbance long after the usage as past.	Low	Low
Moderate loss of landscape character due to existing rural farmlands in close proximity to the existing Eskom powerline and corridor where future powerline are most likely to be routed.	Low	Low
Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	Low	Low
Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site.	Medium	Low
Litter has the potential to degrade landscape character and can be contained by fencing around the construction camp/ laydown.	Low	Low
Long fencing lines has the potential to be visually dominating, degrading the rural landscape sense of place.	Low	Low
Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	Low	Low

Impact	Pre-mitigation	Post-mitigation
Risk Assessment		
Solid State Lithium-ion Battery Energy Storage System		
Causes - Construction materials such as cement, paints, solvents, welding fumes, truck fumes etc. Consequences - Employee / contractor illness.	Medium	Low
Causes - Drilling, piling, generators, air compressors. Consequences - Adverse impact on hearing of workers. Possible nuisance factor in near-by areas.	Medium	Low
Causes - Heat during the day. Cold in winter. Consequence - Heat stroke. Hypothermia.	Low	Low
Causes - Large projects bring many contractor workers into a small, isolated community. Consequences – Lack of sufficient accommodation, entertainment etc. Increase in alcohol abuse, violence	Low	Low
Causes - Lifting heavy equipment. Awkward angles during construction. Consequences - Back and other injuries.	Low	Low
Causes – Involvement in an external fire. Fire involving fuels used in construction vehicles or vehicles themselves (e.g., tyre fire). Fire due to uncontrolled welding or other hot-work Consequences - Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire.	Medium	Low
Causes - Solid state battery containers damaged on route e.g., dropped in port (drops do happen about 1/2000 containers) and importing possibly < 30 containers for the site. With this it is possible, although unlikely, that one will be dropped, traffic accident on-route. Involvement in an external fire e.g., at the port or on route. Data indicates installed facility events are 0.001/year. Transport of 700 units per installation assumed to take 4 weeks each so f= 0.05 - once in 20 years so likelihood is moderate. Consequences – Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire (refer to noxious smoke in APPENDIX A below for the major impact).	High	Low
Causes - With solid state lithium containers, flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static. Consequences - Potential fatalities amongst first responders. Damage to container, transport truck or other nearby items, e.g., other container in the port.	Medium	Low
Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc	Medium	Low
Causes - Damaged solid-state batteries release fumes, leak electrolyte, are completely broken exposing hazardous chemicals. Thermal runaway and hazardous fumes released. Consequences - Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns or lung damage.	Medium	Low
Causes - Construction moving equipment, heavy loaded, elevated loads, working at heights Consequences - Injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses	High	Low
Causes - Use of electrical machines, generators etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage electrical equipment.	Medium	Low
Causes - Dust from construction and generally hot dry area. Consequences - Adverse impact on employee health.	Low	Low
Causes - Diesel for equipment, paints and solvents. Transformer oil spills. Sewage and kitchen/mess area wastewater. Consequences - Environmental damage, particularly to the surface and underground water in the area.	Low	Low
Causes - Mess area and other solid waste. Consequences - Environmental damage.	Low	Low
Causes - Water usage not controlled. Battery containers damaged. Consequences - Delays.	Low	Low
Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	Low	Low
Causes - Defective technology. Extreme project delays. Consequences - Financial loss	Medium	Low

Impact	Pre-mitigation	Post-mitigation
Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	Medium	Low
Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	Medium	Low
Causes Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using “cheaper supplier or less developed technology”.	Medium	Low
Vanadium Redox Flow Battery Energy Storage Systems		
Causes - Construction materials such as cement, paints, solvents, welding fumes, truck fumes etc. Consequences - Employee / contractor illness.	Medium	Low
Causes - Drilling, piling, generators, air compressors. Consequences - Adverse impact on hearing of workers. Possible nuisance factor in near-by areas.	Medium	Low
Causes - Heat during the day. Cold in winter. Consequence - Heat stroke. Hypothermia.	Low	Low
Causes - Large projects bring many contractor workers into a small, isolated community. Consequences – Lack of sufficient accommodation, entertainment etc. Increase in alcohol abuse, violence	Low	Low
Causes - Lifting heavy equipment. Awkward angles during construction. Consequences - Back and other injuries.	Low	Low
Causes – Involvement in an external fire. Fire involving fuels used in construction vehicles or vehicles themselves (e.g., tyre fire). Fire due to uncontrolled welding or other hot-work Consequences - Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire.	Medium	Low
No credible causes	N/A	N/A
Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc	Medium	Low
Causes - Construction moving equipment, heavy loaded, elevated loads, working at heights Consequences - Injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses	High	Low
Causes - Use of electrical machines, generators etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage electrical equipment.	Medium	Low
Causes - Dust from construction and generally hot dry area. Consequences - Adverse impact on employee health.	Low	Low
Causes - Diesel for equipment, paints and solvents. Transformer oil spills. Sewage and kitchen/mess area wastewater. Consequences - Environmental damage, particularly to the surface and underground water in the area.	Low	Low
Causes - Mess area and other solid waste. Consequences - Environmental damage.	Low	Low
Causes - Water usage not controlled. Battery equipment damaged. Consequences - Delays.	Low	Low
Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	Medium	Low
Causes - Defective technology. Extreme project delays. Consequences - Financial loss	Medium	Low
Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	Medium	Low
Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	Medium	Low

Impact	Pre-mitigation	Post-mitigation
Causes Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using “cheaper supplier or less developed technology”.	Medium	Low
OPERATIONAL		
Impacts to Biophysical Systems		
Aquatic		
Changes in sediment regimes of the aquatic ecosystem and its sub -catchment by for example sand movement, meandering river mouth /estuary, changing flooding or sedimentation patterns. Construction and maintenance activities will result in earthworks and soil disturbance as well as the disturbance of natural vegetation. This could result in the loss of topsoil, sedimentation of the watercourses and pan and increase the turbidity of the water. Possible sources of the impacts include: • Earthwork activities during construction • Clearing of surface vegetation will expose the soils, which in rainy events would wash through the watercourse, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees can spread easily into these eroded soil. • Disturbance of soil surface • Disturbance of slopes through creation of roads and tracks adjacent to the watercourse • Erosion (e.g. gully formation, bank collapse)	Medium	Low
Changes to hydrological function at a landscape level 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). The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary, seasonal, permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). Changes to base flows (e.g. too little/too much water in terms of characteristics and requirements of system). Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal). The sources of this impact include the compaction of soil, the removal of vegetation, surface water redirection, changes to watercourse morphology or input of high energy surface water which could occur during construction and operation of the solar plant	Medium	Low
The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles. Invasions of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plans can easily colonise and impact on downstream users.	Medium	Low
Construction and operational activities may result in the discharge of solvents and other industrial chemicals, leakage of fuel/oil from vehicles and the disposal of sewage resulting in the loss of sensitive biota in the wetlands/rivers and a reduction in watercourse function. Chemical and Thermal Pollution: Potential risk of chemical pollution from storage and handling of chemicals used for panel cleaning or maintenance. Additionally, solar plants with concentrated solar power (CSP) technology may release heated water into nearby water bodies, leading to thermal pollution and potential impacts on aquatic organisms	Medium	Low
Loss of instream habitat, deposition of wind-blown sand, loss of fringing vegetation and erosion, alteration in base flow, natural fire regimes and subsequent loss of non-marginal and marginal vegetation. Increase in invasive species due to disturbance. Change in water quality. Changes in flow. Loss and disturbance of biota due to direct development on the watercourse as well as changes in habitat including water quality, the water column, increased sediment, increased alien vegetation fire regime and habitat fragmentation	Medium	Low
Loss and disturbance of watercourse habitat and fringe vegetation due to direct development on the watercourse as well as changes in management, fire regime and habitat fragmentation	Medium	Low
Terrestrial		
Displacement and/or disturbance of fauna communities	High	Low
Re-establishment of secondary vegetation cover and establishment of alien species	High	Low
Agricultural		
Loss of topsoil as a resource – Contamination, Disturbance, Erosion, and Compaction	Medium	Medium

