APPENDIX F2 – MATRIX ANALYSIS

The matrix describes the relevant listed activities, the aspects of the development that will apply to the specific listed activity, a description of the environmental issues and potential impacts, and the significance and magnitude of the potential impacts. The matrix also highlights areas of particular concern (see Table below) for more in depth assessment during the EIA process. An indication is provided of the specialist studies which have been conducted. Each cell is evaluated individually in terms of the nature of the impact, duration and its significance – should no mitigation measures be applied. This is important since many impacts would not be considered insignificant if proper mitigation measures were implemented. The matrix also provides an indication if mitigation measures are available.

In order to conceptualise the different impacts the matrix specify the following:

- **Stressor**: Indicates the aspect of the proposed activity, which initiates and cause impacts on elements of the environment.
- **Receptor**: Highlights the recipient and most important components of the environment affected by the stressor.
- **Impacts**: Indicates the net result of the cause-effect between the stressor and receptor.
- **Mitigation**: Impacts need to be mitigated to minimise the effect on the environment.

Table 6.2: Matrix analysis

LISTED ACTIVITY (The Stressor)	ASPECTS OF THE DEVELOPMENT /ACTIVITY	POTENTIAL IMPACTS		SIGNIFICANCE AND MAGNITUDE OF POTENTIAL IMPACTS							MITIGATION OF POTENTIAL IMPACTS			SPECIALIST STUDIES / INFORMATION
		Receptors	Impact description / consequence	Minor	Major	Extent	Duration	Probability	Reversibility	Irreplaceable loss of resources	Possible Mitigation	Possible mitigation measures	Level of residual risk	
CONSTRUCTION PHASE														
Activity 11(i) (GN.R. 983): "The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts." Activity 27 (GN.R. 983): "The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation..." Activity 36(ii) (GN. R. 983): "The expansion of facilities or structures for the generation of electricity from a renewable resources where the electricity output will be increased by 10 megawatts or more and regardless the output of the facility, the development footprint, the development footprint will be expanded by 1 hectare or more…"	Site clearing and preparation Certain areas of the site will need to be cleared of vegetation and some areas may need to be levelled. Civil works The main civil works are: • Terrain levelling if necessary– Levelling will be minimal as the potential site chosen is relatively flat. • Laying foundation- The structures will be connected to the ground through cement pillars, cement slabs or metal screws. The exact method will depend on the detailed geotechnical analysis. • Construction of access and inside roads/paths – existing paths will be used were reasonably possible. Additionally, the turning circle for trucks will also be taken into consideration. • Trenching – all Direct Current (DC) and Alternating Current (AC) wiring within the PV plant will be buried underground. Trenches will have a river sand base, space for pipes, backfill of	BIOPHYSICAL ENVIRONMENT	Fauna & Flora	• Loss or fragmentation of indigenous natural vegetation. • Loss or fragmentation of habitats. • Vegetation clearing for access roads and power lines. • Effects on local migration • Disturbance of avifauna.	-		P	L	D	I	M	Yes	- If the development is approved, contractors must ensure that no animal species are disturbed, trapped, hunted or killed. - The site should be fenced off prior to commencement of construction activities. - The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be confined to the fenced off area and minimised where possible. - An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase. - All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end	L	Ecological Fauna and Flora Habitat Survey Avifaunal Study

