4 PROJECT DESCRIPTION

This Chapter provides a description of the proposed Olyven Kolk solar power plant. The main project activities for the construction, operation and decommissioning phases are discussed in this section as well as the motivation for the project and the consideration of alternatives.

4.1 MOTIVATION

The electricity consumers in South Africa are supplied by the state owned utility, Eskom. The latter is a vertically integrated, regulated power utility with operations at all levels of electricity supply business, including generation, transmission and distribution.

It is anticipated that for now, Eskom will act as the single buyer to procure electric power from independent power producers (IPPs) which could use either conventional generation technologies or renewable generation technologies. The establishment of an independent system operator (ISMO) is expected to take over the power purchasing function from Eskom in the future. In addition to supplying power to electricity consumers in South Africa, Eskom also exports power to other countries such as Lesotho, Swaziland, Botswana, Namibia, Mozambique and Zimbabwe. South Africa has at present a total of some 43,900 MW of generation capacity, some 40,600 MW of which, i.e. about 92 percent is owned by Eskom and the rest is owned by IPPs.

Emergency load shedding in South Africa during 2007 and 2008 highlighted the challenges facing South Africa in terms of electricity generation, transmission and distribution. The National Energy Response Plan (NERP), drafted at the time, acknowledged the role that IPPs (including those harnessing renewable energy resources) can play in ensuring sustainable electricity generation, and sets a goal that 30 percent of all new power generation will be derived from IPPs (1).

In August 2011, the release of the request for qualification and proposals by the South African Department of Energy presented opportunities for the renewable energy industry, promoting competiveness for renewable energy with conventional energy generation technologies. Initially, it was indicated that the market mechanism to be used for the purchase of power would be premised on predetermined renewable-energy feed-in tariffs (REFITs). However, the South African government has since abandoned REFIT in favour of a selection process that would involve price and non-price criteria. This decision followed concerns regarding REFIT's legal compatibility with government procurement rules and cases of such schemes in other countries having led to prices that could not be sustained.

In South Africa the government has developed a policy framework (the White Paper on Renewable Energy) and set a target of sourcing 10,000 GWh from renewable energy projects by 2013 (1). This amounts to approximately 4 percent of South Africa's total estimated energy demand by 2013. At the Copenhagen Conference in December 2009 South Africa's president also set a target for the reduction of CO_2 (2) emissions, as laid out in the Integrated Resource Plan (IRP 2010) (3) which sets a target reduction of CO_2 emissions by 34 percent by 2020. The utilisation of renewable energy will play a major role in achieving this goal. South Africa's commitment to achieving this goal was reiterated by Minister Edna Molewa at the December 2010 Climate Change Conference in Cancun, Mexico. At present, South Africa generates approximately 77 percent of its power consumed from coal (4) and as a country, South Africa is among the largest emitters of CO_2 globally.

Beyond the positive climate impact however, solar energy is very well placed to rapidly come on line and contribute to alleviating the power gap in South Africa.

As the proposed development is located near the Eskom Aries substation and associated infrastructure, it promotes grid support, reduces the need for long potentially less energy efficient interconnection lines and may result in a more secure energy supply for energy users in the local area. A generating facility may increase the locality's priority in Eskom's distribution network and therefore potentially reduces the risks of future load shedding in the area. The intention of AES in establishing a solar energy facility is to assist in reducing South Africa's dependence on non-renewable fossil fuel resources and contribute to climate change mitigation.

The potential for the Northern Cape to become a hub especially for the generation of electricity through solar energy is recognized by the Provincial Government. The Premier of the Northern Cape, Ms H. Jenkins stated in her address to delegates of the Northern Cape Climate Change and Green Jobs Summit in Upington on 14 April 2011,*"The Northern Cape has been identified as one of the provinces best suited and strategically poised for a number of solar and wind renewable energy projects. These projects will be responsible for creating a number of green jobs in the province and will also be contributing to the clean energy that will be put on to the electricity grid. These projects will also contribute in reducing South Africa's green house gas emissions at a national level."*