Impact	Pre-mitigation	Post-mitigation
Loss of Land Capability	Medium	Medium
Loss of Agricultural Resources and Infrastructure	Low	Low
Loss of topsoil as a resource – Contamination, Disturbance, Erosion, and Compaction	Medium	Medium
Loss of Land Capability	Medium	Medium
Loss of Agricultural Resources and Infrastructure	Low	Low
Avifauna		
Disturbance (including of nesting SCC) due to noise such as, machinery movements and maintenance operations during the construction phase the proposed PV solar farm causing loss of offspring for a generation.	Low	Low
Bird mortalities during the operational phase due to vehicle collisions, collisions with infrastructure and/or combustion.	High	Medium
Loss of Bird Foraging Habitat	High	Low
Disruption of bird migratory pathways during the operational phase	Medium	Low
The attraction of some novel bird species due to the development of a solar farm with associated infrastructure such as lake effect perches, nest and shade opportunities may cause both damage to the infrastructure through acidic defecation by certain species but also draw birds closer to infrastructure and cause significant direct mortality risks.	Medium	Medium
Chemicals being used to keep the PV panels clean from dust (suppressants) etc.	High	Low
Heritage		
Operational activities that take place near to archaeological resources may result in their destruction	High	Low
Operational activities that take place near to palaeontological resources may result in their destruction	Low	Low
Operational activities that take place near to cultural landscape elements may result in their destruction	Medium	Low
Social		
The use of renewable energy technology reduces long-term economic losses from extreme weather events, worsened air quality, rising sea levels and other effects. Switching from fossil fuels to renewables could help slow down climate change and avoid some of these potential economic losses.	Medium	Medium
Creation of direct and indirect employment, and skills development opportunities and skills development because of the operation of the project. Employment opportunities include safety and security staff, operation and monitoring, and maintenance crew. Maintenance activities are carried out throughout the lifespan of the project and include washing of solar panels, vegetation control, and general maintenance around the solar energy facility. Coupled to employment creation are increased household income and standard living.	Low	Medium
Income tax and Municipal rates increase above that gained from the agricultural use of the land.	Medium	Medium
Sense of place impacts associated with the operation phase of the solar energy facility and associated infrastructure. The presence of the solar energy facility could impact the “sense of place” for the local community. This may have an impact on tourism in the area.	Medium	Low
The development footprint on which the solar energy facility will be developed will be removed from agricultural production. The development of the proposed project on an agricultural property would result in an area of land required to support the development footprint being removed from potential agricultural production. If the land is currently used for agricultural production the farm jobs may be threatened.	Medium	Medium
Transportation		
Increase in normal load traffic	Low	Low
Increase of Incidents with pedestrians	Low	Low
Increased need for road maintenance	Low	Low
Additional Abnormal Loads	Low	Low
New / Upgraded Access points	Low	Low
Visual		
Compaction of larger areas can result in soil sterilisation and landscape degradation.	Low	Low
Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	Low	Low
Compaction of larger areas can result in soil sterilisation and landscape degradation.	Low	Low
Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	Low	Low

Impact	Pre-mitigation	Post-mitigation
Risk Assessment		
Solid State Lithium-ion Battery Energy Storage System		
Causes - Operation and maintenance materials spare parts, paints, solvents, welding fumes, transformers oils, lubricating oils and greases etc. Consequences - Occupational illness.	Medium	Low
Causes - Compromised battery compartments vapours accumulate in the containers, solids/liquids on surfaces. Maintenance of battery components, corrosive and mildly toxic liquid on surfaces. Consequences - Dermatitis, skin /eye/lung irritation.	Medium	Low
Causes - Moving parts inside containers, buildings, pumps, compressors, cooling systems etc. Consequences - Adverse impact on hearing of workers. Nuisance factor at near -by residences or other activities.	Medium	Low
Causes - Heat during the day. Batteries generate heat within enclosed building / containers. Cold in winter. Night work requires lighting. Consequences - Heat stroke. Hypothermia.	Low	Low
Causes - Isolated workstation and monotonous repetitive work. Consequences - Low performance, system productivity suffers.	Low	Low
Causes - Lifting heavy equipment. Awkward angles during maintenance, stretching reaching to high level and bending to low level. Working at height if equipment located on top of roofs or elevated electrical equipment (e.g., pylons). Consequences - Back and other injuries.	Medium	Low
Causes – Involvement in an external fire e.g., veld fire, maintenance vehicle fire, electrical systems fire. Manufacturing defects or damage to battery leading to shorting and heating. High humidity condensation of water or ingress of water or flooding leading to shorting. Dust accumulation on electrical parts leading to overheating. Excessive electrical loads - surges Operator abuse BMS failure or software failure. Incorrect extinguishing medium, escalate the fire. Consequences - Contaminated run off. Radiation burns unlikely to be severe as no highly flammable materials on site. Damaged equipment. Fire spreads to other units or offsite if grass/vegetation not controlled.	High	Low
Causes - Power Conversion System (PCS – DC to AC) cooling failure electrical fire. Consequences - Fire starts in PCS or another section or room and spreads to battery area.	High	Low
Cause 1 - Transformer shorting / overheating / explosion. Cause 2 - Flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static. Lithium Cobalt Oxide generates O2 during decomposition – escalation. Consequences - Potential fatalities amongst first responders. Damage to container or other nearby items, e.g., other container.	Medium	Low
Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc	Low	Low
Causes - Damaged batteries components, leak electrolyte, are completely broken exposing hazardous chemicals. Hazardous fumes released on thermal run away see fire above. Consequences - Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns for large exposure. In the case of toxic fumes, serious lung damage.	Medium	Low
Causes - Moving equipment, pumps, heavy equipment at elevation, nip points, working at heights. Traffic accidents. Earthquake / tremor. Consequences - Injury. Fatality in unlikely worst case, e.g., traffic accidents or fall from heights. Damage to equipment, spills, environment pollution	Medium	Low
Causes - Use of electrical machines, generators etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage electrical equipment.	Medium	Low
Not expected on a normal basis. Refrigerant may be an asphyxiant if accidentally released indoors it can accumulate and displace oxygen.	Low	Low
Causes - Cooling water blow-down. Laboratory waste (if included in the design). Maintenance waste, e.g., oils. Spills from batteries, coolant system, diesel trucks, transformers. Parked vehicles – oil drips. Fire water runoff control. Kitchen waste and sewage. Refrigerant release. Consequences - Pollution if not contained. Excessive disposal costs if emissions not limited.	Low	Low