Activity 4(ii)(ee) (GN.R. 985): "The development of a road wider than 4 metres with a reserve less than 13.5 metres (e) in North West (ii) outside urban areas in (ee) critical biodiversity areas as identified in bioregional plans.." Activity 12 (GN.R. 985): "*The clearance of an area of 300 square metres or more of indigenous vegetation…(a) in North West (ii) within critical biodiversity areas identified in bioregional plans."*	sifted soil and soft sand and concrete layer where vehicles will pass. Transportation and installation of PV panels into an Array The panels are assembled at the supplier's premises and will be transported from the factory to the site on trucks. The panels will be mounted on metal structures which are fixed into the ground either through a concrete foundation or a deep seated screw. Wiring to the Central Inverters Sections of the PV array would be wired to central inverters which have a maximum rated power of 2000kW each. The inverter is a pulse width mode inverter that converts DC electricity to alternating electricity (AC) at grid frequency.												of the construction phase. - The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. - Keep the area cleared to a minimum and careful removal and replanting of plants and trees of conservation importance. - Seed collection, propagation and re-planting of saplings to make up for lost species should also be applied. - A nursery should be started as a community project. The impact of vegetation clearing is likely to be a long term impact, but through careful planning and rehabilitation can be greatly reduced. - A low speed limit can be strictly enforced in order to reduce collisions with animals on the roads. - If the nest of a large species is detected within the vicinity of the area to be disturbed, then the North West Department needs to be notified and all attempts made to minimise the amount of disturbance near it.		
			Air	• Air pollution due to the	-		S	S	D	CR	NL	Yes	- Dust suppression	L	-

				increase of traffic of construction vehicles.									measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.		
			Soil	• Soil degradation, including erosion. • Disturbance of soils and existing land use (soil compaction). • Physical and chemical degradation of the soils by construction vehicles (hydrocarbon spills).		-	S	S	Pr	PR	M	Yes	- The most effective mitigation will be the minimisation of the project footprint by using the existing roads in the area and not create new roads to prevent other areas also getting compacted.	M	-
			Geology	• Spillage of harmful or toxic substances		-	S	S	Pr	CR	NL	Yes	- The spillage of harmful or toxic substances can be mitigated by the implementation of a sound emergency spillage containment plan, which can be implemented as soon as a spill of harmful or toxic substances occurs.	L	-
			Existing services infrastructure	• Generation of waste that need to be accommodated at a licensed landfill site. • Generation of sewage that need to be accommodated by the local sewage plant. • Increase in construction vehicles on existing roads.	-		L	S	D	PR	ML	Yes	- All waste generated on site should be stored in waste bins and removed from site on a regular basis. - Remove waste to a licensed landfill site. - If possible and feasible, all waste generated on site must be separated into glass, plastic, paper, metal and wood to be recycled.	L	Confirmation from the Local Municipality
			Ground water	• Pollution due to construction vehicles.	-		S	S	Pr	CR	ML	Yes	- A groundwater monitoring	L	-

													programme (quality and groundwater levels) should be designed and installed for the site. Monitoring boreholes should be securely capped, and must be fitted with a suitable sanitary seal to prevent surface water flowing down the outside of the casing. Full construction details of monitoring boreholes must be recorded when they are drilled (e.g. screen and casing lengths, diameters, total depth, etc). Sampling of monitoring boreholes should be done according to recognised standards.		
			Surface water	• Increase in storm water run-off. • Pollution of water sources due to soil erosion. • Destruction of watercourses.		-	L	S	Pr	PR	ML	Yes	- Silt fences should be used to prevent any soil entering the stormwater drains - New stormwater construction must be developed strictly according to specifications from engineers in order to ensure efficiency. - Any hazardous substances must be stored at least 20m from any of the water bodies on site.	M	-

		SOCIAL/ECONOMIC ENVIRONMENT	Local unemployment rate	• Job creation. • Business opportunities. • Skills development.		+	P	S	D	I	N/A	Yes	- Where reasonable and practical, local contractors should be appoint and implement a 'locals first' policy, especially for semi and low-skilled job categories	L	-
			Visual landscape	• Potential visual impact on residents of farmsteads and motorists in close proximity to proposed facility.	-		L	S	D	CR	NL	Yes	- Dust suppression will play an important role to minimise the visibility of dust. - Contractors must avoid using roads not relevant to the project. - Contractors should try using public roads not used that often by the residents of Vryburg. - Construction vehicles must limit travelling on surrounding roads and in Vryburg during peak hours when possible. - New road construction must be avoided if possible. - Good housekeeping should be implemented. - Proper rehabilitation of disturbed areas after construction. - Proper firefighting equipment should be available on site. Not only fire extinguishers but also equipment like	L	-

