(Solar International, 2013)

# ATLANTIC RENEWABLE ENERGY PARTNERS (PTY) LIMITED

**DSR Technical Layout Development Report, May 2015**

**On behalf of AEP Kathu Solar (Pty) Ltd**


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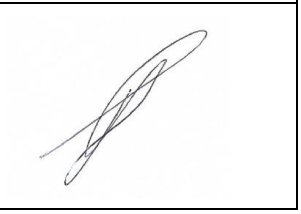
| David Peinke | Director |  |

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# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AC | Alternating Current |
| CPV | Concentrating Photovoltaic |
| DC | Direct Current |
| DEA | National Department of Environmental Affairs |
| DSR | Draft Scoping Report |
| EAP | Environmental Assessment Practitioner |
| EIA | Environmental Impact Assessment |
| EIR | Environmental Impact Report |
| EMP | Environmental Management Plan |
| ha | Hectare |
| IPP | Independent Power Producer |
| kV | Kilovolt |
| MV | Medium Voltage |
| MW | Mega Watt |
| MWp | Mega Watt Peak (maximum peak power production) |
| OH | Overhead |
| PV | Photovoltaic |
| REDz | Renewable Energy Development Zones |
| REIPPPP | Renewable Energy Independent Power Producer Procurement Programme |
| SANRAL | South African National Roads Agency Limited |
| SDP | Site Development Plan |
| SEF | Solar Energy Facility |
| SWSA | Strategic Water Source Areas |
| UN | United Nations |
| Wp | Watt Peak |
| WUL | Water Use License |

# 1 INTRODUCTION

AEP Kathu Solar (Pty) Ltd is proposing the establishment of a commercial solar photovoltaic energy facility (SEF) on the farm known as Legoko Farm No 460 portion 0, situated in the District of Kuruman RD, Northern Cape Province, within the jurisdiction area of the Gamagara Local Municipality.

The proposed photovoltaic (PV) SEF will have a contracted (nominal) capacity of 75 $MW_{AC}$ with an estimated maximum footprint of ± 220 ha. A preliminary study area of ± 315 ha was identified by the Project Developer. Following this an ecological expert was appointed to develop a vegetation and sensitivity rating for the entire property. This sensitivity plan was then used to determine the preferred location of the proposed PV footprint that will not exceed ± 220 ha. The approximate area that each component of the SEF will occupy is summarised in the table below.

TABLE 1: COMPONENT AREAS AND % OF TOTAL PROJECT AREA

| SEF Component | Estimated Area | % of Total Area (± 225 ha) | % of Farm Area (1370.898 ha) |
|---|---|---|---|
| **PV structures/modules** | ± 200 ha | 86.7 % | 14.2 % |
| **Laydown area** | ± 5 ha | 2.2 % | 0.36 % |
| **Internal roads** | ± 18.16 ha | 8 % | 1.32 % |
| **Auxiliary buildings** | ± 1 ha | 0.4 % | 0.07 % |
| **Substation** | ± 0.84 ha | 0.4 % | 0.06 % |

The technology under consideration is either concentrating photovoltaic (CPV) modules or photovoltaic (PV) modules mounted on tracking structures. Other infrastructure includes inverter stations, internal electrical reticulation, internal roads, an on-site switching station / substation, a 132 kV overhead (OH) transmission line, auxiliary buildings, construction laydown areas and perimeter fencing and security infrastructure. The on-site switching station / substation will locate the main power transformer/s that will step up the generated electricity to a suitable voltage level for transmission into the national electricity grid, via the OH line. Auxiliary buildings include, *inter alia*, a control building, offices, warehouses, a canteen and visitors centre, staff lockers and ablution facilities and gate house and security offices. Depending on the final plant design, these facilities may be integrated.

Figure 1 below depicts a typical layout of a solar PV energy facility.