Impact	Pre-mitigation	Post-mitigation
Causes - Mess area and other solid waste. Disposal of solid-state batteries. Consequences - Environmental damage.	Low	Low
Causes - Similar to construction phase. Disposal of batteries or components. Disposal of containers. Water usage not controlled. Consequences - Delays. Excessive costs and disposal of large volumes of hazardous waste.	Low	Low
Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	Low	Low
Causes - Defective technology. Extreme project delays. Consequences - Financial loss	Medium	Low
Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	Medium	Low
Causes - Cyber security attacks aimed at the National Electricity Grid. Consequences - Ransom of the National Electricity Grid.	Medium	Low
Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	Medium	Low
Causes Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using “cheaper supplier or less developed technology”.	Medium	Low
Vanadium Redox Flow Battery Energy Storage Systems		
Causes - Construction materials such as cement, paints, solvents, welding fumes, truck fumes etc. Consequences - Employee / contractor illness.	Medium	Low
Causes - Drilling, piling, generators, air compressors. Consequences - Adverse impact on hearing of workers. Possible nuisance factor in near-by areas.	Medium	Low
Causes - Heat during the day. Cold in winter. Consequence - Heat stroke. Hypothermia.	Low	Low
Causes - Large projects bring many contractor workers into a small, isolated community. Consequences – Lack of sufficient accommodation, entertainment etc. Increase in alcohol abuse, violence	Low	Low
Causes - Lifting heavy equipment. Awkward angles during construction. Consequences - Back and other injuries.	Low	Low
Causes – Involvement in an external fire. Fire involving fuels used in construction vehicles or vehicles themselves (e.g., tyre fire). Fire due to uncontrolled welding or other hot-work Consequences - Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire.	Medium	Low
No credible causes	N/A	N/A
Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc	Medium	Low
Causes - Construction moving equipment, heavy loaded, elevated loads, working at heights Consequences - Injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses	High	Low
Causes - Use of electrical machines, generators etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage electrical equipment.	Medium	Low
Causes - Dust from construction and generally hot dry area. Consequences - Adverse impact on employee health.	Low	Low
Causes - Diesel for equipment, paints and solvents. Transformer oil spills. Sewage and kitchen/mess area wastewater. Consequences - Environmental damage, particularly to the surface and underground water in the area.	Low	Low
Causes - Mess area and other solid waste. Consequences - Environmental damage.	Low	Low
Causes - Water usage not controlled. Battery equipment damaged. Consequences - Delays.	Low	Low
Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	Medium	Low
Causes - Defective technology. Extreme project delays. Consequences - Financial loss	Medium	Low

Impact	Pre-mitigation	Post-mitigation
Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	Medium	Low
Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	Medium	Low
Causes Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using “cheaper supplier or less developed technology”.	Medium	Low
DECOMMISSIONING		
Impacts to Biophysical Systems		
Aquatic		
Changes in sediment regimes of the aquatic ecosystem and its sub -catchment by for example sand movement, meandering river mouth /estuary, changing flooding or sedimentation patterns. Construction and maintenance activities will result in earthworks and soil disturbance as well as the disturbance of natural vegetation. This could result in the loss of topsoil, sedimentation of the watercourses and pan and increase the turbidity of the water. Possible sources of the impacts include: • Earthwork activities during construction • Clearing of surface vegetation will expose the soils, which in rainy events would wash through the watercourse, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees can spread easily into these eroded soil. • Disturbance of soil surface • Disturbance of slopes through creation of roads and tracks adjacent to the watercourse • Erosion (e.g. gully formation, bank collapse)	Medium	Low
Changes to hydrological function at a landscape level 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). The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary, seasonal, permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). Changes to base flows (e.g. too little/too much water in terms of characteristics and requirements of system). Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal). The sources of this impact include the compaction of soil, the removal of vegetation, surface water redirection, changes to watercourse morphology or input of high energy surface water which could occur during construction and operation of the solar plant.	Medium	Low
The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles. Invasions of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plans can easily colonise and impact on downstream users.	Medium	Low
Decommissioning activities may result in the discharge of solvents and other industrial chemicals, leakage of fuel/oil from vehicles and the disposal of sewage resulting in the loss of sensitive biota in the wetlands/rivers and a reduction in watercourse function.	Medium	Low
Loss of instream habitat, deposition of wind-blown sand, loss of fringing vegetation and erosion, alteration in base flow, natural fire regimes and subsequent loss of non-marginal and marginal vegetation. Increase in invasive species due to disturbance. Change in water quality. Changes in flow. Loss and disturbance of biota due to direct development on the watercourse as well as changes in habitat including water quality, the water column, increased sediment, increased alien vegetation fire regime and habitat fragmentation.	Medium	Low
Loss and disturbance of watercourse habitat and fringe vegetation due to direct development on the watercourse as well as changes in management, fire regime and habitat fragmentation.	Medium	Low

Impact	Pre-mitigation	Post-mitigation
Terrestrial		
Dismantling and removal of infrastructure	Medium	Low
Repurpose all recyclable materials	High	Medium
Avifauna		
Disruption of bird migratory pathways during the decommissioning phase	Medium	Low
Destruction of habitats and scarring	High	Medium
Heritage		
Decommissioning activities that take place near to archaeological resources may result in their destruction	High	Low
Decommissioning activities that take place near to palaeontological resources may result in their destruction	Low	Low
Decommissioning activities that take place near to cultural landscape elements may result in their destruction	Medium	Low
Social		
Economic multiplier effects from the use of local goods and services during the construction phase. The economic benefits through investment into capital construction and infrastructure and equipment manufacturing leads to growth in the national GGP, Income and production output of the private and government sectors.	Low	Low
Construction of the project will result in the creation of several direct and indirect employment opportunities, which will contribute towards lessening the unemployment levels within the area and aid in skills development of communities in the area.	Low	Low
An influx of people into the area leading to a temporary increase in social disruption, pressures on basic services change in social dynamics, increase in HIV, pregnancies, and drug abuse.	Low	Low
Temporary increase in safety and security concerns associated with the influx of people during the construction phase. An influx of job seekers, and or construction workers to an area is a contributor to increased criminal activities in an area, such as increased safety and security risk for neighbouring properties and damage to property, increased risk of veld fire, stock theft and crime etc.	Low	Low
Temporary increase in traffic disruptions and movement patterns during construction. Increased traffic due to construction vehicles and heavy vehicles could cause disruptions to road users and increase safety hazards. The use of local roads and transportation systems may cause road deterioration and congestion.	Low	Low
Nuisance impacts in terms of temporary increase in noise and dust, and wear and tear on access roads to the site. Impacts associated with construction related activities include noise, dust and disruption or damage to adjacent properties. Site clearing activities increase that risk of dust and noise being generated, which can in turn negatively impact on adjacent properties.	Low	Low
Transportation		
Increase in normal load traffic	Low	Low
Increase of Incidents with pedestrians	Medium	Low
Increased need for road maintenance	Low	Low
Additional Abnormal Loads	Low	Low
New / Upgraded Access points	Low	Low
Visual		
Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	Medium	Low
Old, unused structures have the potential to significantly degrade the landscape character.	Medium	Low
Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access road.	Medium	Low
Old, unused structures have the potential to significantly degrade the landscape character.	Medium	Low
Risk Assessment		
Solid State Lithium-ion Battery Energy Storage System		
Similar to the construction and operational phases - no new hazards.	N/A	N/A
Causes - Batteries / electrolyte / equipment reached end of life and may leak. Consequences - Environment damage from heavy metal ions.	Medium	Low
Disposal of hazardous “waste” is rife with difficulties and numerous regulations that need to be complied with.	Medium	Low