													a water truck which can store large amounts of water. - Partial screening is possible by adding indigenous flora.		
			Traffic volumes	• Increase in construction vehicles.	-		L	S	Pr	CR	NL	Yes	- The contractor must ensure that damage caused by construction related traffic to the R34 Road is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the contractor. - Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. - All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.	L	-
			Health & Safety	• Air/dust pollution. • Road safety. • Impacts associated with the presence of construction workers on site and in the area. • Influx of job seekers to the area. • Increased safety risk to		-	L	S	Pr	PR	ML	Yes	- Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced.	M	-

				farmers, risk of stock theft and damage to farm infrastructure associated with presence of construction workers on the site. • Increased risk of veld fires.								- It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site		
			Noise levels	• The generation of noise and vibration as a result of construction vehicles, the use of machinery such as drills and people working on the site.	-		L	S	D	CR	NL	Yes	- During construction care should be taken to ensure that noise from construction vehicles and plant equipment does not intrude on the surrounding residential areas. - Plant equipment such as generators, compressors, concrete mixers as well as vehicles should be kept in good operating order and where appropriate have effective exhaust mufflers. - Vibration and noise from heavy machinery can be kept to a minimum by reducing the movement of heavy vehicles to a minimum necessary for operations. Placing the vehicle yard as close to the construction area as possible will also reduce the scale of impact of vibration.	L	-
			Tourism industry	• Since there are no tourism facilities in close proximity to the site, the proposed activities will not have an impact on tourism in the area.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Heritage resources	• No heritage impacts are expected.	-		S	S	Po	I	ML	Yes	N/A	L	Heritage Impact

															Assessment
OPERATIONAL PHASE															
	The key components of the proposed project are described below: PV Panel Array - To produce 75MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a fixed northern angle in order to capture the most sun. Wiring to Central Inverters - Sections of the PV array would be wired to central inverters sized from 500kW to 1MW. The inverter is a pulse width mode inverter that converts DC electricity to alternating current (AC) electricity at grid frequency. Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33,000V to 132,000V. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into step up transformers to 132kV (via 33kV). A new substation will be required on the site to step the voltage up to 132kV, after which the power will be evacuated to the national grid. It is expected that generation from the facility will tie in with the Mookodi-Magopela 132kV power line. It is expected that electricity generated from the facility will tie in with the Mookodi-Magopela 132kV power line. The transmission line will be	BIOPHYSICAL ENVIRONMENT	Fauna , Flora & Avifauna	• Fragmentation of habitats. • Establishment and spread of declared weeds and alien invader plants (operations). • Impact on avifauna. • Collision of birds with infrastructure and electrocution with the development		-	P	L	Po	PR	ML	Yes	- Indigenous vegetation must be maintained and all exotics removed as they appear and disposed off appropriately. - Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to construction. - Implement an Avifauna Monitoring plan. - The line should be kept as low as possible taking into account engineering and legal requirements. - The span lengths should be kept as short as is reasonable. - Placement of bird flappers as markers on the earth wire, which will increase the visibility of the power line. - Markers should be placed with sufficient regularity (at least every 5-10m). - Mono pole bird friendly tower structures can be	M	Ecological Fauna and Flora Habitat Survey