FIGURE 1: TYPICAL LAYOUT OF A SOLAR PV ENERGY FACILITY
(THE MILLION SOLAR ROOF INITIATIVE – SOLAR SALVATION OR SOLAR SCAM? CALIFORNIA PV SOLAR FARMS – A BITTER HARVEST!, 2014)

It is customary to develop the final / detailed construction layout of the SEF only once an Independent Power Producer (IPP) is awarded a successful bid under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), after which major contracts are negotiated and final equipment suppliers identified. For the purpose of the Draft Scoping Report (DSR), two alternative layouts are assessed in accordance with the minimum requirements prescribed by the Department of Environmental Affairs (DEA).

The preferred layout alternative has taken into account the site constraints identified by the specialist ecologist appointed by AEP Kathu Solar (Pty) Ltd.

# 2 PROGRESSION OF LAYOUT DESIGN

Two layout alternatives were assessed as part of the DSR. The following section elaborates on the layout progression to the point of identifying Layout Alternative 2 – Preferred.

## 2.1 LAYOUT ALTERNATIVE 1 – INITIAL / CONCEPTUAL LAYOUT

An initial / conceptual layout area of ± 225 ha (Layout Alternative 1) was identified during the initiation phase of the EIA (Scoping) for the AEP Kathu Solar PV Energy Facility. The area is located along the southern side of Portion 0 of the Farm 460 Legoko.

This initial / conceptual layout identified as Layout Alternative 1 did not consider any of the existing infrastructure located on and adjacent to the site (e.g. existing access and internal roads, transmission lines, dwellings and reservoirs), nor any potential site constraints and environmental sensitive areas (to be identified by the various specialist studies). Layout Alternative 1 was driven primarily by its proximity to the N14 access road as well as reduced HV line distance to connect into the planned Sekgame Switching Station, located to the east of the site on the other side of the N14.

Figure 2 below depicts Layout Alternative 1 outlined in red. The property boundary for Portion 0 of the Farm 460 Legoko is depicted by the black line.

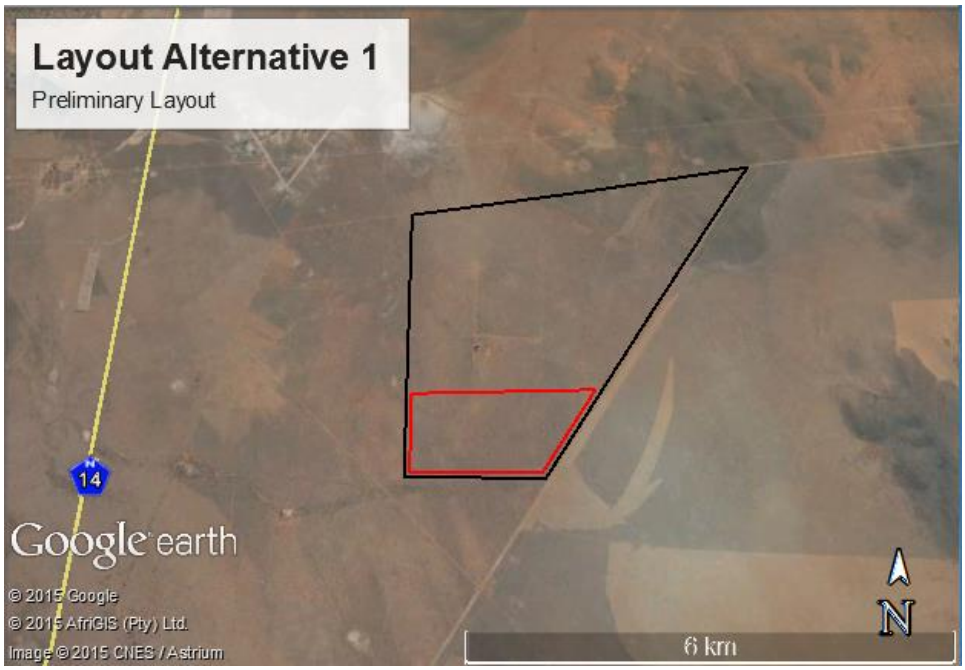


FIGURE 2: LAYOUT ALTERNATIVE 1 – INITIAL LAYOUT

## 2.2 SITE SENSITIVITY SCREENING

Following the identification of Layout Alternative 1, AEP Kathu Solar (Pty) Ltd appointed an ecological expert, Mr Simon Todd, to develop a vegetation and sensitivity rating for the entire property. This sensitivity plan was then used to determine the location of the preferred layout alternative, identified therefore in such a manner as to avoid all areas with a medium – high, high and very high sensitivity. This also ensured that potential impact on the protected Acacia erioloba was minimised.