Impact	Pre-mitigation	Post-mitigation
Vanadium Redox Flow Battery Energy Storage Systems		
Similar to the construction and operational phases - no new hazards.	N/A	NA
Causes - Batteries / electrolyte / equipment reached end of life and may leak. Consequences - Environment damage from heavy metal ions.	Medium	Low
Disposal of hazardous "waste" is rife with difficulties and numerous regulations that need to be complied with.	Medium	Low
CUMULATIVE		
CONSTRUCTION		
Impacts to Biophysical Systems		
Avifauna		
Regional Saturation of SEF facilities causing habitat loss	Very High	N/A
Increased roadkill due to higher traffic volumes	High	Low
Increased mortalities due to collisions with SEF infrastructure, especially powerlines and fences	High	Medium
Increased collision related mortalities due to increased powerlines	High	High
Heritage		
Cumulative destruction of significant archaeological heritage	Medium	Low
Cumulative destruction of significant paleontological heritage	Medium	Low
Cumulative impact to the cultural landscape	Medium	Low
Transportation		
Increase in normal load traffic	Medium	Low
Increase of incidents with pedestrians	Medium	Low
Increased need for road maintenance	Medium	Low
Additional Abnormal Loads	Medium	Low
Need for new / Upgraded Access points	Medium	Low
Visual		
Intervisibility of the proposed project with surrounding PV projects could result in massing effects degrading landscape resources. No other RE projects are located in the ZVI with limited residential receptors in mainly Medium to Low Visual Exposure distances.	Low	Low
OPERATIONAL		
Impacts to Biophysical Systems		
Avifauna		
Regional Saturation of SEF facilities causing habitat loss	Very High	N/A
Increased roadkill due to higher traffic volumes	High	Low
Increased mortalities due to collisions with SEF infrastructure, especially powerlines and fences	High	Medium
Increased collision related mortalities due to increased powerlines	High	High
Heritage		
Cumulative destruction of significant archaeological heritage	Medium	Low
Cumulative destruction of significant paleontological heritage	Medium	Low
Cumulative impact to the cultural landscape	Medium	Low
Transportation		
Increase in normal load traffic	Medium	Low
Increase of incidents with pedestrians	Medium	Low
Increased need for road maintenance	Medium	Low
Additional Abnormal Loads	Medium	Low
Need for new / Upgraded Access points	Medium	Low
Visual		
Intervisibility of the proposed project with surrounding PV projects could result in massing effects degrading landscape resources. No other RE projects are located in the ZVI with limited residential receptors in mainly Medium to Low Visual Exposure distances	Low	Low
DECOMMISSIONING		
Impacts to Biophysical Systems		
Avifauna		
Increased collision related mortalities due to increased powerlines	High	High
Heritage		
Cumulative destruction of significant archaeological heritage	Medium	Low
Cumulative destruction of significant paleontological heritage	Medium	Low

Impact	Pre-mitigation	Post-mitigation
Cumulative impact to the cultural landscape	Medium	Low
Transportation		
Increase in normal load traffic	Medium	Low
Increase of Incidents with pedestrians	Medium	Low
Increased need for road maintenance	Medium	Low
Additional Abnormal Loads	Medium	Low
New / Upgraded Access points	Low	Low
Visual		
Intervisibility of the proposed project with surrounding PV projects could result in massing effects degrading landscape resources. No other RE projects are located in the ZVI with limited residential receptors in mainly Medium to Low Visual Exposure distances.	Low	Low

17. SUMMARY OF SPECIALIST FINDINGS AND RECOMMENDATIONS

Table 21: Summary of specialist findings and recommendations

Specialist Study	Findings	Recommendations
Agricultural Assessment	The sensitivity analysis has identified the project area to have a Medium to Low sensitivity, with small areas of High sensitivity where existing agricultural fields are. therefore, an Agro-ecosystem impact assessment is required. The desktop results as well as the field verification and detailed soils assessment have determined that the agricultural potential is rated as Medium to High based on the climatic conditions as well as the soils identified on site. The following indicates the desktop and in field findings: <u>Desktop Results;</u> • DEA screening assessment determined the agricultural sensitivity to be Medium to Low, with small areas of High; • The project has small areas of crop field boundaries; • The desktop land capability rated the project area as Low to Low-Moderate with a small portion to the east being rated as Moderate; • The climate capability was determined to be Moderate; • The desktop soil capability rated the project area as Very-Low with a small portion to the east being rated as Moderate. A very narrow edge of Moderate-High capability occurs on the northern edge of the project area; and • The desktop grazing capability rated the project area as 5ha/LSU. <u>Site Assessment Results;</u> • Land capability was determined as grazing to light cultivation; • Land potential was determined to be L2 (high potential) to L4 (moderate potential); and • Land use showed natural grasslands used for cattle grazing and small areas of maize farming.	The specialist opinion is that the proposed project can be considered favourably from an agricultural and soils impact perspective based on the following: • The DFFE screening tool showed very small areas of potential High sensitivity areas. • These areas were isolated to the existing crop farming areas in the western edge of the project. • The land capability is marginal with limited soil depth and a light cultivation to grazing capability only. • Based on the site layout no Solar PV sites fall within the L2 land potential. The impacts are considered Moderate impact. • Additionally, the alternative substation falls within the L2 land potential. Therefor it is the specialist opinion that the preferred substation be selected. • The high potential land capability (L2; category B) must be retained for agricultural use due to the limited availability of high potential land, as per departmental guidelines. • The only mitigation measure that will reduce the impact level is by avoiding the high potential (L2) areas completely.

Specialist Study	Findings	Recommendations
Aquatic Assessment	The site assessment confirmed the presence of two wetland types. The watercourses are further classified as follows: ➢ Channelled Valley Bottom Valley; ➢ 2 Hillslope Seepage Wetlands The current footprint of the Solar and associated infrastructure does not encroach into the wetland and associated buffer areas. Although the exact footprint positions of the pylons were not known during the writing of this report it is assumed that it will span the wetlands and buffer zones with no pylons located in these areas. The proposed substations are not located on any wetland or wetland buffer zone. Prior to the proposed mitigation measures most impacts rated moderate and post mitigation they ranked low in both the construction and operational phase.	It is advised that the structures remain outside of the wetlands and associated buffer zones. The risk scores fall in the Low category.
Terrestrial Biodiversity Assessment	Based on the SSV and field survey, the Terrestrial Biodiversity theme was confirmed to have Very High sensitivity, while the Sensitive Plant Species theme was confirmed to have High sensitivity owing to presence of protected species. The study areas are located within natural systems in the Endangered Eastern Highveld Grassland and Steenkampsberg Montane Grassland vegetation units. The study area is located primarily in CBA Optimal, Other Natural Areas, Heavily Modified, and a small section in CBA Irreplaceable and Moderately Modified. Areas of high biodiversity value including CBA Irreplaceable and Optimal should be avoided as far as possible concerning transformation of land cover; accordingly, all permanent infrastructure such as the BESS, substation and O&M Building must be located outside these sensitive areas. All temporary infrastructure including the site camp required during the construction phase, must also be located outside high sensitivity areas.	• Rehabilitation and monitoring plan required post-construction and post-operational phase of the project which addresses ecosystem functioning, fire management, alien invasive species management and effective methods of rehabilitating natural vegetation to functional systems (not just biomass replacement). • Roads and underground cabling must avoid sensitive areas as far as possible by considering various layout alternatives. The karoo shrubland habitat will not be transformed completely (only PV related – this is not the case for roads and temporary laydown areas), accordingly with appropriate mitigation and rehabilitation measures post-construction and post-operational, the impact