	constructed within 36m wide servitude and will traverse the farm Waterloo 992. <u>Roads</u> – Ready access already exist from the regional road (R34). However an internal site road network to provide access to the solar field and associated infrastructure will be required. All site roads will require a width of approximately 4m. Drainage trenches along the side of the internal road network will be installed. <u>Fencing</u> - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm.											utilised in the development. This will significantly minimise the number of electrocutions.		
			Air quality	• The proposed development will not result in any air pollution during the operational phase.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Soil	• Soil degradation, including erosion. • Disturbance of soils and existing land use (soil compaction). • Loss of agricultural potential (low significance relative to agricultural potential of the site).	-		L	L	D	PR	SL	Yes	- To avoid soil erosion, it will be a good practice to design storm water canals into which the water from the panels can be channeled. These canals should reduce the speed of the water and allow the water to drain slowly onto the land. - Another important measure is to avoid stripping land surfaces of existing vegetation by only allowing vehicles to travel on existing roads and not create new roads.	M	-
			Geology	• Collapsible soil. • Active soil (high soil heave). • Erodible soil. • Hard/compact geology. If the bedrock occurs close to surface it may present problems when driving power line columns. • The presence of undermined ground. • Instability due to soluble rock. • Steep slopes or areas of unstable natural slopes.		-	S	S	Po	PR	ML	Yes	- Surface drainage should be provided to prevent water ponding. - Mitigation measures proposed by the detailed engineering geological investigation should be implemented.	L	-

				• Areas subject to seismic activity. • Areas subject to flooding.											
			Ground water	• Leakage of hazardous materials. The development will comprise of a distribution substation and will include transformer bays which will contain transformer oils. Leakage of these oils can contaminate water supplies.	-		L	L	Po	PR	ML	Yes	- All areas in which substances potentially hazardous to groundwater are stored, loaded, worked with or disposed of should be securely bunded (impermeable floor and sides) to prevent accidental discharge to groundwater.	L	-
			Surface water	• Destruction of watercourses.	-		L	L	Pr	PR	ML	Yes	-	L	-
		SOCIAL/ECONOMIC ENVIRONMENT													
				• Change in land-use/sense of place. The site is characterized by open veldt with a rural agricultural sense of place. The use of the area for the construction and operation of the PV plant will result in the area not being used for livestock grazing anymore.									- The proponent should investigate the option of establishing a Rehabilitation Fund to be used to rehabilitate the area once the proposed facility has been decommissioned. The fund should be funded by revenue generated during the operational phase of the project. The motivation for the establishment of a Rehabilitation Fund is based on the experience from the mining sector where many mines on closure have not set aside sufficient funds for closure and decommissioning.		
			Visual landscape	• Potential visual impact on residents of farmsteads and travellers in close proximity to proposed facility.	-		L	L	D	PR	ML	Yes		M	-
			Traffic volumes	• The proposed development will not	-		L	L	Po	CR	NL	Yes	-	L	-

				result in any traffic impacts during the operational phase.											
			Health & Safety	• The proposed development will not result in any health and safety impacts during the operational phase.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	N/A	N/A
			Noise levels	• The proposed development will not result in any noise pollution during the operational phase.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Heritage resources	• It is not foreseen that the proposed activity will impact on heritage resources or vice versa.	-		S	L	Po	PR	ML	Yes	-	L	-
			Electricity supply	• Generation of additional electricity.	+		I	L	D	I	N/A	Yes	-	N/A	-
			Electrical infrastructure	• Additional electrical infrastructure. The proposed solar facility will add to the existing electrical infrastructure and aid to lessen the reliance of electricity generation from coal-fired power stations.	+		I	L	D	I	N/A	Yes	-	N/A	-
DECOMMISSIONING PHASE															
-	<u>Dismantlement of infrastructure</u> During the decommissioning phase the Solar PV Energy facility and its associated infrastructure will be dismantled. <u>Rehabilitation of biophysical environment</u> The biophysical environment will be rehabilitated.	BIOPHYSICAL ENVIRONMENT	Fauna & Flora	• Re-vegetation of exposed soil surfaces to ensure no erosion in these areas.	+		S	L	Po	N/A	N/A	Yes	- Re-vegetation of affected areas must be made a priority to avoid erosion.	N/A	-
			Air quality	• Air pollution due to the increase of traffic of construction vehicles.	-		S	S	D	CR	NL	Yes	- Regular maintenance of equipment to ensure reduced exhaust emissions.	L	-
			Soil	• Soil degradation, including erosion. • Disturbance of soils and existing land use (soil compaction). • Physical and chemical		-	S	S	Pr	PR	M	Yes	- Re-vegetation of affected areas must be made a priority to avoid erosion.	M	-

