Draft Environmental Impact Report

Proposed 90 MW Graspan Photovoltaic (PV) Power Facility, Northern Cape

Solaire Direct Southern Africa (Pty) Ltd

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October 2012

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Proposed 90 MW Graspan Photovoltaic (PV) Power Facility, Northern Cape

October 2012

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ERM Reference: 0156408

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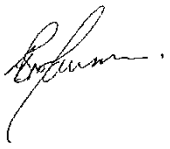

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ACRONYMS

BID	Background Information Document
DEA	Department of Environmental Affairs
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIR	Environmental Impact Assessment Report
EMP	Environmental Management Programme
ERM	Environmental Resources Management
GN	Government Notice
I&AP's	Interested & Affected Parties
IPP	Independent Power Producer
NEMA	National Environmental Management Act
NERSA	National Energy Regulator of South Africa
SAHRA	South African Heritage Resources Agency
ToR	Terms of Reference

ABBREVIATIONS

%	Percent
cm	Centimetres
CO_2	Carbon Dioxide
GWh	Giga Watt Hour
kg	Kilograms
km	Kilometres
km^2	Square kilometres
kV	Kilovolt
m	Metres
MW	Mega Watts
m^2	Square meters
R	South African Rand

1 NON-TECHNICAL SUMMARY

1.1 INTRODUCTION

Solaire Direct Southern Africa (Pty) Ltd, hereafter referred to as Solaire Direct, appointed *Environmental Resources Management Southern Africa (Pty) Ltd*, hereafter referred to as ERM, as independent environmental consultants to undertake the Environmental Impact Assessment (EIA) process for the proposed Graspan Photovoltaic (PV) Power Facility at a site located approximately 40 km north east of Hopetown, in the Northern Cape Province. The proposed development includes the installation and operation of photovoltaic (PV) panel arrays with a projected output of up to 90 megawatts (MW). It is intended that the electricity generated by the proposed PV power facility will feed into the national grid network.

1.2 PURPOSE OF THIS REPORT

This report is the non-technical summary of the Environmental Impact Report (EIR) for the proposed Graspan PV Power Facility. The EIR has been compiled as part of the EIA process in accordance with regulatory requirements stipulated in the EIA Regulations (Government Notices R543, R544 and R546 of 18 June 2010) promulgated in terms of Section 24(5) of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), as amended.

The non-technical summary provides a summary of the proposed project activities, alternatives considered, the EIA methodology, and impacts identified and assessed.

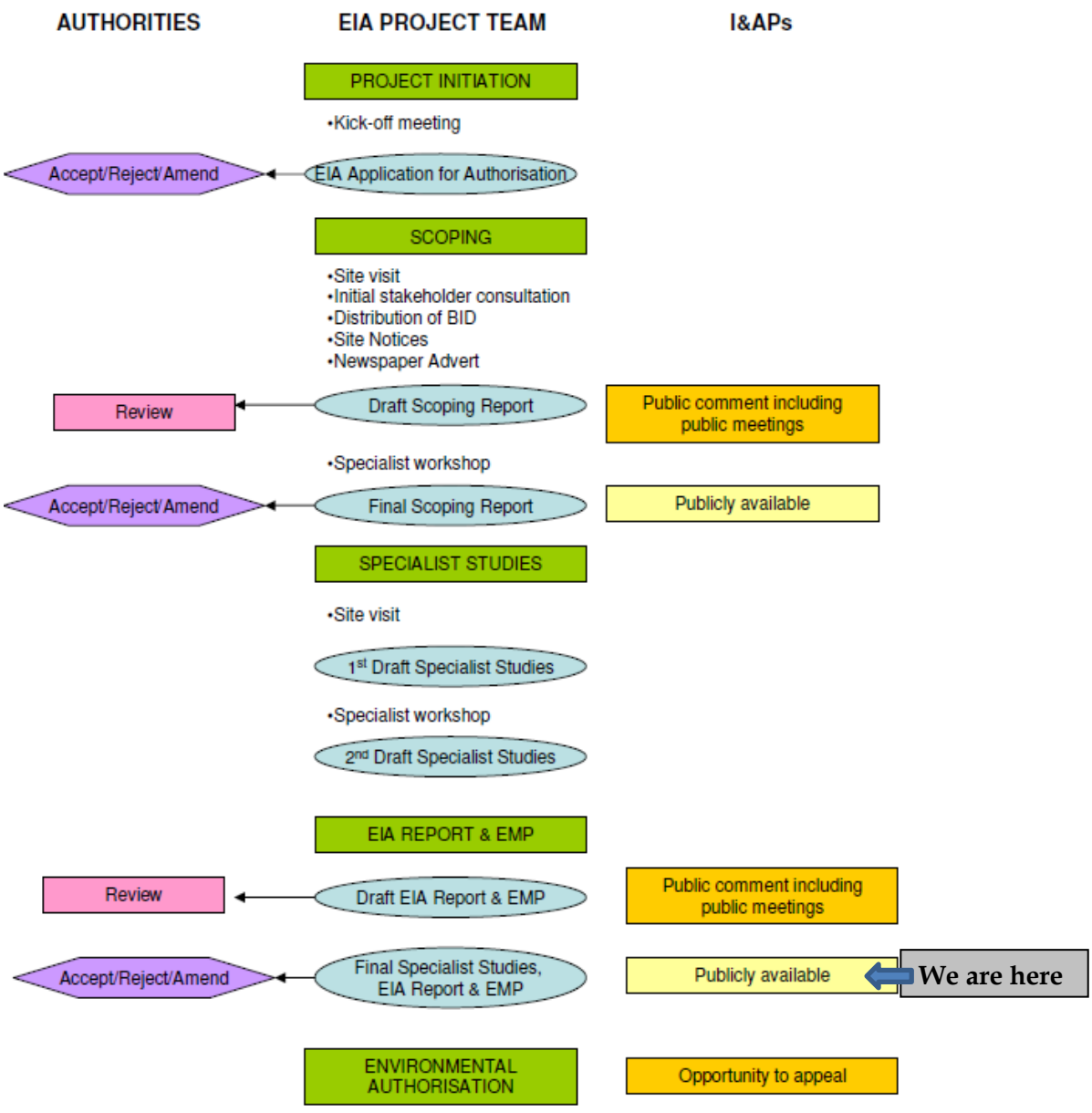
1.3 EIA PROCESS, APPROACH AND METHODOLOGY

Environmental Impact Assessment (EIA) is a systematic process that identifies and evaluates the potential impacts (positive and negative) that a proposed project may have on the biophysical and socio-economic environment. It identifies mitigation measures that need to be implemented in order to avoid, minimise or reduce the negative impacts, and also identifies measures to enhance positive impacts. The overall EIA process required for development proposals in South Africa is shown schematically in *Figure 1.1.* The EIA is not fully a linear process, but one where several stages are carried out in parallel and where the assumptions and conclusions are revisited and modified as the project progresses. The following sections provide additional detail regarding the key stages in this EIA process. These stages are:

- Scoping Phase;
- Specialist Study Phase; and
- Integration and Assessment Phase.