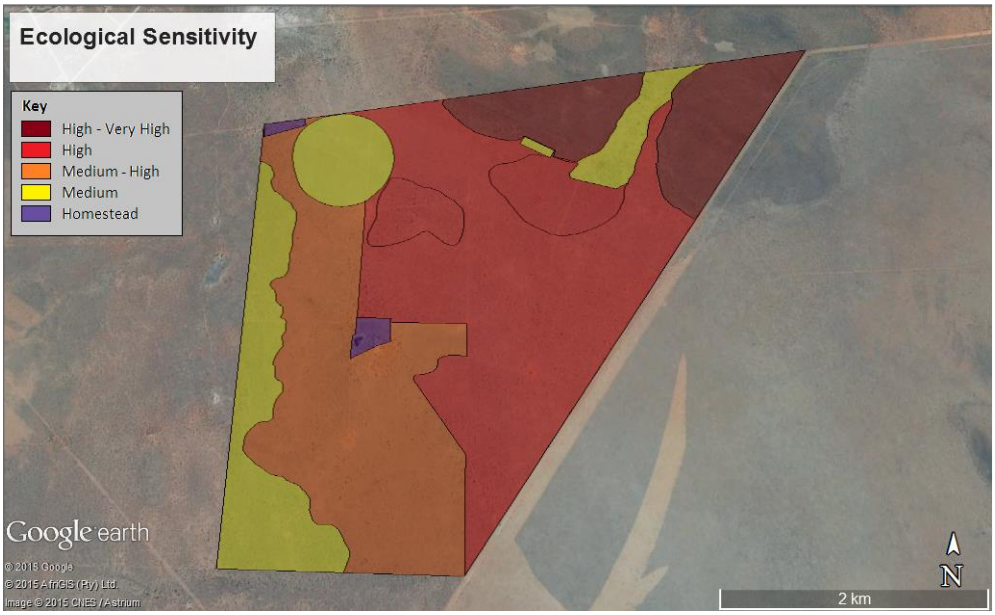


FIGURE 3: ECOLOGICAL SENSITIVITY FOR PORTION 0 OF THE FARM 460 LEGOKO

## 2.3 LAYOUT ALTERNATIVE 2 – PREFERRED

The second layout alternative considered during the draft scoping phase of the EIA is depicted in Figure 4 below. Layout Alternative 2 – Preferred constituted a preliminary layout area concentrated on the east of the site. Layout Alternative 2 considered existing infrastructure located on Portion 0 of the Farm 460 Legoko as well as adjacent properties. In particular, it took into account preliminary site constraints identified during the scoping phase of the project. Most notably, the solar facility footprint only occupies medium and medium-high sensitivity area, depicted in Figure 4 below by the yellow and orange areas respectively.