The development of solar energy in the Northern Cape provides the opportunity for the establishment of a new industry in the province. Existing levels of employment are low within the province and wider site locality. Employment is considered to be the single biggest opportunity outside of the advantages expressed above, associated with the project. Training provided

(1) National Energy Regulator of South Africa **South Africa Renewable Energy Feed-In Tariff** (2009) NERSA Publications.
(2) Carbon dioxide is generated as a by product of the combustion of fossil fuels such as coal, petroleum and natural gas and is referred to as a greenhouse gas . Increasing concentrations of greenhouse gases in the atmosphere are causing an unprecedented rise in global temperatures, with potentially harmful consequences for the environment and human health.
(3) Department of Energy Integrated Resource Plan (2010).
(4) Eskom website. Date accessed 19 October 2011. http://www.eskom.co.za/c/article/199/understanding-electricity/

to employees will provide individuals with a skill set that will be highly desirable throughout the industry sector in South Africa as the renewable energy industry and specifically, the solar energy sector rapidly develops, thereby increasing potential opportunities available to such individuals.

Furthermore, the site location in one of the highest irradiation areas in South Africa maximizes the total power produced, given the same infrastructure.

A summary of the project motivation is provided in *Box 4.1* below.

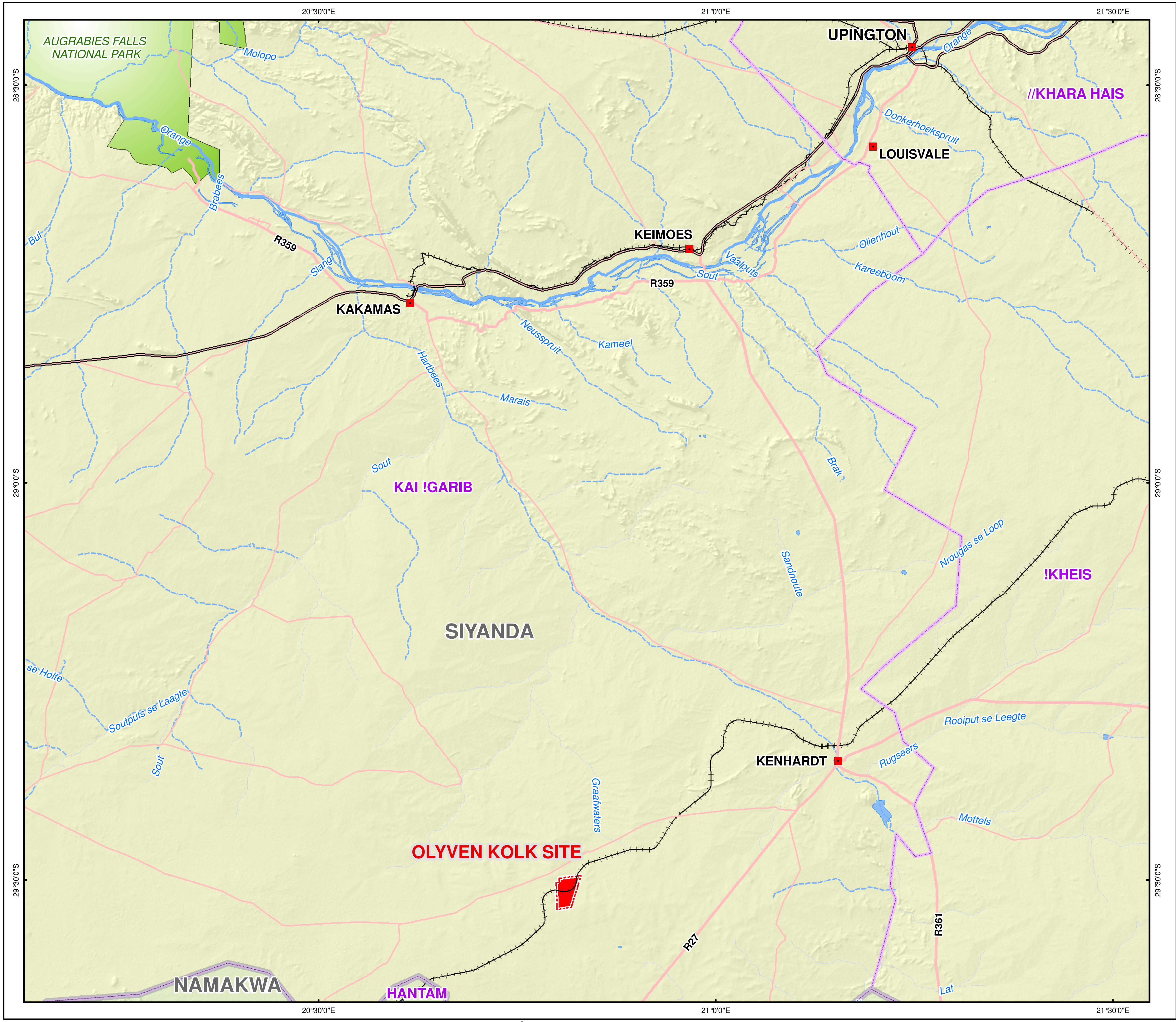
Box 4.1 Project Motivation

- Direct and indirect job creation in the Northern Cape;
- 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;
- Promote environmental, social and economically sustainable development;
- Contribute to reaching South Africa's goal of 10,000 GWh of renewable energy by 2013; and
- Contribute to meeting the NERP goal of 30 percent of all new energy from IPPs.

4.2 *PROJECT LOCATION*

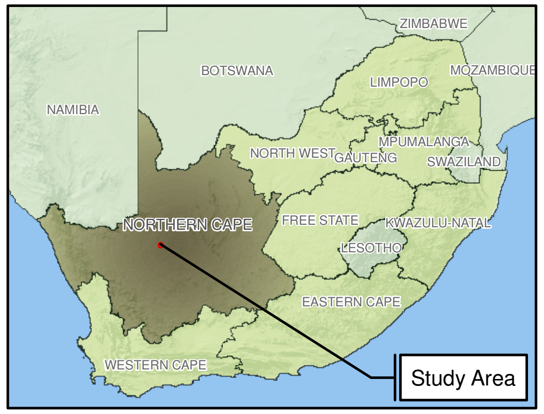