Figure 1.1 below provides an outline of the EIA process and indicates where you can be involved as an interested and affected (I&AP). All steps are described in more detail in the EIR.

Figure 1.1 EIA Process Flow Diagram



1.4 OPPORTUNITY TO COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT REPORT

Interested and Affected Parties (I&APs) and authorities have been provided with an opportunity to comment on any aspect of the proposed activity and the Draft EIR. A hardcopy of the Draft EIR has been made available at the

Hopetown and Kimberley Public Libraries and electronically at http://www.erm.com/SolaireDirect/Graspan.

A notification letter has been sent to all registered and identified I&APs to inform them of the release of the Draft EIR and where the report could be reviewed.

I&APs were requested to forward comments to ERM at the address, tel. /fax numbers or e-mail address shown below. The deadline by which comments are to reach ERM is 30 November 2012.

Attention: Tougheeda Aspeling
Solaire Direct Graspan PV Power Facility
DEA Ref: 14/12/16/3/3/2/276
ERM Ref: 0156408
ERM Southern Africa (Pty) Ltd
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Private Bag X12
Tokai, Cape Town,
7966
Tel: (021) 702 9100; Fax: (021) 701 7900
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1.5 PROJECT JUSTIFICATION

Solaire Direct's intentions of establishing the PV power facility include developing solar resources to generate electricity and reduce the dependence on non-renewable fossil fuel resources. Emergency load shedding in 2007 and 2008 highlighted the challenges facing South Africa in terms of security of electricity supply. The National Energy Response Plan (NERP), drafted at the time, acknowledged the role that independent power producers (IPPs) could play in ensuring sustainable electricity generation.

1.5.1 Project Motivation

- Reduce South Africa's dependence on fossil fuel resources
- Improve reliability and range of electrical services
- Meet demand for diversified energy sources
- Ensure the future of sustainable energy use
- Reduce CO_2 emissions and the nation's carbon footprint
- Contribute to targets for emission reduction as outlined in IRP 2010
- Promote environmental, social and economically sustainable development
- Contribute to reaching South Africa's goal of 10,000 GWh of renewable energy by 2013
- Contribute to meeting the NERP goal of 30 percent of all new energy from IPPs

1.6 *PROJECT DESCRIPTION*

The proposed PV power facility is located on the remaining extent of Farm Graspan (No. 172), situated in the Siyancuma Local Municipality in the Northern Cape province. The site is located approximately 40 km north-east of Hopetown and is accessible from the N12 (tarred road).

The site is designated for agricultural use, with current agricultural practices including sheep and cattle farming. There is an existing railway line traversing the site in a northeast-southwest direction. An existing gravel road network exists on the site, which crosses the railway line. The existing 132 kV Graspan Traction Substation is located within the northern section of the site, and an existing 132 kV power line traverses the site from the Graspan Traction Substation in a north-south direction, exiting the southern boundary of the site. It is anticipated that the project will feed a total of 90 MW into the national grid. The key components of the proposed PV power plant include:

- PV solar panels/modules (arranged in arrays);
- PV module mountings;
- DC-AC current inverters and transformers;
- New grid connection substation;
- Underground cabling/ overhead power lines;
- On-site buildings (including an operational control centre, office, ablutions and a guard house);
- Access roads and internal road network; and
- Ancillary infrastructure.

The proposed development will include PV panels that will occupy approximately 150 ha (1.5 km^2) of the site area in total. The collective term for a series of PV panels in rows is a PV array. The footprint of PV arrays will be approximately 127 ha. The PV panels will be 1975 mm in length, 990 mm in width and 50 mm in height with each producing an output of 300 W. The PV panels will be mounted on aluminium fixed-frame structures approximately 3.33 m in height from the ground. The aluminium structures will be mounted on steel screw piles or concrete foundations 1500 mm deep, depending on soil conditions. The distance or spacing between rows will be approximately 6.2 m. The PV arrays will face north in order to capture maximum sunlight.

The PV panel arrays will be connected to array enclosures which combine the power generated by multiple PV panels and transmit that power to an inverter/transformer enclosure. The inverter/transformer enclosures convert the direct current (DC) produced by the PV panels to alternating current (AC). The inverter/transformer enclosures also contain transformers that transform Low Voltage AC (350 V) from the inverter to Medium Voltage AC (22 kV). The inverter/transformer enclosures will connect to two new grid connection substations, one of approximately 400 m^2 and the other of approximately 2,500 m^2. This combined power will then be transformed from Medium Voltage (22 kV) up to High Voltage (132 kV) for connection to the existing Eskom Graspan Traction Substation by power transformers. The new

substations will connect to the existing Graspan Traction Substation by two overhead power lines of approximately 800 m in length.

The site will be accessed from the N12 national road at the existing site entrance (29^{0}20'42.59" S; 24^{0}24'51.66"E). An existing gravel road will be upgraded to approximately 6 m in width and used to cross the site. Internal paths will be created to enable access within the PV power facility. Within the PV arrays, a minimum spacing of 6.2 m is required between each row to avoid shadowing of the panels by adjacent rows. These spaces will not be gravelled or paved.

Additional infrastructure that will be required for the project includes the following:

- site perimeter fencing (electrified palisade fencing of approximately 2.8 m in height) including access gates;
- lighting at the main entrance only;
- temporary construction camp of approximately 4,800 m^2 (to house 35 personnel);
- an office for project supervision;
- a meeting room;
- an office for the caretaker of the site;
- two cloakrooms;
- two chemical toilets, as there is no water on the site; and
- a lay-down area for the temporary storage of materials during the construction activities of approximately 4,800 m^2.

During the construction phase, the primary water use requirement will be for dust control. However, water may also be required to moisture condition the soils for proper compaction at roads and foundations. It is estimated that for dust control and compaction, approximately 4,800,000 litres of water will be required. Water will also be required for the concrete mixing for the foundations. It is estimated that 575,586 litres of water will be required for the concrete foundations. The estimated construction-related water requirement is 5,4 million litres with a daily usage of 60,000 kilolitres over 18-24 months. Water requirements for the construction phase of the PV power facility will be supplied by the Local Water Users' Association. Alternatively, additional water will be provided via a rainwater tank. During the operational phase, it is estimated that PV panel cleaning will require a total of approximately 100,000 litres/year.

The total investment cost of the project is estimated to be approximately R1,35 million. During the construction phase, the following employment opportunities will be created:

- Site management: 25
- Civil works: 54
- Frames & foundations: 27
- PV modules: 125

- Electrical system & components: 60

Of the PV power facility's employees during construction, approximately 174 employees are estimated to be skilled.