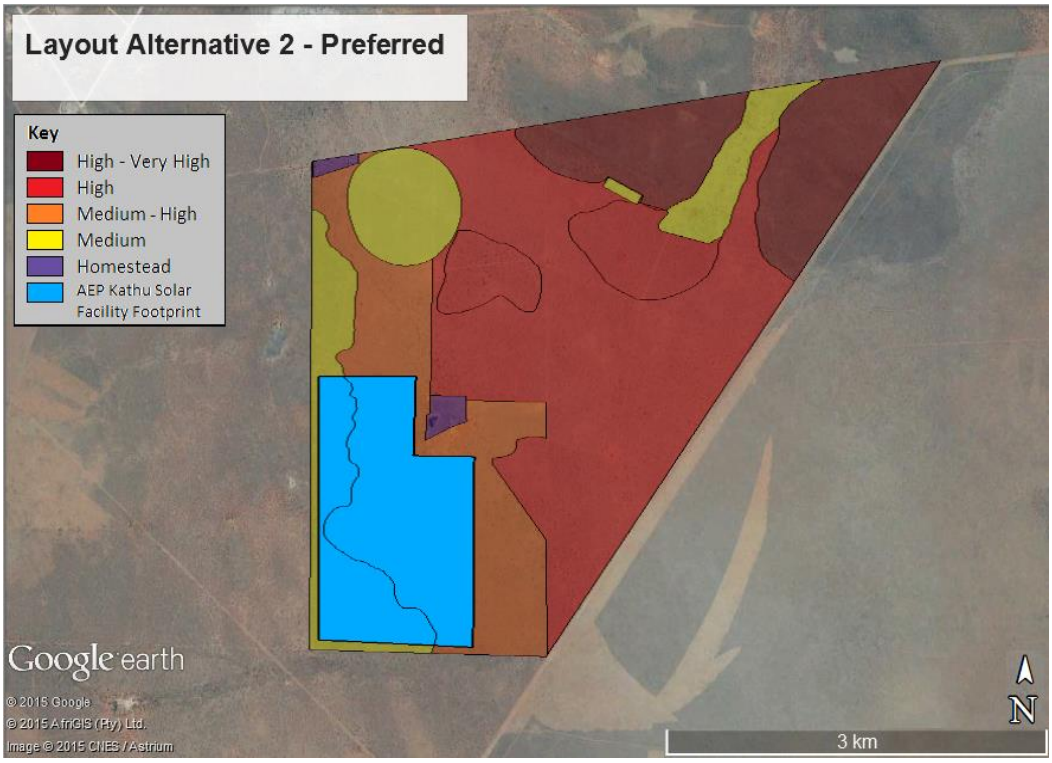


FIGURE 4: LAYOUT ALTERNATIVE 2 – PREFERRED LAYOUT

# 3 OVERVIEW OF THE SOLAR ENERGY FACILITY

The following section presents an overview of the main components of the solar energy facility layout.

## 3.1 SOLAR ARRAY

Solar PV modules are connected in series to form a string. A number of strings are then wired in parallel to form an array of modules. PV modules are mounted on structures that are either fixed, north-facing at a defined angle, or mounted to a single or double axis tracker to optimise electricity yield.

The solar arrays for the AEP Kathu Solar PV Energy Facility will be placed in such a way that they do not interfere with sensitive features defined above.

## 3.2 MOUNTING STRUCTURES

Various options exist for mounting structure foundations, which include cast / pre-cast concrete, driven / rammed piles, or ground / earth screws mounting systems.

FIGURE 5: CAST CONCRETE FOUNDATION (SOLAR POWER PLANT BUSINESS, 2013)

The impact on agricultural resources and production of these options are considered to be the same, however concrete is least preferred due the effort required at a decommissioning phase in order to remove the concrete from the soil, and therefore its impact on the environment. The AEP Kathu Solar PV Energy Facility will therefore aim to make the most use of either driven / rammed piles, or ground / earth screws mounting systems, and only in certain instances resort to concrete foundations should geotechnical studies necessitate this.

FIGURE 6: RAMMED / DRIVEN STEEL PILE (SOLARPRO, 2010)

FIGURE 7: GROUND SCREW (PV MAGAZINE, 2014)

## 3.3 GRID CONNECTION AND CABLING

It is proposed to connect the SEF directly to the planned Sekgame Switching Station (SS) located ± 5km to the south of the existing Ferrum MTS. The SEF substation will be approximately 120m x 70m in size and feature a step-up transformer/s to transmit electricity via a 132 kV OH line directly to the Sekgame SS. The OH power line is envisaged to be ± 5 - 6km in length, a maximum height of 32m and occupy a servitude width of between 31m – 40m.