The proposed solar power plant is located on the remaining portion of 14 (a portion of portion 4) of Olyven Kolk Farm, No. 187 which is situated within the Siyanda District Municipality in the Northern Cape Province (see *Figure 4.1*). The site is located approximately 126 km south west of Upington and is accessible from the R27 (tarred road) along the Sishen -Saldanha railway line service road. The nearest town to the site is Kenhardt, which lies approximately 44 km north east of the site. The proposed site is approximately 400 m from the Eskom 400 kV Aries Substation.

The area of the proposed site is approximately 1,010 ha (10.10 km^2). The footprint of solar panels will be around 160 ha. A further 200 ha will be used for the necessary space to be kept between rows to avoid shadow effects from one row to the next one, and will remain free from any construction. The outstanding area will be used for access roads, technical buildings and other facilities or will remain undeveloped.



Legend

- MainTowns
- Perennial Rivers
- Non Perennial Rivers
- Dry Rivers
- National Roads
- Main Roads
- Secondary Roads
- Railway Line
- Conservation areas
- Perennial Dam
- District Municipalities
- Local Municipalities
- Olyven Kolk Site



SCALE: 0 5 10 15 20 25 Kilometres

N

TITLE:

Figure 4.1
Location of Project Site

CLIENT:

AES Solar Energy

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 500 000

DRAWING: Fig4.1_Location of Project Site.mxd

REV: 0

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Demarcation Board (2011)
Inset Map, Esri Data & Maps

SIZE: A3

C:\0126393_AES\Mapping\MXD\October2011\Fig4.1_Location of Project Site.mxd

4.3 *PV PLANTS AND POWER GENERATION*

Solar energy systems produce energy by converting solar irradiation into electricity or heat. PV facilities use PV panels comprising many individual PV cells which absorb solar energy. This excites electrons inside the cells and produces energy. The electricity produced by the cells is direct current (DC). The feeding of electricity into the grid requires the transformation of DC from the PV array into alternating current (AC) by an inverter.