During the operation phase, the PV power facility is expected to create the following opportunities:

- General administration & maintenance: 30
- Compliance related activities: 3
- Performance monitoring of the PV power facility: 2
- Security: 24

Of the PV power facility's employees during operation, 21 employees are estimated to be skilled.

Expected value of the employment opportunities during the construction phase is estimated to be 5 percent of the total investment cost of the project, i.e. R 67.5 million, of which local labour is expected to receive 75 percent (approximately R 50 million). This estimate excludes the value of manufacturing labour costs.

Solaire Direct intends to contribute a portion of the gross profit (before tax and depending on the project stage) to a local community trust that has been set up specifically for this project. The value of this contribution will be determined on finalisation of the tariff as part of the Power Purchase Agreement (PPA).

The project life-cycle can be divided into three key stages as follows:

- site preparation and construction;
- operation (including maintenance and repair); and
- decommissioning.

Prior to construction, site preparation would include the following activities:

- vegetation clearance – removal or cutting of any tall vegetation if present (bush cutting);
- levelling and grading of areas where the arrays will be sited, to remove steep slopes and undulations normally occurring, but this is not deemed necessary given the flat nature of the terrain on the site ;
- levelling of hard-standing areas, e.g. for temporary laydown and storage areas;
- erection of site fencing;
- construction of a temporary construction camp; and
- upgrading of farm tracks/ construction of on-site access roads.

Once the site has been prepared, prior to the installation of the PV components, the following construction activities will take place:

- the installation of fixed aluminium structures to support the PV modules;
- the construction of the new grid connection substation;
- the construction of electrical and control room;
- the construction of site office and storage facilities, including security and ablution facilities and associated septic tanks;
- the construction of array enclosure and inverter/transformer foundations and housing; and
- the installation of cables.

Installation of the full 90 MW could take 18 - 24 months or more to complete. Once each phase of the facility is complete and operational, it is expected that it will have a lifespan of at least 20 years. Day to day facility operations will involve both regular on-site preventive and corrective maintenance tasks, in order to keep the PV power plant in optimal working order throughout the operational period. The PV power facility will be decommissioned after 20 to 30 years. Alternatively, it will be upgraded and an application submitted to obtain a new license for the upgraded facility. Solaire Direct intend for the salvage value to cover the cost of decommissioning. Should the plant be decommissioned, the site will be rehabilitated to its original state.

1.7 CONSIDERATION OF ALTERNATIVES

As part of the site selection process, a number of potential sites were investigated in the Northern Cape through a desk-top analysis and intrusive studies. The Graspan site was identified, based on a number of criteria, including:

- Solar resource;
- Site extent;
- Eskom grid access;
- Land suitability;
- Landowner consent;
- Environmental and socio-economic impacts; and
- Workforce availability.

The PV power facility layout and project component design was subjected to a number of iterations, based on technical aspects of the project. These included aspects such as detailed site-specific solar data and construction conditions, as well as specialist input and sensitivity ratings for the site that were explored during the EIA process.

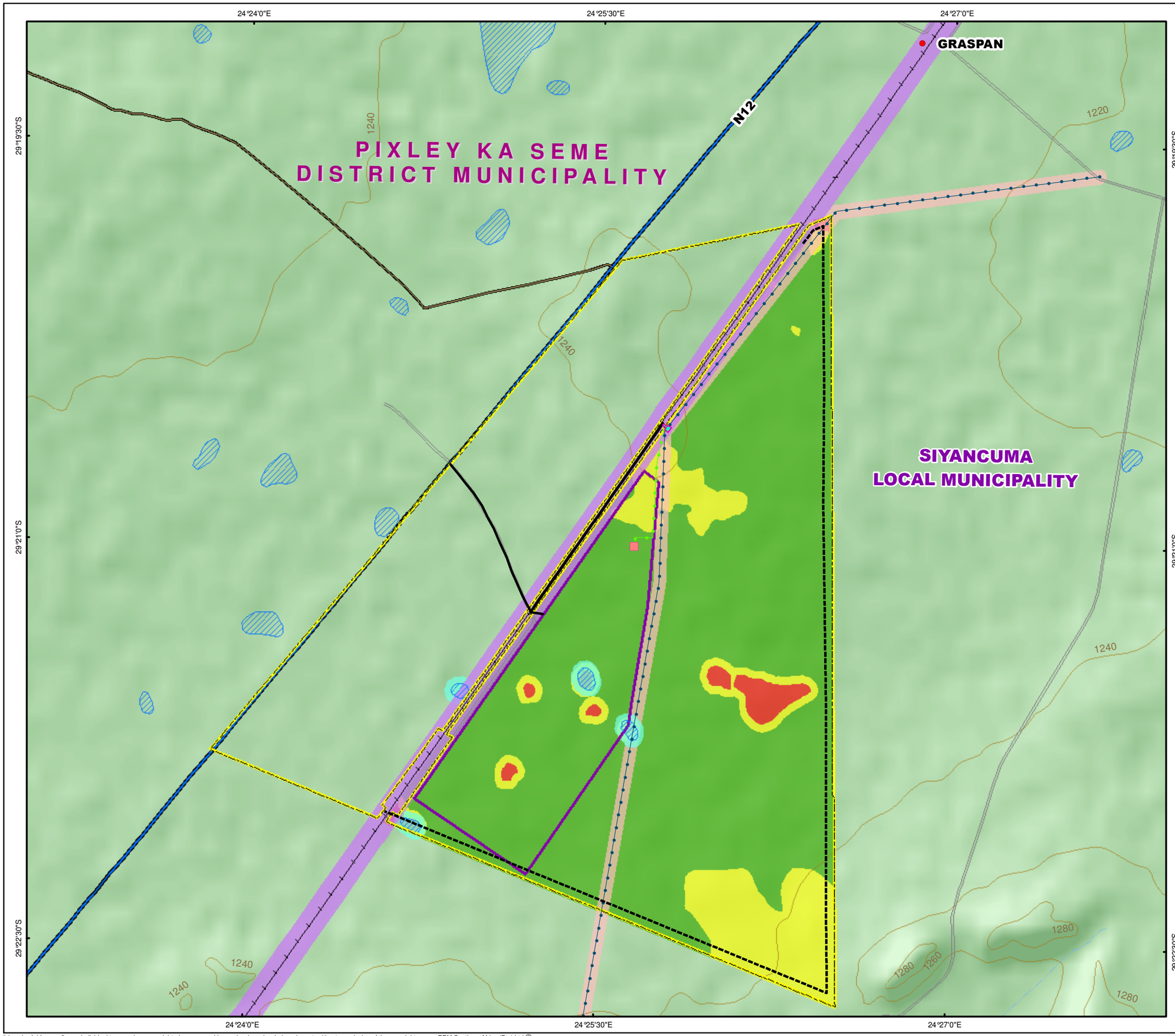
An original layout (Layout Alternative 1 shown in *Figure 1.2*) provided by Solaire Direct and based on limited data was used as the basis for the initial specialist assessment. After field surveys and workshops by the EIA team, particular areas posing additional environmental and social constraints or

specific unsuitable locations were identified and fed back to the Solaire Direct technical team. Areas considered unsuitable by the environmental specialists were excluded where possible, based on potential impacts to vegetation, ecology, heritage and visual considerations. The technical team then generated a revised 'buildable areas map' based on these environmental and social constraints, as well as additional technical constraints, and from there developed a revised layout design, namely Layout Alternative 2 (*Figure 1.3*), taking these constraints into consideration.