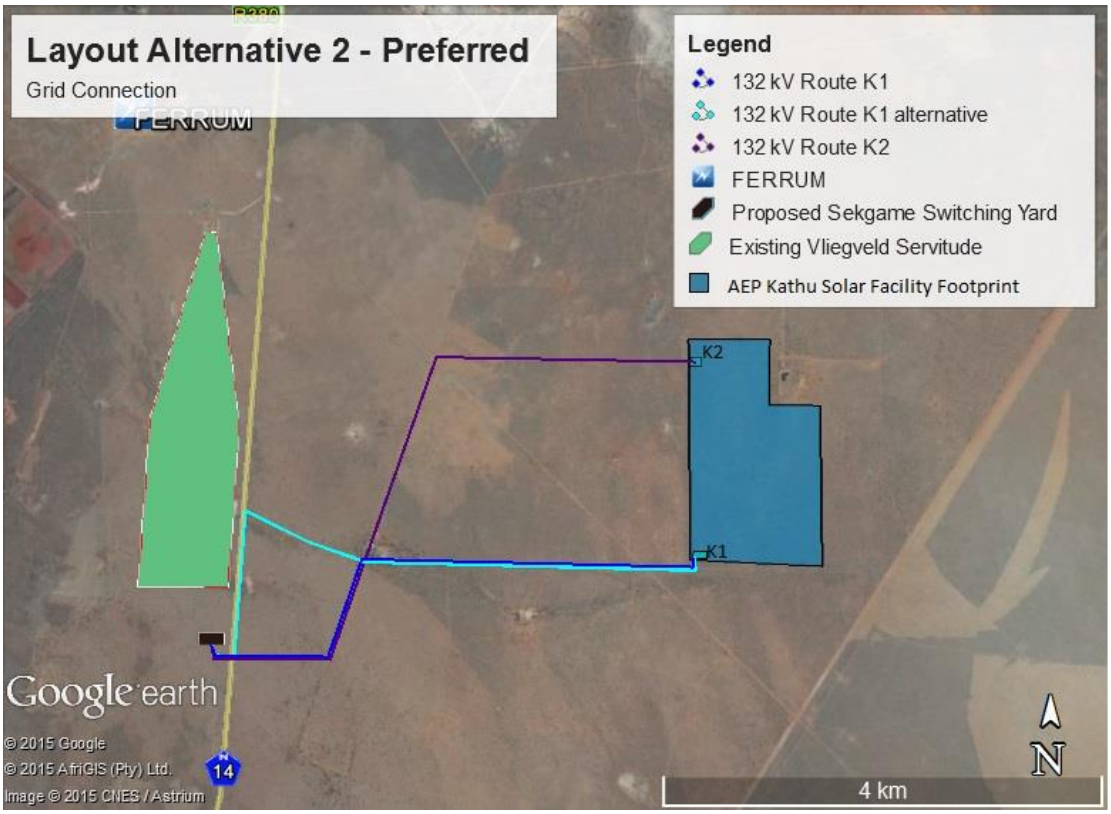


FIGURE 8: GRID CONNECTION - PORTION 0 OF THE FARM 460 LEGOKO

A 75 $MW_{AC}$ installation will require specific electrical components to meet the national grid code requirements in order to generate and supply electricity into the national grid.

The conversion from DC (modules) to AC is achieved by means of inverter stations. A single inverter station is connected to a number of solar arrays, are will be placed along the internal service roads for ease of access. A number of inverter stations will be installed for the SEF (up to maximum of ± 60), each of which is connected to the on-site / facility substation.

Final placement of the inverter stations and on-site / facility substation will need to take ground conditions into consideration. Interconnecting electrical cabling will be trenched where practical, and follow internal access roads to the greatest extent. Sensitive areas will consequently be avoided as far as possible, or alternatively, cables will be fastened above-ground to the mounting structures so as to avoid excessive excavation works and clearing of vegetation.