				degradation of the soils by construction vehicles (hydrocarbon spills).											
			Geology	• It is not foreseen that the decommissioning phase will impact on the geology of the site or vice versa.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Existing services infrastructure	• Generation of waste that need to be accommodated at a licensed landfill site. • Generation of sewage that need to be accommodated by the municipal sewerage system and the local sewage plant. • Increase in construction vehicles.	-		L	S	D	I	NL	Yes	-	L	-
			Ground water	• Pollution due to construction vehicles.	-		S	S	Pr	CR	ML	Yes	-	L	-
			Surface water	• Increase in storm water run-off. • Pollution of water sources due to soil erosion. • Destruction of watercourses.		-	L	S	Pr	PR	ML	Yes	- Removal of any historically contaminated soil as hazardous waste. - Removal of hydrocarbons and other hazardous substances by a suitable contractor to reduce contamination risks. - Removal of all substances which can result in groundwater (or surface water) contamination.	M	-
			Local unemployment rate	• Loss of employment		-	L	L	Po	PR	NL	Yes	- Waterloo Energy should ensure that retrenchment packages are provided for all staff retrenched when the facility is decommissioned.	M	-
			Visual landscape	• Potential visual impact on visual receptors in close	-		L	S	D	CR	NL	Yes	- Locate laydown and storage areas in zones of	L	-

				proximity to proposed facility.									low visibility i.e. behind tall trees or in lower lying areas.		
			Traffic volumes	• Increase in construction vehicles.	-		L	S	Pr	CR	NL	Yes	- Movement of heavy construction vehicles through residential areas should be timed to avoid peak morning and evening traffic periods. In addition, movement of heavy construction vehicles through residential areas should not take place over weekends.	L	-
			Health & Safety	• Air/dust pollution. • Road safety. • Increased crime levels. The presence of construction workers on the site may increase security risks associated with an increase in crime levels as a result of influx of people in the rural area.	-		L	S	Pr	PR	ML	Yes	- Demarcated routes to be established for construction vehicles to ensure the safety of communities, especially in terms of road safety and communities to be informed of these demarcated routes. - Where dust is generated by trucks passing on gravel roads, dust mitigation to be enforced. - Any infrastructure that would not be decommissioned must be appropriately locked and/or fenced off to ensure that it does not pose any danger to the community.	L	-
			Noise levels	• The generation of noise as a result of construction vehicles, the use of machinery and people	-		L	S	D	CR	NL	Yes	- The decommissioning phase must aim to adhere to the relevant noise regulations and	L	-

				working on the site.									limit noise to within standard working hours in order to reduce disturbance of dwellings in close proximity to the development.		
			Tourism industry	• Since there are no tourism facilities in close proximity to the site, the decommissioning activities will not have an impact on tourism in the area.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Heritage resources	• It is not foreseen that the decommissioning phase will impact on any heritage resources.	-		S	S	Pr	PR	ML	Yes	-	L	Heritage Impact Assessment

Nature of the impact:	(N/A) No impact	(+) Positive Impact (-)	Negative Impact	
Geographical extent:	(S) Site;	(L) Local/District;	(P) Province/Region;	(I) International and National
Probability:	(U) Unlikely;	(Po) Possible;	(Pr) Probable;	(D) Definite
Duration:	(S) Short Term;	(M) Medium Term;	(L) Long Term;	(P) Permanent
Intensity / Magnitude:	(L) Low;	(M) Medium;	(H) High;	(VH) Very High
Reversibility:	(CR) Completely Reversible;	(PR) Partly Reversible;	(BR) Barely Reversible;	-
Irreplaceable loss of resources:	(IR) Irreversible	(NL) No Loss;	(ML) Marginal Loss;	(SL) Significant Loss;	(CL) Complete Loss
Level of residual risk:	(L) Low;	(M) Medium;	(H) High;	(VH) Very High	-