Technical criteria and buffer zones considered in deriving the final site layout (Layout Alternative 2) included:

- Where possible, avoiding areas which are very rocky or uneven, in order to minimise earthworks and thus real and potential environmental impact;
- Buffer around dry pans of 50 m;
- National road buffer of 1 km;
- Local district road buffer of 100 m;
- Railway buffer of 100 m;
- External farm boundary buffer of 50 m; and
- Buffer along existing Eskom grid infrastructure of 500 m.

Layout Alternative 2 is the preferred and **final PV power facility layout** design applied for in this EIR.



Legend

- Town
- Contours
- Non-Perennial River
- Water Bodies
- National Route
- Secondary Road
- Other Access
- Railway Line
- Existing Overhead Transmission Line ESKOM
- Transmission Line
- Access Road
- Proposed Substation
- Graspan Eskom Traction Substation
- 50m Existing Transmission Line Buffer
- 100m Railway Buffer
- 50m Dry Pan Buffer
- 50m Visual Setback Line
- Site Layout Alternative 1 (90MW)
- Graspan Photovoltaic (PV) Power Facility

Ecological Sensitivity

- Very High
- High
- Medium

0 500 1000
Meters

N

TITLE:

Figure 1.2: Site Layout Alternative 1 on Constraints Map

CLIENT:

solairedirect
Southern Africa
The solar MWh company

DATE: Oct 2012	CHECKED: DA	PROJECT: 0156408
DRAWN: AB	APPROVED: SHC	SCALE: 1 : 25 000

DRAWING: Graspan EIR Alt1 on Constraints Map.mxd

REV: 0

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Cape Town, SOUTH AFRICA
Tel: +27 (0)21 702 9100
Fax +27 (0)21 701 7900

Projection: Transverse Mercator, CM 23, WGS84
Source: Chief Directorate National Geo-Spatial Information - Base Data Simon Todd - Ecological Sensitivity
Inset Map: Esri Data & Maps

SIZE: A3

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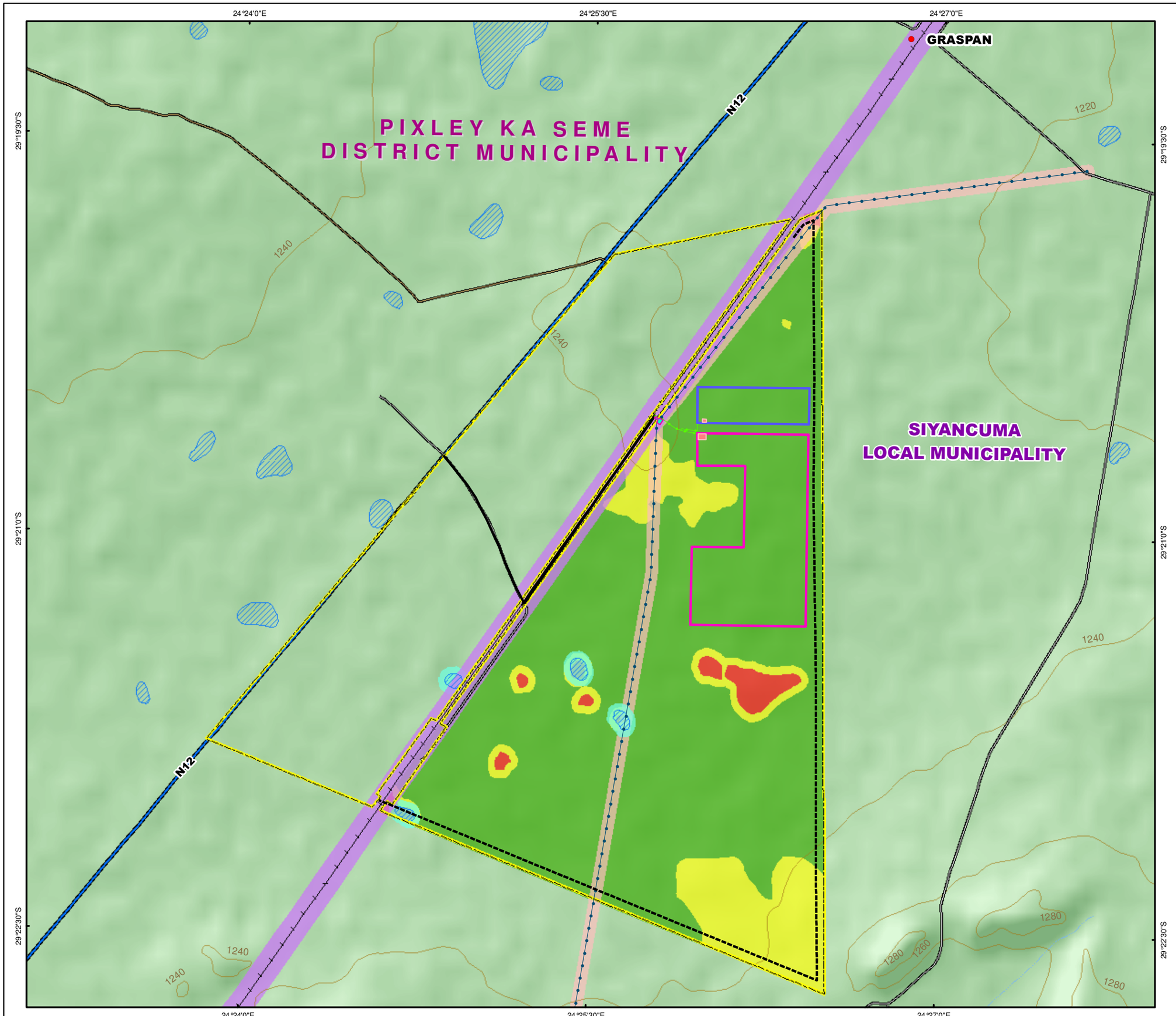

Legend

- Town
- Contours
- Non-Perennial River
- Water Bodies
- National Route
- Secondary Road
- Other Access
- Railway Line
- Existing Overhead Transmission Line ESKOM
- Transmission Line
- Access Road
- Proposed Substation
- Graspan Eskom Traction Substation
- 50m Existing Transmission Line Buffer
- 100m Railway Buffer
- 50m Dry Pan Buffer
- 50m Visual Setback Line
- Site Layout Alternative 2 (10MW)
- Site Layout Alternative 2 (80MW)
- Graspan Photovoltaic (PV) Power Facility

Ecological Sensitivity

- Very High
- High
- Medium

0 500 1000
Meters

N

TITLE:

Figure 1.3: Site Layout Alternative 2 on Constraints Map

CLIENT:

solairedirect
Southern Africa
The solar MWh company

DATE: Oct 2012	CHECKED: DA	PROJECT: 0156408
DRAWN: AB	APPROVED: SHC	SCALE: 1 : 25 000

DRAWING: Graspan EIR Alt2 on Constraints Map.mxd

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SIZE: A3

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The following different solar energy technologies were considered as technology alternatives:

- Fixed PV plants;
- Tracking PV plants (with solar panels that rotate to follow the sun's movement);
- Concentrated Solar Power (CSP) plants; and
- Concentrated PV Plants.