## 3.4 AUXILIARY BUILDINGS

The auxiliary buildings will comprise of the following as a minimum:

- Control Building / Centre (± 31m x 8m);
- Office (± 22m x 11m);
- 2 x Warehouses (each ± 50m x 20m);
- Canteen & Visitors Centre (± 30m x 10m);
- Staff Lockers & Ablution (± 22m x 11m); and
- Gate house / security offices (± 6m x 6m).

The total area occupied is approximately 1 ha, excluding the facility substation. Depending on the final plant design, the auxiliary buildings may be integrated to a certain extent.

## 3.5 CONSTRUCTION OF ROADS

The internal road network of the SEF will be gravelled roads, 4 – 5m in width, around the solar array periphery. Roads located in-between the solar modules will be un-surfaced tracks to be used for maintenance and cleaning of solar PV panels.

A detailed transport and traffic plan will be undertaken during the EIA phase of the project. Precautionary measures will be taken to mitigate the risk of ground disturbances where access roads will be constructed. Special attention will be given to drainage, water flow and erosion by applying appropriate building methods.

# 4 ACCESS ROUTES

Two main access roads are being considered off the N14 to the proposed AEP Kathu Solar PV Energy Facility, as depicted in Figure 9 below. The black lines in Figure 9 depict cadastral boundaries.

- Site access 1 (Preferred) is shown by the green route. The light green is an existing gravel access road, while the darker green section would need to be constructed. The access road falls on Portion 1 of the Farm 460 Legoko so a servitude would need to be secured with the farmowner, however this is the preferred access road option because it is located further away from the farm homestead in the north western corner of Portion 0 of the Farm Legoko 460.
- Site access 2 (Alternative) is shown by the orange route and follows an existing road from the intersection of the R380 and the N14. The road is a communal access road up to the point where Bestwood 459/1 and Legoko 460/2 meet, then the road goes along the boundary on Bestwood 459/1. A servitude would need to be secured with this farm owner. This option however is in closer proximity to the farm homestead.