Specialist Study	Findings	Recommendations
	The Primary Grassland and Watercourse is considered to have Very High SEI, especially with regards to the presence of sensitive plant species, suitable habitat for sensitive plant species and important ecosystem functions. Accordingly, transformation of these habitats is not supported (no destructive development activities should be considered) as avoidance mitigation is required wherever possible and changes to project infrastructure design must be done to limit the amount of habitat impacted. Therefore, only limited development activities of low impact will be acceptable. Linear infrastructure such as roads and internal powerlines can cross the watercourses, but care should be taken in the planning of this. The aquatic biodiversity assessment must also be consulted for additional mitigation measures to be considered during the design phase, as well as the construction and operational phases of the projects. A sensitive plant species, K. carolinensis was recorded in Primary Grassland which should be protected in situ and must be avoided by the proposed development. A 200m buffer has been placed around its location. The DDT Aloe verdoorniae was also recorded in Primary Grassland and could also occur within the Rocky Grassland. All suitable habitat for the species has been mapped and included as high sensitivity including suitable habitat for other sensitive plant species. For provincially listed species which are affected by the proposed development, a permit application for their removal must be applied for with the provincial authority prior to the commencement of construction activities.	of the PV panels is considered medium for grassland. • It is advised that an ecological specialist is appointed during the construction, operational and decommissioning phases to monitor impacts and related mitigation measures regarding natural and sensitive habitats and the faunal and floral assemblages occurring there. • Care should be taken not to unnecessarily clear or destroy natural vegetation. • Development and planned activities should therefore be planned in such a way that totally transformed areas are chosen for major developments and natural veld and especially any highly sensitive areas are avoided as far as possible. • Provincially listed species which are affected by the proposed development require a permit application for their removal from the provincial authority prior to the commencement of construction activities.
Avifaunal Assessment	The PA is located in a region dominated by natural grassland, drainage lines, disturbed grassland, cropland and stands of alien invasive trees. Several drainage lines and small farm dams can be found scattered across the PA with most being mostly permanent with some seasonal flow/ inundation. The powerline infrastructure that traverses the PAOI is a significant habitat for	• The addition of the proposed Roos SEF does indicate some (relatively few) potentially significant impacts (without mitigation) to the receiving environment via the risk to Priority Species (such as Secretary Bird, Martial Eagle,

Specialist Study	Findings	Recommendations
	Martial Eagles and other raptors. Fifteen (15) priority species were predicted during the initial surveys, including Secretarybirds, Martial Eagles, Black-chested Snake Eagle, Southern Bald Ibis and White Storks Of these, the Secretarybirds and Martial Eagle were the most concerning large bird species. At the commencement of the survey, the PAOI was characterised by an extreme rainfall event (wet season) may have atypically transformed the PAOI where it is possible that increased densities (and perhaps diversity) of avifaunal assemblages may have been recorded due to an abundance of high forage value habitat. However, although the density and diversity of Priority Species was high, most of these species were common and widespread and largely synanthropic (water and natural grassland associates excluded) and the density and diversity of SCC was very low.	and Denham's Bustard and Southern Bald Ibis) and need to be considered with provision made within the EMPr for this development. • Although previous impact assessments and monitoring programs for existing local SREFs indicated that not all impacts can be mitigated to acceptable levels, medium significance post-mitigation should be interpreted that more can be done to avoid critically important species-specific (especially Martial Eagle and Secretary Bird impacts as is the case for the impacts discussed within this statement). This is mainly because impact assessments regarding solar energy developments have been poorly understood since their inception and the impacts (especially cumulative impacts) of solar developments may have significant consequences if mitigation and monitoring is not implemented correctly. • Overall, it is still the opinion of the consultants that the impacts associated with SEF projects are far preferable (from an environmental impact perspective) to extractive and/ or non-renewable alternatives or even Wind Energy Facilities (WEF). It must be related that this report must be considered in context with the greater EIA process which factors in economic desirability etc. • In addition, while striving to maintain the highest standards of mitigation and monitoring as well as the commissioning of a highly detailed pre-construction micro siting assessment,

Specialist Study	Findings	Recommendations
		developments such as the Roos SEF should be encouraged within designated areas. • The roosting of Martial Eagles and the foraging of Secretarybirds is of some concern. • Avoidance mitigation must be implemented in conjunction with the aforementioned micro siting as well as technological applications such as perch diverters, flappers and possibly taping over solar panels in the case of Lake Effect impacts. Thus, the author will look to support Environmental Authorisation (EA) based upon the following conditions: o All recommended No-Go buffering must be strictly adhered to; o Micro siting of panel placement must occur prior to construction and should be supervised by a specialist zoologist in order to mitigate habitat loss and collision risks for species; o All recommended mitigation measures described above must be applied; o The EMPr must be updated every three years in order to reevaluate the potential distributional population changes of species such as Martial Eagles and Southern Crowned Cranes Thus, technological mitigations such as monitoring, flapper and diverter technology may have to be re-positioned, re-calibrated and updated. • Since the immediate area comprising approved or pending SEFs are expected to cumulatively result

Specialist Study	Findings	Recommendations
		in a Moderate impact significance to avifauna after the application of the recommended mitigation measures, and since the combined area will likely contribute moderately to the total land area in the region transformed by renewable energy projects, it is recommended that the development may proceed on condition that: • All mitigation measures stipulated above are adhered to and captured in an Environmental Management Plan (EMP); • The EMP must include the necessity for post-construction avifauna monitoring as stipulated in Jenkins et al., (2015); • All updated mitigation recommendations issued post-construction (informed by monitoring) must be adhered to Ultimately, the specialist recommends that the project be given a positive authorisation based upon the avifaunal baseline and Environmental Impact Assessment.
Heritage Assessment	The broader area surrounding this proposed for this development is known for a variety of kinds of heritage resources including Stone Age and Iron Age archaeology, significant structures and living heritage sites such as significant baobab trees as well as burial grounds and graves. The survey results confirm these findings. The survey proceeded with limited constraints and limitations, and the project area was comprehensively surveyed for heritage resources. The Iron Age remains identified in the field assessment likely reflect a much more extensive past settlement and as such, CTS Heritage has mapped out	There is no objection to the proposed development from a heritage perspective on condition that: • A no development buffer of 100m is implemented around site 004. This is largely respected in the final layout provided. • A no development buffer of 100m is implemented around site 003 and 009. This is respected in the final layout provided.

Specialist Study	Findings	Recommendations
	the areas of high archaeological sensitivity associated with this. These areas are reflected in RED in the maps above and must be considered strict no-development areas as the likelihood of impacting significant archaeological heritage in these areas is VERY HIGH.	• The identified sensitive archaeology areas are not impacted by the development of any new infrastructure, including fencing. This is largely respected in the final layout provided. • A Heritage Management Plan and Heritage Agreement are drafted for the ongoing conservation of the significant Iron Age resources identified. • Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.
Social Impact Assessment	The proposed development site is next to the N4 Highway between Gauteng and Mbombela. The Emakhazeni Municipality is mainly a rural municipality The area serves as a gateway to the tourism parks and private reserves in the Lowveld areas of the Province. There are no tourism related destinations within 15 km from the site. The proposed development is in Ward One of the Municipality which will be most affected by the direct socio-economic impacts of the project. Whereas the total population of Emakhazeni is in the order of 54 400 in 2022/3, the population of Ward One was 5 853 in 2011. The community of Ward One is poor working mainly on the farms and mines in the region with an average annual income of R29 400 per household in 2011 and with a high unemployment rate of more than 24%. Most of the formally employed persons work in the agriculture and mining sectors. Ninety-nine percent (99%) of the population in Ward One is from the Black population group with an even male	The proposed project does not present any socio-economic fatal flaws and the project should go ahead. The benefits of the proposed project exceed the negative socio-economic impacts as well as the no-go option. Given that renewable energy development is highly desirable in South Africa from a social, environmental and development point of view, the positive economic and social opportunities lost under the no-go option renders it as an unattractive alternative. It is recommended that the proposed project proceed with the following actions being undertaken: • Implementation of the mitigations.