Financial, technical and environmental factors were taken into account when choosing the type of solar power technology for the site, including the local solar resource and its likely generation output, the economics of the proposed facility and availability of government feed-in tariffs and energy production licenses, and the requirement for other development inputs such as water resource requirements. PV is the most environmentally appropriate technology for the preferred site. The remaining types of technologies were evaluated and the preferred configuration was selected based primarily on the operating environment. The Graspan PV Power Facility will install fixed structures rather than tracking systems as they require less repair work and maintenance during the operational life of the project. The no-go alternative is the option of not implementing the activity or executing the proposed development.

1.8 BIO-PHYSICAL AND SOCIO-ECONOMIC BASELINE

1.8.1 Bio-physical Baseline

The site is located in a semi-arid region, and is designated for agricultural use, with current agricultural practices including sheep and cattle farming. Land use in the surrounding area includes further sheep and cattle farming, cultivation approximately 15 km to the east and 30 km to the north east of the site, and various salt works within a 15 km radius of the site.

Although the site is remote, there are existing man-made features present in the immediate landscape. There is an existing railway line traversing the site in a northeast-southwest direction. An existing gravel road network exists on the site, which crosses the railway line. The existing 132 kV Graspan Traction Substation is located within the northern section of the site, and an existing 132 kV overhead power line traverses the site from the Graspan Traction Substation in a north-south direction, exiting the southern boundary of the site. The total area of the site is 2,080.82 ha.

The topography of the area is generally flat with a gentle slope up towards the dolerite hills (referred to as 'koppies') around Klein Kareelaagte to the southeast. A small boulder-strewn dolerite koppie is located on the northern edge of the site. There are no major drainage features on the site. The Driekops Pan located approximately 1 km southeast of the site is a major feature in the surrounding landscape.

The surrounding area has a rural character consisting mainly of open grassland, with clumps of trees around farmsteads, such as the Graspan homestead to the west. Farmsteads in the area tend to be 2 km or more apart. The Graspan and Enslin Battle Site, dating to the Boer War (1899), is located approximately 7 km to the north of the site.

The affected project area has a semi-arid, continental climate with a late summer rainfall regime, i.e. most of the rainfall is confined to mid and late summer.

The geology of the site contains rocks of the Tierberg Formation, Ecca Group and the Karoo Supergroup, which are Early Permian in age (approximately 270 million years old). Fossils from the Ecca Group have mostly been recovered from the underlying Whitehill Formation. Presence of fossils on the site is possible due to the presence of the Ecca Group formations. The entire site is underlain by red apedal soil types. The following major soil forms were identified at the site:

- Mispah Form
- Glenrosa Form
- Coega Form

The overall agricultural potential of the site is based on a number of inter-related factors including climate, topography, soil type, soil limitations and current land use. The combination of low rainfall and a severe moisture deficit means that sustainable crop production cannot take place without some form of irrigation. The entire Graspan site is classified as having low potential for crop production, due to the arid climate and highly restrictive soil characteristics.

During the site visit, six small pans were identified and mapped. Of these, three have also been identified and mapped by the Freshwater Ecosystem Priority Areas (FEPAs) assessment produced by the CSIR (Nel et al., 2011). The pans identified under the FEPA were, however, given a rank of 4 indicating that they are wetlands which are perceived to be in good condition and which occur in proximity to other such wetlands, but have not been identified by experts as priority wetlands.

The national vegetation map for the site indicates a dominance of the Northern Upper Karoo vegetation type and a small section of Kimberley Thornveld located in the south eastern section of the site (Mucina and Rutherford, 2006). Field surveys undertaken, however, identified several small pans on the site corresponding to the Highveld Salt Pans vegetation types and an area of rock outcrop which corresponds to the Vaalbos Rocky Shrubland vegetation type. The field survey further identified the Kimberley Thornveld to be of greater extent on the site than as depicted by the national vegetation map. The above-mentioned vegetation types are all classified as

Least Threatened according to the IUCN [(1)]. Of the vegetation types present on site, the Vaalbos Rocky Shrubland found in the vicinity of the rocky outcrop is considered the most ecologically sensitive, and as a habitat type is not found anywhere else on the site. On a broad scale, the Kimberley Thornveld vegetation type is considered to be more ecologically sensitive than the northern Upper Karoo vegetation type. This is due to the Kimberley Thornveld containing numerous large trees, while the Northern Upper Karoo vegetation type is dominated by low bushes and grasses.

The site has been found to be generally free of alien species. There were, however, alien species present around water points and other disturbed areas. Alien species identified on site included *Opuntia imbricata, Malva parviflora, Conyza bonariensis, Datura stramonium* and *Tagetes minuta*.

The Graspan site is located within the distribution range of 49 terrestrial mammalian species, indicating that the mammalian diversity at the site is potentially high. Of the 49 species, the Brown Hyaena *Hyaena brunnea* (Near Threatened) and Black-footed Cat *Felis nigripes* (Vulnerable) are IUCN listed species. The likelihood that the Brown Hyaena occurs at the site is low, given the agricultural activity on the site. The Black-footed Cat, however, is more likely to occur at the site, as this species favours a mixture of open and densely vegetated areas which occurs on the site. The rocky outcrops are the most important habitats and, compared to the adjacent plains habitats on the site, are likely to harbour a greater mammalian species richness, particularly of small mammals (Round-eared Elephant Shrew (*Macroscelides proboscideus)* were observed during the field survey within the rocky outcrop habitat, and are likely to occur within the *Rhus ciliata* shrubland). The pans identified are likely to be an important habitat for gerbil species and Springhares (*Pedetes capensis)*, the burrows of which were common in the vicinity of the pans. Evidence of Aardvark (*Orycteropus afer)* activity was common at the site.

The Graspan site is located in or near the distribution range of at least 37 reptile species, indicating that the reptile diversity for the site is relatively low. However, given the diversity of habitats present on the site, these reptile species are likely to be found on the site. Based on distribution maps and habitat requirements, the composition of the reptile species is likely to comprise one terrapin, two tortoises, 18 snakes, 13 lizards and skinks and three geckos. There are no listed reptile species known from the area.