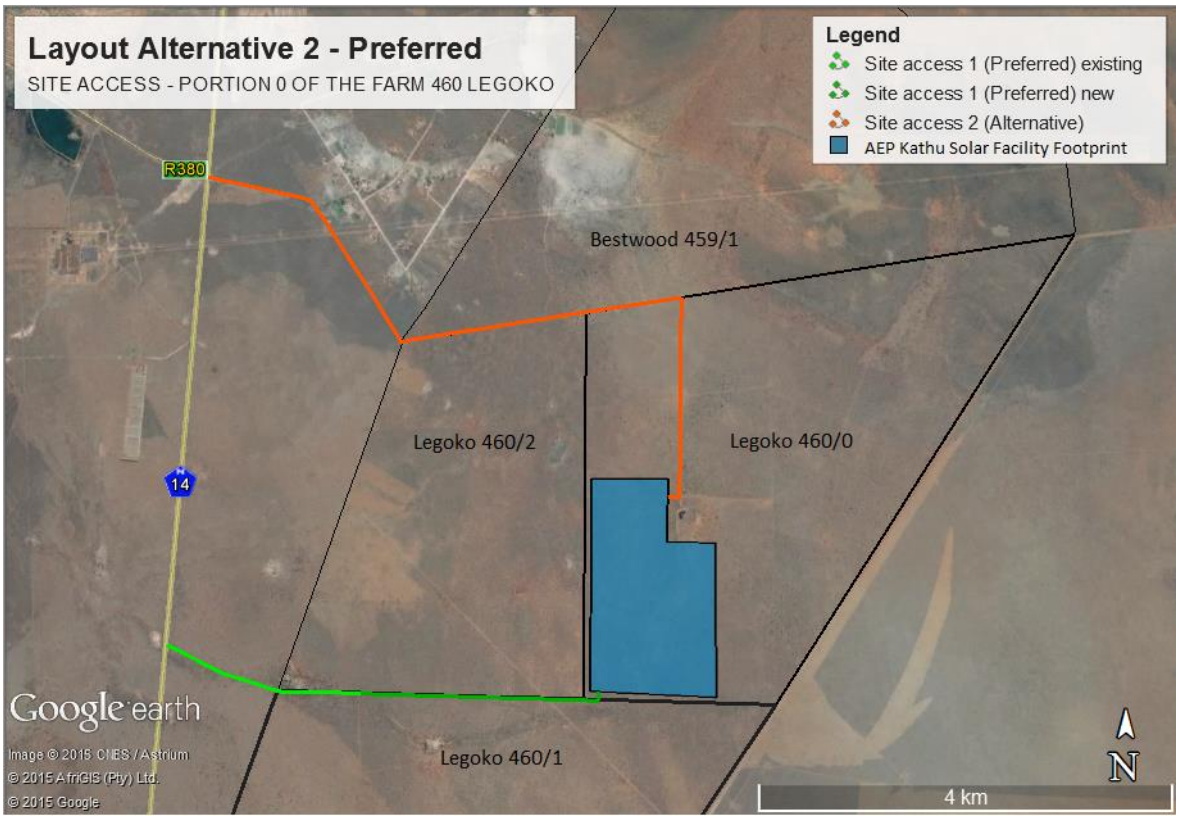


FIGURE 9: SITE ACCESS TO PORTION 0 OF THE FARM 460 LEGOKO

Both the abovementioned access road options are considered to be viable from environmental and technical viewpoints, and neither of the options will impact the usability of any grazing camps since they run along boundary fences. These alternatives will be investigated in further detail during the EIA phase of the project.

The required access roads would be gravel and approximately 6m in width.

# 5 ASSESSMENT OF COMPETITOR PROJECTS

There are two solar projects under development in the immediate vicinity of the proposed AEP Kathu Solar PV Energy Facility; AEP Mogobe Solar and AEP Legoko Solar on Portions 1 and 2 of the Farm Legoko 460 respectively. The development directly north of Portion 0 of the Farm 460 Legoko is the Bestwood Residential Complex currently under construction. It is believed that a solar farm was proposed to be developed on this property, however there is little certainty as to whether this is actually the case.

The majority of solar farms are concentrated north of Kathu, closer to Deben, identified as follows:

- 100 MW Kathu Solar Park, adjacent to the Kathu airport (preferred bidder);
- 75 MW Kathu Solar PV Project, alongside the R380 towards Deben (commissioned);
- 75 MW Sishen Solar PV Project, alongside the R380 towards Deben (commissioned);
- 75 MW San Solar PV Project, alongside the R380 towards Deben (Environmental Authorisation awarded);
- 25 MW Wincanton Solar PV Project, alongside the R380 towards Deben (Environmental Authorisation awarded).