Specialist Study	Findings	Recommendations
	and female gender split. The population is a young population with a mean age of 23 years and 46% of the people are younger than 19 years of age. About 5% of the population is older than 60 years. The 'no-go' alternative will result in no direct socio-economic impacts from the proposed project on the site or surrounding local area although, it does means that some economic employment opportunities will be lost for the local community. The socio-economic benefits and disadvantages of the proposed project relates to the broader environment outside of the site and do not relate to the specific solar site and grid infrastructure. The identification of preferred site options is not sensitive to the socio-economic impacts. There are no other renewable energy projects within 15 km of the proposed PV project. Although the broader project area is known for its mining activities within 50 km from the site, the location of the site, which on the north of the N4, share few socio-economic impacts with the mines. It is therefore assessed that the proposed project will not contribute to the cumulative socio-economic impacts in the local area.	• Review comments received from members of the public, key stakeholders, and any organ of state during the public review process. • Prepare a SIA Report for inclusion in the BA Report to be prepared for the project.
Transportation Impact Assessment	The development is located along the N2 national route. It is reachable from likely points of supply through an existing road network that is in good and suitable condition, including for the transportation of abnormal loads. Two accesses to the facility already exist in the form of private farm access roads off the N2. These accesses are deemed suitable for the proposed adjusted land use but will require minor upgrades to accommodate the anticipated traffic. The construction phase of this development is estimated to generate ±18 peak hour trips, the operation and maintenance phase ± 56 peak hour trips, and the	With reference to this report, associated assessment and the findings made within, the Roos Solar Energy Facility will have a nominal impact on the existing traffic network. The project is therefore deemed acceptable from a transport perspective provided the recommendations and mitigations measures proposed herein are implemented, and hence the Environmental Authorisation (EA) should be granted.

Specialist Study	Findings	Recommendations
	decommissioning phase ±15 peak hour trips. Overall, the traffic impacts of the proposed development are considered to be nominal. Several mitigation measures are proposed to accommodate the development and to reduce the impact to the surrounding road network.	
Visual Impact Assessment	In terms of Landscape and Visual Impact Significance, the PV project is rated Medium without mitigation, and Medium to Low with mitigation or wind-blown dust, lights at night as well as soil erosion on the PV panels areas located on slope areas (less than 1 in 10m). In terms of negative cumulative effects, without mitigation the risk is rated High due to light spillage in the rural landscape from security lights at night. With mitigation and the careful management of security lighting and no overhead flood lights for the PV, BESS or substation areas, the risk can be reduced to Low. While both the Preferred and Alternative LILO/ BESS areas are suitable, there is a preference for the Preferred LILO area as the locality is less exposed to rural receptors. The following key reasons provide the motivation for the overall PV development: • The site visual resources are limited with a Medium rating for Scenic Quality and Low rating for Receptor Sensitivity to landscape change. • Regionally, the viewshed is contained to some degree from topographic screening and has no High or Medium Exposure Receptors. The nearest significant receptor area is the KNP located 12km to the north where massing effects of the combined views of the PV areas will not generate a dominating visual effect. • National energy objectives for renewable energy and job creation will be met and there is a good alignment with regional and local planning. • Medium rating for Visual Impact Significance with mitigation.	It is recommended that the proposed PV project should be authorised WITH Mitigation. With mitigation, the benefits of the PV related landscape change are likely to outweigh the landscape status quo, where scenic resources are limited.

Specialist Study	Findings	Recommendations
Glint and Glare Impact Assessment	The impact of glare is assessed against ocular hazard protocols to determine whether such glare can be considered a nuisance or harmful to potential observers operating in, and around the solar PV facility. Several buildings and the natural environment surrounding the location of the proposed PV facility and several glare receptors, including route receptors such as nearby roads and railway lines, which lie within the viewshed of the proposed solar PV facility were considered in this assessment. Aviation receptors are excluded from this assessment due to none being in close proximity to the proposed solar PV facility. The potential impacts from the proposed solar PV facility from glint and glare are either none, or have a low impact (Green Glare). Green glare has a low intensity level and is similar to many materials such as concrete, steel sheeting and other building materials that have minimal visual impact. No negative impacts were observed from the site analysis. Due to low glare intensity observed during the analysis of the site, no negative impacts were identified and therefore no mitigation measures are required for the proposed solar PV modules. Using smooth glass solar PV modules without protective coatings will be suitable and not cause any harmful visual impact on surroundings.	Using smooth glass solar PV modules without an anti-reflective coating will result in either no glare, or green glare received at the assessed receptors. Green glare will not cause any harmful effect on nearby observers due to its low intensity and has a low potential for temporary after-image. As such, the proposed solar PV facility will not cause any significant, or harmful impact on nearby surroundings from a glint and glare perspective. SOLINK supports the findings of this report, as supplementary to the intended renewable energy project's Environmental Impact Assessment applications. It must be noted that although the intended solar PV project does not trigger any requirements for an aviation-related glint and glare assessment according to South African Civil Aviation Authority regulations, it would be advisable to contact Air Traffic Navigation Services (ATNS) to confirm in writing that Obstacle Registration with ATNS is not required due to their requirements (for glint and glare assessments, and obstacle registration) not being triggered: • The solar PV facility is not within 3 km of any aerodrome, airstrip, or helipad. • The solar PV facility does not lie within the extended 8 km, 9 degree diverted runway viewshed.
Risk Assessment	This report summaries the high-level Safety Health and Environmental Risk Assessment conducted by ISHECON for the proposed Battery Energy Storage Systems at the proposed Roos SEF facilities.	• There are numerous different battery technologies but using one consistent battery technology system for the BESS installations associated with

Specialist Study	Findings	Recommendations
	There will be a single BESS serving all four Solar PV facilities. The BESS storage capacity will be up to 500MW with up to four hours of storage i.e. up to 2000 megawatt-hour (MWh). Two alternative technologies are being considered for the BESS, i.e. either Solid State (typically Lithium chemistry) (SSL) or Redox Flow (typically vanadium chemistry) (VRFB). The technology is advancing rapidly and the exact technology and chemistry will be chosen during the Engineering, Procurement and Construction (EPC) phase. For SSL batteries this would mean multiple 251ontainerized units. For VRFB, the systems can be containerized but could, in order to achieve economies of scale, be one large utility scale plant within a conventional industrial type structural steel / brick warehousing structure. In either configuration there could be large volumes of electrolyte on site either in smaller tanks inside containers or larger tanks in a building. The VRFB facilities, either containerized or as utility buildings, will be bunded to contain 110% of the largest vessel. Supplementary infrastructure and equipment may include substations, power cables, transformers, power converters, substation buildings & offices, HV/MV switch gear, inverters and other control equipment that may be positioned within the battery containers / separate dedicated containers / the battery building. From a safety and health point of view, there are no significant cumulative impacts from any other BESS installation in the greater area.	all the developments in the Belfast area associated with the Roos Project would allow for ease of training, maintenance, emergency response and could significantly reduce risks. • Where reasonably practicable, state-of-the-art battery technology should be used with all the necessary protective features e.g., draining of cells during shutdown and standby-mode, full BMS with deviation monitoring and trips, leak detection systems. • There are no fatal flaws associated with the proposed Solar Energy battery installation for either technology type. • The tables in Section 4 of the specialist report of this report contains technical and systems suggestions for managing and reducing risks. Ensure the items listed in these tables under preventative and mitigative measures are included in the design. • The overall design should be subject to a full Hazop prior to finalization of the design. • For the VRFB systems an end of life (and for possible periodic purging requirements) solution for the large quantities of hazardous electrolyte should be investigated, e.g., can it be returned to the supplier for re-conditioning. • Prior to bringing any solid-state battery containers into the country, the contractor should ensure that: o An Emergency Response Plan is in place that would be applicable for the full route from the ship