The Graspan site is located within the distribution range of 12 amphibian species. However, given the paucity of surface water at the site, only those species able to survive away from perennial water are likely to occur at the site. Only the Giant Bullfrog (*Pyxicephalus adspersus)* is of conservation concern and is listed as Near Threatened according to the IUCN. Should this species occur at the site, it would be associated with the pans. However, based on field evidence, the small pans present at the site do not hold water

(1) International Union for the Conservation of Nature.

for sufficient periods to offer suitable breeding habitat, and it is unlikely that the site represents an important area for this species.

There are 225 bird species known to occur in the broad area surrounding the Graspan site, according to the SABAP (1) 1 and 2 data sets. Of these species, there are 13 IUCN (2) listed species. All of the listed species are susceptible to some degree to both electrocution by, or collision with, power line infrastructure. Larger raptors are susceptible to both collision and electrocution, while storks, bustards and flamingos are all vulnerable to collision with power lines.

There has been no fine-scale conservation planning for the affected project area. Furthermore, the Graspan site does not fall within a National Protected Areas Expansion Strategy focus area, and therefore has not been identified as a potentially important area for future conservation. The Mokala National Park (MNP) is located approximately 13 km to the north of the site. The park was proclaimed on 19 June 2007 to conserve the interface between the Savanna Biome and the Nama-Karoo Biome. The deproclamation of Vaalbos National Park (VNP) in the Northern Cape Province resulted in the establishment of MNP. As part of the conservation and management plan strategy for MNP, there is a proposed expansion programme which would increase the size of MNP, bringing the MNP border to the N12 and adjacent to the Graspan site (South African National Parks, 2008).

1.8.2 Socio-economic Baseline

The project is located within the Siyancuma Local Municipality, which falls within the Pixley Ka Seme District Municipality, in the Northern Cape. Within this administrative structure, the provincial government is responsible for providing a strategic vision and framework for the province, as well as ensuring cooperation between municipalities and ensuring each municipality performs their respective functions.

It must be noted that while the site falls within the Siyancuma Local Municipality (SLM), the town of Hopetown (where Solaire Direct are likely to source local labour) is located in the neighbouring Thembelihle Local Municipality (TLM). The administrative centre of the SLM is located in the town of Douglas. There are six Wards within the Municipality and the Graspan site is located in Ward 2. The Vaal and Orange Rivers run through the SLM and are important from an agricultural perspective. The N12 national road bisects the Municipality from north to south and links a number of the smaller towns to Kimberley, the capital of the Northern Cape.

According to the Water Services Development Plan, Siyancuma Municipality 2011/12, agriculture, fishing and forestry form the backbone of the local

(1) South African Bird Atlas Project.
(2) International Union for the Conservation of Nature.

economy, contributing 27 percent towards the Municipal Gross Geographic Product (1) (GGP).

The population in the SLM was estimated to be 35,967 at the time of the 2007 Community Survey, totaling approximately 22 percent of the Pixley Ka Seme District Municipality population. General education levels are low within the SLM. An estimated 20.3 percent of the population over 20 years of age are illiterate, as they have not received any schooling. It is estimated that 66.6 percent of the population over 20 years have completed schooling (from Grade 0 to Grade 12), and a low 7.3 percent have attained a higher education qualification (2). The economically active population (aged 16 – 65 years) of the SLM was estimated to be 22,862 people in 2007, making up 63.6 percent of the total population. Of that total, 34 percent are employed, while 17 percent are unemployed. A further 49 percent are considered economically inactive (3). The SLM does have a higher population of economically inactive people when compared to that of the Province, (42 percent).

There are two primary types of farming activities that take place in the area, namely, dryland farming and intense irrigation farming. The irrigation farming is practiced along the Vaal and Orange Rivers, where water from the rivers can be used to irrigate lucerne, wheat, oats, maize and vegetables. The irrigated fields also facilitate dairy farming. The dryland farming consists of stock farming (sheep, cattle, and goats), ostrich farming and game. The farming activity surrounding the project site is large-scale, commercial farming. The Graspan site is considered dryland and the main activity on the site is grazing. The farmer keeps cattle and sheep on the Graspan farm. The carrying capacity on the site is one small stock unit (SSU) per three hectares, and one large stock unit (LSU) per 15 ha (4) .

There is a hospital located in Hopetown and a primary health care clinic located in Steynville. The most prevalent illnesses in the area are Tuberculosis (TB), HIV/Aids and Hypertension (high blood pressure).

A large portion (79 percent) of the population of SLM live in a house on a separate stand, while 14 percent reside in an informal dwelling/ shack. Two percent live in informal dwellings/ shacks that are located in a backyard, while another two percent of the population live in a block of flats (5). The majority of the households within the SLM (89 percent) have access to electricity. An estimated 56 percent of households in the SLM have access to tap water inside their homes, while 32 percent have access to water outside their homes (within their yard) (6) . Four percent of households have access to

(1) The gross geographic product (GGP) of a particular area amounts to the total income or payment received by the production factors – (land, labour, capital, and entrepreneurship) – for their participation in the production within that area. (http://www.environment.gov.za/enviro-info/nat/ggp.htm).
(2) Statistics South Africa, Census 2001
(3) Economically inactive population refers to students, elderly, sick, differently-abled persons and people who choose not to work.
(4) Stock Units are based on the energy requirements of the animal and are used as units for measuring the carrying capacity of grazing land.
(5) Statistics South Africa: Community Survey, 2007.
(6) Statistics South Africa: Community Survey, 2007.

piped water from an access point outside of their yard and eight percent do not have access to piped water and obtain water from boreholes, dams, rainwater tanks or streams.

Little archaeological information is available for the project site and most of the local archaeological knowledge is based around the railway line and the Riet River. A range of different heritage sites were identified during the field survey. These includes stone artefact scatters, dolerite boulders with grinding surfaces, a single incidence of historical graffiti on a dolerite boulder, a circular stone structure near the railway line, some calcrete cairns and a distribution of late 19th/early 20th century historical dump material along the railway line. The region is steeped in cultural heritage as numerous battles forming part of the Boer wars were fought along the Kimberley railway line. The Battle of Graspan (also known as Enslin or Rooilaagte) was fought during the second Anglo-South African War (1899-1902) and the battle site is approximately seven kilometres to the north-east of the project site.

The site and surrounds has a rural character consisting mainly of open grassland, with clumps of trees around farmsteads, such as the Graspan homestead to the west of the site. Farmsteads in the area tend to be 2 km or more apart and, combined with the large extent of open farmland, create a sense of openness and space in the Karoo landscape.

Two concentric circles of packed stone, historic material strewn around the stone structure, historic material found mainly concentrated along the railway line, historic late 19th or early 20th century dump material, including glass bottles, tin cans, etc. were found on the site. These materials are particularly concentrated within a swathe of 50 m to100 m from the railway line.