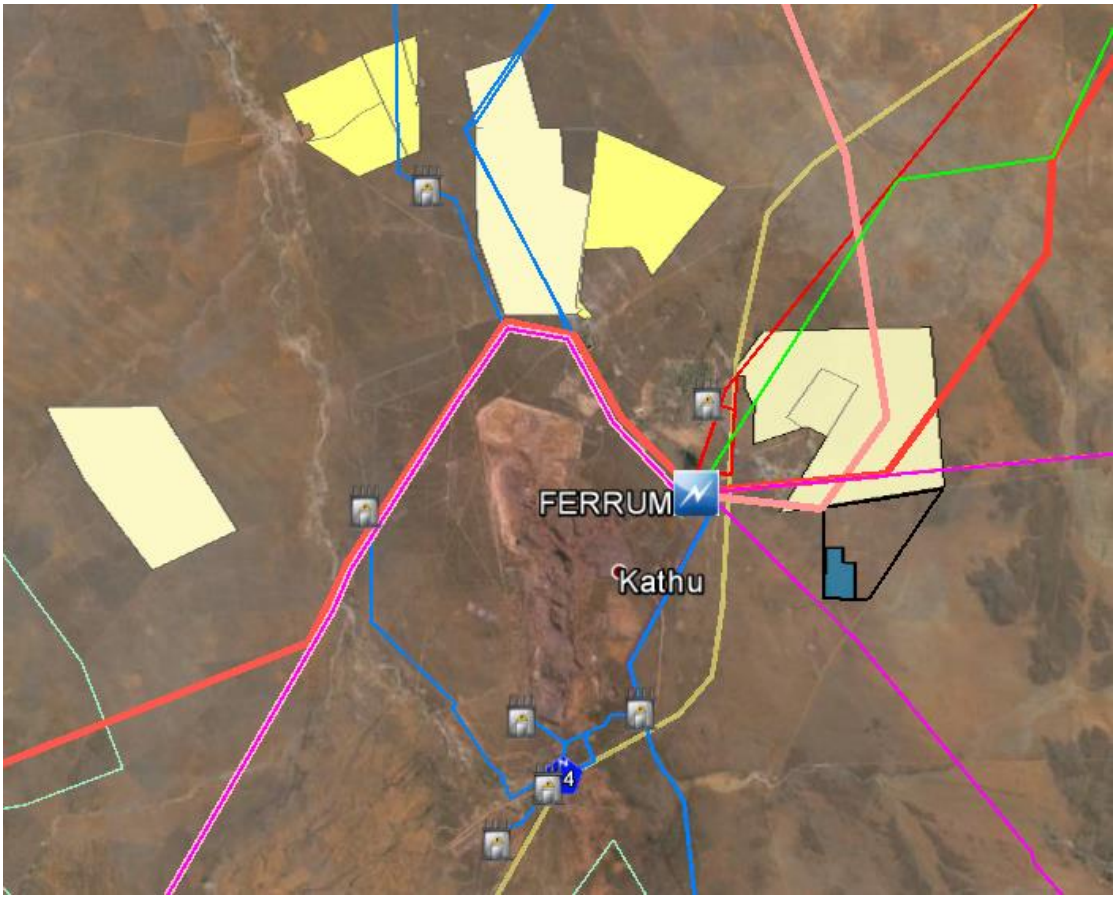


FIGURE 10: ASSESSMENT OF COMPETITORS

# 6 CONCLUSION

The preferred layout alternative site (Layout Alternative 2 – Preferred) has been enveloped and proposed based on key criteria identified above, including *inter alia*, terrain / slope, accessibility, assessment of alternatives, proximity to the planned Sekgame Substation as well as consideration of sensitive areas to minimise ecological and other impacts.

Further assessment will be undertaken for the proposed Layout Alternative 2 site during the detailed EIA phase of the project.

# 7 LIST OF REFERENCES


pv magazine. (2014, September 3). *100 MW solar PV project underway in Pakistan*. Retrieved from http://www.pv-magazine.com/news/details/beitrag/100-mw-solar-pv-project-underway-in-pakistan_100016311/#axzz3PaUWtQ77

Solar International. (2013, January 17). *Trina Solar Supplies 61MW Of Solar PV Modules For Green Tower Project In Brandenburg*. Retrieved from http://www.solar-international.net/article/76674-Trina-Solar-supplies-61MW-of-solar-PV-modules-for-Green-Tower-project-in-Brandenburg.php

Solar Power Plant Business. (2013, December 07). *Abandoned Farmland Serves as Solar Site*. Retrieved from http://techon.nikkeibp.co.jp/english/NEWS_EN/20131207/321200/?ST=msbe

SolarPro. (2010, June/July). *Ground-Mounted PV: Page 6 of 9*. Retrieved from http://solarprofessional.com/articles/design-installation/ground-mounted-pv/page/0/5

*The Million Solar Roof Initiative – Solar Salvation or Solar Scam? California PV Solar Farms – A Bitter Harvest!* (2014, January). Retrieved from GO Solar CALIFORNIA: http://www.gosolarcaliforniainformation.com/