Specialist Study	Findings	Recommendations
		to the site. This plan would include details of the most appropriate emergency response to fires both while the units are in transit and once they are installed and operating. o An End-of-Life plan is in place for the handling, repurposing or disposal of dysfunctional, severely damaged batteries, modules and containers. • The site layout and spacing between lithium solid-state containers should be such that it mitigates the risk of a fire or explosion event spreading from one container to another. • In order to limit the possibility of domino failures the BESS should be separated from the substation by at least 20m. • Under certain weather conditions, the noxious smoke from a fire in a lithium battery container could travel some distance from the unit. The smoke will most likely be acrid and could cause irritation, coughing, distress etc. Close to the source of the smoke, the concentration of toxic gases may be high enough to cause irreversible harmful effects. Location of the facilities needs to ensure a suitable separation distance from public facilities/residences etc. The preferred and the alternative BESS locations are over 500m from isolated farmhouses/developments, and are therefore suitable in this context. • VRFB hazards are mostly related to possible loss of containment of electrolyte and solid-state systems may experience fires that may result in

Specialist Study	Findings	Recommendations
		loss of containment of liquids or the use of large amounts of fire water which could be contaminated. One would not want these run-offs to enter water courses directly and a BESS Location that is far from water courses would be preferred. The buffer distance between water bodies and the facilities containing chemicals should be set in consultation with a water specialist and is therefore not specified in this SHE RA. It is noted that there are no tributaries of the main water courses in the area within 100m of the proposed BESS Location. • Finally, it is suggested once the BESS technology has been chosen and more details of the final design are available, the necessary updated Risk Assessments should be in place (prior to commencement, after environmental authorisation and other necessary approvals are granted (should such be granted)).

18. ENVIRONMENTAL IMPACT STATEMENT

Specialist assessments were conducted to address the potential impacts relating to the proposed development in order to ascertain the level of each identified impact, as well as mitigation measures which may be required. The results of the specialist assessments have indicated that all alternatives (including the preferred alternative) contain no fatal flaws that should prevent the proposed project from proceeding. In light of this, it is the EAP's reasoned opinion that authorisation be granted, and that the layout being proposed as part of this BA process also be authorised (provided there are no concerns raised during the public participation process).

A layout of the development and the environmental sensitivities is included below:

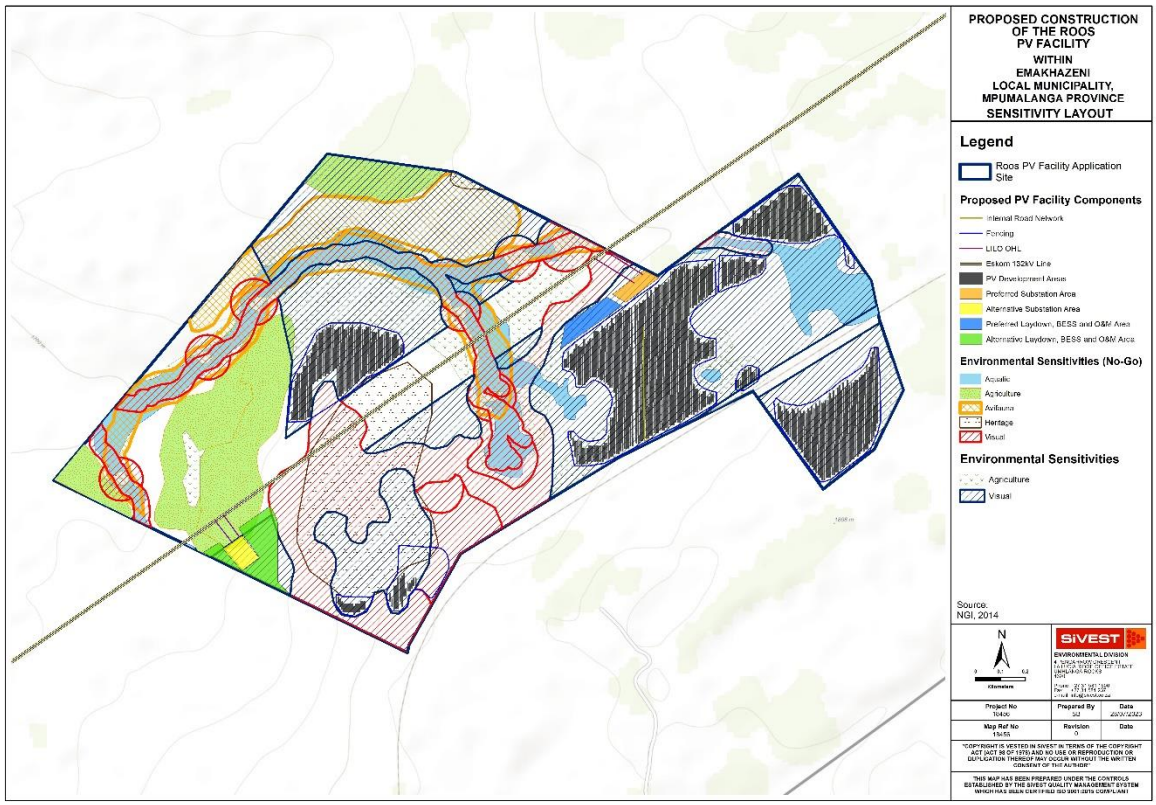

Figure 48: Layout of preferred alternatives with sensitives overlaid

The following specialist studies have been undertaken for the project:

- Visual Impact Assessment
- Heritage Impact Assessment
- Social Impact Assessment
- Transportation Impact Assessment
- Agriculture and Soils Impact Assessment (desktop)
- Aquatic Impact Assessment
- Terrestrial Biodiversity Impact Assessment
- Avifaunal Impact Assessment
- Glint and Glare Impact Assessment

- Risk Assessment

All specialist studies are included in **Appendix 6**. The specialist assessments concluded the following:

The **agricultural** specialist concluded that the proposed project can be considered favourably from an agricultural and soils impact perspective. It is recommended that the development be approved.

The **aquatic** specialist confirmed that, based on the findings of the study, there is no reason to withhold authorisation of any of the proposed activities. It is advised that the structures remain outside of the wetlands and associated buffer zones. The risk scores fall in the Low category.

The **terrestrial biodiversity** specialist advised that a Rehabilitation and monitoring plan is required post construction and post-operational phase of the project. Roads and underground cabling must avoid sensitive areas as far as possible by considering various layout alternatives. An ecological specialist should be appointed to monitor impacts. Care should be taken not to unnecessarily clear or destroy natural vegetation. A permit application for the removal of the provincially listed species is required prior the commencement of construction activities The proposed development is supported from the biodiversity perspective.

The **avifaunal specialist** confirmed that the proposed Roos SEF does indicate some (relatively few) potentially significant impacts (without mitigation) to the receiving environment via the risk to Priority Species (such as Secretary Bird, Martial Eagle, and Denham's Bustard and Southern Bald Ibis) and need to be considered with provision made within the EMPr for this development. Ultimately, the specialist recommends that the project be given a positive authorisation based upon the avifaunal baseline and Environmental Impact Assessment.

The **heritage** specialist confirmed that the Iron Age remains were identified in the field assessment and these areas are considered strict no-development areas as the likelihood of impacting significant archaeological heritage in these areas is VERY HIGH. There is no objection to the proposed development from a heritage perspective.

The **social** specialist confirmed that the proposed project does not present any socio-economic fatal flaws and the project should go ahead. The benefits of the proposed project exceed the negative socio-economic impacts as well as the no-go option. Given that renewable energy development is highly desirable in South Africa from a social, environmental and development point of view, the positive economic and social opportunities lost under the no-go option renders it as an unattractive alternative.