1.9 IMPACTS IDENTIFIED AND ASSESSED

The bio-physical and socio-economic impacts during the construction phase that have been identified and assessed in the EIR include the following:

Table 16.1 ***Summary of Pre-mitigation Significance during Construction Phase for Layout Alternative 1 and Layout Alternative 2 and Residual Impact Significance for Layout Alternative 2 (preferred and final layout)***

	Section	Impact	Pre-mitigation Significance *(Based on Layout Alternative 1)*	Pre-mitigation Significance *(Based on Layout Alternative 2)*	Residual Impact Significance *(Based on mitigation and Layout Alternative 2)*
Soils	7.1	Loss of Topsoil, Soil Compaction and Soil Erosion	**MODERATE (-VE)**	**MODERATE (-VE)**	**MINOR (-VE)**
Water	7.2	Impact on Surface and Groundwater	**MAJOR-MODERATE (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
Flora	9.1	Destruction and Loss of Natural Vegetation and Sensitive Plant Communities	**MAJOR (-VE)**	**MODERATE (-VE)**	**MINOR (-VE)**
Fauna	9.3	Impacts from Habitat Loss and Disturbance	**MAJOR (-VE)**	**MODERATE (-VE)**	**MINOR (-VE)**
Avifauna	9.4	Impacts on Avifauna	**MAJOR (-VE)**	**MODERATE-MINOR (-VE)**	**MINOR (-VE)**
Visual	10.4	Visual Impacts	**N/A**	**MODERATE(-VE)**	**MODERATE(-VE)**
Palaeontology	11.1	Damage or Destruction to Paleontological Resources	**N/A**	**MINOR (-VE)**	**NEGLIGIBLE**
Archaeology	11.2	Archaeological Finds	**N/A**	**MINOR (-VE)**	**MINOR (+VE)**
	11.2	Destruction or Disturbance to Archaeological Resources	**N/A**	**MINOR (-VE)**	**MINOR (-VE)**
Cultural Heritage	11.3	Destruction or Disturbance of Cultural Heritage	**N/A**	**MINOR (-VE)**	**NEGLIGIBLE**
Socio-economic	12.1	Direct Employment and Training	**N/A**	**MINOR - MODERATE (+VE)**	**MODERATE (+VE)**
	12.1	Procurement and Indirect Employment	**N/A**	**MINOR - MODERATE (+VE)**	**MODERATE (+VE)**
	12.1	Induced Economic Benefits	**N/A**	**MINOR (+VE)**	**MINOR (+VE)**
	12.1	Increased Community Investment	**N/A**	**MODERATE (+VE)**	**MODERATE-MAJOR (+VE)**
	12.1	Inflation and Increased Cost of Living	**N/A**	**MINOR (+VE)**	**MINOR (+VE)**
	12.2	Social Nuisance Factors	**N/A**	**MINOR (-VE)**	**NEGLIGIBLE**
	12.3	Impact on Agricultural Activities	**N/A**	**MINOR (-VE)**	**NEGLIGIABLE**
	12.4	Impact on Tourism	**N/A**	**MINOR (-VE)**	**NEGLIGIABLE**
Traffic	13.1	Impact from Increased Traffic	**N/A**	**MODERATE (-VE)**	**MINOR (-VE)**
Waste	13.2	Impact from Waste and Effluent	**N/A**	**MODERATE (-VE)**	**MINOR (-VE)**
Air Quality	13.3	Dust and Emissions	**N/A**	**MINOR (-VE)**	**NEGLIGIBLE**

* *The visual, cultural heritage, socio-economic, traffic, waste and air quality impact assessments only assessed the preferred and final layout, Site Layout Alternative 2*

The major mitigation/enhancement measures to address the more significant impacts for the construction phase include the following (for a comprehensive list of mitigation measures please refer to the EIR report and EMP):

- Protect disturbed surfaces against erosion, and disturbed areas will be rehabilitated as soon as possible to prevent erosion.
- Fuel, oil and used oil storage areas will be contained in bunds of 110 percent capacity of the stored material.
- Site clearing activities will be kept to the minimum required (PV arrays and road footprint).
- Sensitive areas as demarcated on the ecological sensitivity map in the EIR will be avoided as far as possible, and where these areas must be traversed by roads or infrastructure, specific precautions should be taken to ensure that impacts are minimized.
- Ecologically sensitive areas near the construction areas will be clearly demarcated as no-go areas.
- Any fauna directly threatened by the construction activities will be removed to a safe location by the Environmental Control Officer (ECO) or suitably qualified ecologist.
- In order to reduce collisions of vehicles with fauna, a 30 km/hr speed limit will apply to all roads and vehicles using the site. Animals will have right of way.
- The collection, hunting or harvesting of any animals at the site will be strictly forbidden throughout all phases of the project. Solaire Direct will develop and implement a disciplinary procedure for staff who are caught conducting such activities.
- All new power lines will be marked with bird flight diverters.
- All new power line infrastructure will be bird-friendly in configuration and adequately insulated.
- Visual buffer zones from the N12, district roads, the rail line and farm boundaries have been recommended in the EIR, and applied to the layout.
- The layout of the proposed facility should avoid the railway line and the koppies on the project site. Layout Alternative 2 avoids these areas sufficiently.
- If any human remains are uncovered during the construction of the site, development should cease and SAHRA and HNC should be notified. SAHRA or HNC will investigate and propose a way forward.
- Solaire Direct will initiate training and skills development programmes prior to the commencement of construction, as a means of ensuring that members of the local workforce are up-skilled and can be employed on the project.
- Solaire Direct will build the capacity of employees through development plans, technical, health and safety training and provide them with relevant training certificates.
- Solaire Direct will develop and implement a grievance procedure that is easily accessible to local communities, through which complaints related to contractor or employee behaviour can be lodged and responded to.

- Solaire Direct and its appointed contractors will develop an induction programme, including a Code of Conduct, for all workers (including contractors and their workers). A copy of the Code of Conduct will be presented to all workers and signed by each person.
- A Waste Management Plan (WMP) for the proposed project will be developed. This will follow the principles of waste minimisation at source, segregation for reuse, recycling, treatment or disposal.

Table 16.2 ***Summary of Pre-mitigation Significance during Operational Phase for Layout Alternative 1 and Layout Alternative 2 and Residual Impact Significance for Layout Alternative 2 (preferred and final layout)***

	Section	**Impact**	**Pre-mitigation Significance** *(Based on Layout Alternative 1)*	**Pre-mitigation Significance** *(Based on Layout Alternative 2)*	**Residual Impact Significance** *(Based on mitigation and Layout Alternative 2)*
Soils	7.1	Loss of Topsoil, Soil Compaction and Soil Erosion	**MINOR (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
Water	7.2	Impact on Surface and Groundwater	**MODERATE (-VE)**	**MODERATE-MINOR (-VE)**	**MINOR (-VE)**
Agriculture	8.1	Loss of Agricultural Land and/or Production	**N/A**	**MINOR (-VE)**	**NEGLIGIBLE**
Flora	9.1	Impacts of Maintenance Activities on Vegetation	**MODERATE (-VE)**	**MINOR (-VE)**	**MINOR (-VE)**
	9.2	Alien Plant Invasion	**MODERATE (-VE)**	**MODERATE (-VE)**	**MINOR (-VE)**
Fauna	9.3	Impacts from Habitat Loss and Disturbance	**MODERATE (-VE)**	**MODERATE-MINOR (-VE)**	**MINOR (-VE)**
Avifauna	9.4	Impacts on Avifauna	**MAJOR (-VE)**	**MODERATE (-VE)**	**MINOR (-VE)**
Visual	10.4	Visual Impacts	**N/A**	**MODERATE(-VE)**	**MODERATE(-VE)**
Cultural Heritage	11.4	Impact on Sense of Place	**N/A**	**MODERATE (-VE)**	**MINOR (-VE)**
Socio-economic	12.1	Direct Employment and Training	**N/A**	**MINOR (+VE)**	**MINOR (+VE)**
	12.1	Procurement and Indirect Employment	**N/A**	**MINOR (+VE)**	**MINOR (+VE)**
	12.1	Induced Economic Benefits	**N/A**	**NEGLIGIBLE**	**NEGLIGIBLE**
	12.1	Increased Community Investment	**N/A**	**MODERATE (+VE)**	**MODERATE-MAJOR (+VE)**
	12.1	Inflation and Increased Cost of Living	**N/A**	**NEGLIGIBLE**	**NEGLIGIBLE**
	12.2	Social Nuisance Factors	**N/A**	**NEGLIGIBLE**	**NEGLIGABLE**
	12.3	Impact on Agricultural Activities	**N/A**	**MINOR (-VE)**	**NEGLIGIABLE**
	12.4	Impact on Tourism	**N/A**	**MINOR (-VE)**	**NEGLIGIABLE**
Traffic	13.1	Impact of Increased Traffic	**N/A**	**NEGLIGIBLE**	**NEGLIGIBLE**
Waste	13.2	Impact from Waste and Effluent	**N/A**	**MINOR (-VE)**	**MINOR (-VE)**
Air Quality	13.3	Dust and Emissions	**N/A**	**NEGLIGIBLE**	**NEGLIGIBLE**

* *The agricultural, visual, cultural heritage, socio-economic, traffic, waste and air quality impact assessments only assessed the preferred and final layout, Site Layout Alternative 2*

The major mitigation/enhancement measures to address the more significant impacts for the operational phase include the following (for a comprehensive list of mitigation measures please refer to the EIR report and EMP):

- Allow periodic grazing within the PV fields (sheep and wildlife). This mitigation will minimise the loss of grazing land and allow agricultural production to remain relatively unaffected.
- Vegetation that needs to be reduced in height will be mowed or brush-cut to an acceptable height, and not to ground level, except where necessary.
- Monitor alien plant abundance within the development areas, as well as in the surrounding area on at least a bi-annual basis.
- Document erosion problems and the control measures implemented.
- Any electrocution and collision events that occur will be recorded, including the species affected and the date.
- The footprint of the operations and maintenance facilities, as well as parking and vehicular circulation, should be clearly defined, and not be allowed to spill over into other areas of the site.
- Solaire Direct will calculate their contribution towards the Community Trust and establish the Trust in accordance with the relevant laws and guidelines.
- Projects will be identified in collaboration with the local Municipality and community representatives to ensure alignment with the key needs identified through the Integrated Development Planning process.

The available information gathered during the EIA process was considered adequate to assess all of the impacts identified with a sufficient degree of certainty. A systematic assessment of all the potential impacts, in terms of pre-mitigation impact significance and residual impact significance, showed these to range from negligible to medium-major ratings. The reduction in most residual impacts relative to the pre-mitigation assessment is based on Solaire Direct's commitment to the implementation of mitigation measures and rehabilitation outlined in the EIR and EMP.

Cumulative effects are a result of effects that act together (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the project under consideration (e.g. the combined effect of other similar projects in the general area). An effect to a resource in itself may not be considered significant, but may become significant when added to the existing and potential effects eventuating from similar or diverse developments in the area.

Cumulative effects and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative effects is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. The scale at which the cumulative effects are assessed is important. At this stage it is not feasible to examine solar farm

developments at a national scale and for practical purposes a sub-regional scale has been selected. There are other solar farm developments planned within a 15 km radius of the Graspan site. As there is uncertainty as to whether any other solar farm developments will be implemented in the region surrounding the proposed Graspan site, it is difficult to quantitatively assess the potential cumulative effects. It is however important to explore the potential cumulative effects qualitatively, as this will lead to a better understanding of these effects and the possible mitigation that may be required. As these cumulative effects are explored in more detail, the trade-offs between promoting renewable energy (and the associated benefits in terms of reduction in CO_2 emissions) versus the local and regional environmental and social impacts and benefits (i.e. impacts on landscape, tourism, flora, employment, etc.) will become evident. It is only when these trade-offs are fully understood, that the true benefits of renewable energy can be assessed.

In the absence of any certainty regarding other proposed solar farm developments within a 15 km radius of the site, to assess cumulative effects it is necessary to speculate on the possible cumulative effects of other types of development in the vicinity, which could have similar impacts, e.g. loss of agricultural land. In the context of the proposed Graspan PV Power Facility, the loss of agricultural land, habitat loss, visual impact and cultural heritage, are not significantly high negative impacts when viewed in isolation. However, should other developments in the area (such as residential, industrial, or other solar power farms) lead to similar impacts, the respective cumulative negative effects could become significant. In contrast, the overall cumulative socio-economic impacts are likely to be positive, as a result of the benefits to the local, regional and national economy through employment and procurement of services.

Cumulative effects and benefits on various environmental and social receptors will occur to varying degrees with the development of other renewable energy facilities in South Africa. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant. However, there is a lack of understanding of the cumulative effects on other environmental and social receptors, such as the ecology, visual amenity and landscape character of the affected areas. There is a need for strategic planning and cooperation to better understand the cumulative effects that may result from promoting renewable energy.

1.10 RECOMMENDATIONS

ERM is confident that the necessary effort has been made by Solaire Direct to accommodate the mitigation measures recommended during the EIA process, to the extent that is practically possible, without compromising the economic

viability of the proposed PV power facility. The implementation of the mitigation measures detailed in *Chapters 7* to *14* and listed in the Environmental Management Programme (EMP), including monitoring, will provide a basis for ensuring that the potential positive and negative impacts associated with the establishment of the development are enhanced and mitigated to a level which is deemed adequate for the development to proceed.

In summary, based on the findings of this assessment, ERM finds no reason why the 90 MW PV power facility proposed for the Graspan site (Layout Alternative 2) should not be authorised, contingent on the mitigations and monitoring for potential environmental and socio-economic impacts as outlined in the EIR and EMP being implemented.