The **transportation** specialist confirmed that the proposed project will have a nominal impact on the existing traffic network. The project is therefore deemed acceptable provided the recommendations and mitigations measures proposed herein are implemented, and hence the Environmental Authorisation (EA) should be granted.

The **visual** specialist confirmed that with mitigation, the benefits of the PV related landscape change are likely to outweigh the landscape status quo, where scenic resources are limited. It is the recommendation that the proposed PV project should be authorised WITH Mitigation

The **glint and glare** specialist confirmed that the using smooth glass solar PV modules without an anti-reflective coating will result in either no glare, or green glare received at the assessed receptors. Green glare will not cause any harmful effect on nearby observers due to its low intensity and has a low

potential for temporary after-image. The proposed project will not cause an significant or harmful impact on nearby surrounding and is considered suitable for the proposed development.

The main findings of the specialist studies are included in **Section 17** above.

A summary of the positive and negative impacts associated with the proposed project is included in **Section 16** above.

It is trusted that the DBAR provides adequate information to the I&APs / stakeholders to provide input and for the competent authority to make an informed decision regarding the proposed development.

It should be noted that this section is deemed to be in line with the requirements of Appendix 1 of the EIA Regulations 2014, as amended, and contains a summary of the key findings of the environmental impact assessment, a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers and a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.

19. ENVIRONMENTAL MANAGEMENT PROGRAMME AND CONDITIONS TO BE INCLUDED IN THE EA

In accordance with Appendix 4 of the EIA Regulations, 2014 (as amended), a draft EMPr has been included within the DBAR. The draft EMPr includes the impact management measures formulated by the various specialists and the recording of the proposed impact management outcomes for the development have also been included in the draft EMPr (**Appendix 8**).

The draft EMPr provides suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored. The relevant management plans have also been incorporated into the draft EMPr (where required), which will assist in this regard.

The draft EMPr will need to be finalized once specialist walk downs have been undertaken prior to construction.

Taking into account the potential negative and significant positive impacts that the proposed development could have on the biophysical and social environment, it is the opinion of the EAP that the proposed development should be authorised subject to the following conditions of authorisation:

- All of the mitigation measures identified in this BA Report must be made conditions of the authorisation.
- It is important that all of the listed mitigation measures are costed for in the construction phase financial planning and budget so that the contractor and/or developer cannot give financial budget constraints as reasons for non-compliance.
- All feasible and practical mitigation measures recommended by the various specialists must be incorporated into the Final EMPr and implemented, where applicable;
- Where applicable, monitoring should be undertaken to evaluate the success of the mitigation measures recommended by the various specialists; and

- The final layout should be submitted to the Competent Authority (namely the DFFE) for approval prior to commencing with the activity.
- The activity-specific construction EMPr must be adhered to.
- An independent ECO must be appointed by the applicant to monitor the implementation of the construction EMP. The ECO should undertake regular site inspections and compile an environmental audit report.

20. ASPECTS WHICH WERE CONDITIONAL TO THE FINDINGS OF THE ASSESSMENT EITHER BY THE EAP OR SPECIALIST WHICH ARE TO BE INCLUDED AS CONDITIONS OF AUTHORISATION

None.

21. UNCERTAINTIES, ASSUMPTIONS AND GAPS IN KNOWLEDGE

The assessment has been based by SiVEST on information sourced and provided by the Applicant, site visits conducted, specialist findings and the application of the SiVEST assessment criteria. The EAP is of the opinion that the assessment method applied is acceptable. SiVEST assumes that:

- All the information provided by the Applicant is accurate and unbiased.
- The available data, including Topocadastral maps, Orthophotographs, geological maps and Google Earth images, are reasonably accurate.
- It is not always possible to involve all Interested and/or Affected Parties (I&APs) individually, however, every effort has/will be made to involve as many interested parties as possible. It is also assumed that individuals representing various associations or parties convey the necessary information to these associations / parties.
- It is not possible to determine the actual degree of the impact that the development will have on the immediate environment without some level of uncertainties. Actual impacts can only be determined following construction and/or operation commences.
- SiVEST undertook every effort to obtain the information (including specialist studies, BA / EIA / Scoping and EMPr Reports) for the surrounding developments. However, many of the documents are not currently publicly available to download. The information that could be obtained for the surrounding planned renewable energy developments was taken into account as part of the cumulative impact assessment.
- Refer to specialist studies (**Appendix 6**) for their specific assumptions and limitations.

22. AUTHORISATION OF THE PROPOSED ROOS PV FACILITY PROJECT

Specialist assessments were conducted to address the potential impacts relating to the proposed development in order to ascertain the level of each identified impact, as well as mitigation measures which may be required. The results of the specialist assessments have indicated that all alternatives (including the preferred alternative) contain no fatal flaws that should prevent the proposed project from proceeding. In light of this, it is the EAP's reasoned opinion that authorization be granted, and that the layout being proposed as part of this BA process also be authorized (provided there are no significant concerns raised during the public participation process).

Conditions to be included in the EA for the construction phase are listed in **Section 19** above.

The environmental authorization should be valid for a period of 10 years. It is anticipated that the construction period will however commence shortly after authorization.

23. EAP DECLARATION

The EAP declarations, CV's and qualifications for the EAP's responsible for the preparation of this report have been attached in **Appendix 1**.

24. INFORMATION REQUIRED BY THE CA (IF APPLICABLE)

Currently not applicable.

25. CONCLUSION

This BAR has covered activities and findings related to the BA process for the proposed Roos SEF and associated infrastructure. Professional experience, specialist knowledge, relevant literature and local knowledge of the area have all been used to identify the potential issues associated with the proposed project.

There is no guarantee that all the potential impacts arising from the proposed project have been identified within the Basic Assessment phase, however the report provides an outline of the established measures that were taken to best identify all the potential impacts.

26. WAY FORWARD

Please note that the commenting period on the advert placed in Lowveld Newspaper refers to **04 August 2023** until **04 September 2023**.

Since the DBAR was not made available on the said date, the notification that was sent to interested and affected parties regarding the availability of the DBAR Report have given interested and affected parties 30 days commenting period, which commenced from **07 August 2023** until **06 September 2023** to ensure that the regulated 30 days commenting period is adhered to.

All comments received will be responded to in a C&RR, which will be included prior to submission of the FBAR to the decision-making authority, namely the DFFE. Comments received on the report will be taken into consideration, incorporated into the report (where applicable) and will be used when compiling the FBAR.

Once the FBAR has been submitted and the DFFE has acknowledged receipt thereof, a decision to either grant or refuse the EA for the proposed development will be made by the DFFE. In addition, once a decision regarding the EA has been received from the DFFE, it will be made available to the public and all registered I&APs, stakeholders and OoS / authorities will be notified accordingly and provided details regarding the appeal process. The BA process will thus come to an end once appeals (if any) have been dealt with adequately and the appeal process closes.

All I&APs and key stakeholders are invited to register as I&APs in order to be kept informed throughout the process. To register as an I&AP / stakeholder and/or to obtain additional information, please submit your name, contact details (telephone number, postal address and email address) and the interest which you have in the application to SiVEST Environmental Division, as per the details below:

Contact: Hlengiwe Ntuli
 PO Box 2921, RIVONIA, 2128
 Phone: (011) 798 0600
 E-mail: sivest_ppp@sivest.com
 Fax: (011) 803 7272
Website: www.sivest.com

Please reference '*Roos PV Facility'* in your correspondence, should your comments be project specific. SiVEST shall keep all registered I&APs / key stakeholders informed of the BA process.

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