The PV cells are commonly constructed from silicon. The cells are linked together behind a glass sheet (for protection) and they operate as a single combined PV panel.

4.4 *PROJECT COMPONENTS*

It is anticipated that as each phase of the facility is completed, it will feed electricity into the national power grid. The size of each phase will be dependent on procurement requirements as well as grid ability to connect. Once all phases are constructed, the project will feed a total of 190 MWs into the grid. The key components of the proposed solar power farm include the following, which are discussed in more detail below:

- PV solar panels/modules (arranged in arrays);
- PV module mountings;
- DC-AC current inverters and transformers; and
- Underground cabling/ overhead power lines.

An indicative site layout has been developed and this is shown in *Figure 4.6*.

4.4.1 *PV Arrays and Mountings*

The development will include PV solar panels that will occupy up to 160 ha (1.60 km^2) of the site area in total. The PV panels will be 1.2 m in length and 0.6 m in width and each have an output of 80 W. These will be connected in strings and arrays to form units with a total power of 1MW each (around 12,500 panels/MW). One hundred and ninty of these units will make up the 190 MW Olyven Kolk solar power plant.

The panels will be mounted on fixed structures, approximately 2.5 m in height from the ground. The distance or spacing between rows will be around 3 m. The panels will face north in order to capture maximum sunlight. *Figure 4.2* shows a typical array of PV panels.

Figure 4.2 PV Array

4.4.2 *Electrical Connections and Controls*

The PV panels arrays (1MW) will be connected via underground cables, to an inverter, transforming the direct current (DC) produced by the panels into alternating current (AC). The inverters will connect to a number of step-up transformers, which will elevate the voltage to transmit the current to the Eskom Aries Substation via the medium voltage (MV) interconnection line.

Based on the current constraints on site, the power plant will consist of two main sections, one north of the Sishen –Saldanha railway line and one south. These will be connected either by an overhead line or by an underground cable, using the existing culverts under the railway where possible.

A low voltage internal electric grid will be installed for powering the solar power plant facilities e.g. office and storage facilities and control room.

4.4.3 *Grid Connection*

The electricity generated will be fed into the national grid at the Eskom Aries Substation which borders the site to the west via overhead lines, 600- 700 m in length (see *Figure 4.3*). The interconnection line will have a maximum voltage of up to 400kV.

Figure 4.3 Aries Substation in background

Source: Simon Todd, 2011

4.4.4 Access Roads and Internal Paths

There are two access points to the site under consideration. One option is to access the site from the Sishen -Saldanha railway line service road and the point of access to the site would be in the west of the site, to the north of the railway (see *Figure 4.6*). The other possible option under consideration is accessing the site from the north west via the Eskom Aries Substation. Within the site area, an internal perimeter road inside the plant fence will be required to facilitate the movement of construction and maintenance vehicles around the site. This road will comprise levelled land and will not be gravelled or paved and existing farm tracks will be up-graded where necessary. Internal paths will be created to enable access within the facility.

Between PV arrays, a minimum spacing of 3 m is required between each row to avoid shadowing of the panels by adjacent rows. These spaces will not be gravelled or paved.

4.4.5 Additional Infrastructure

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

- one or more permanent meteorological stations may be erected to collect data on the solar resource at the site;
- a small site office and storage facility, including security and ablution facilities;
- security system- closed circuit video-surveillance system;
- site fencing
- car park;

- temporary construction camp (to house 60-80 people) [1] ;
- permanent accommodation (for 4-5 people); and
- a lay-down area for the temporary storage of materials during the construction activities.

The existing boreholes (subject to appropriate permissions, current abstraction limits and water quality) will be used for the water required for ablution facilities and for periodic cleaning of the solar panels during operations. It is expected that during the operational phase of the project approximately 20m^3 of water per 1MW per year will be required to clean the panels.

Should rock or soil material be required for the construction of project infrastructure this material will be sourced from an existing borrow pit on site or within close proximity to the site.

4.5 PROJECT STAGES AND ACTIVITIES

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

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

Each of these stages is outlined in the sections below.

4.5.1 Site Preparation and Construction

Prior to construction of the solar power plant, the site would be prepared. The 1,010 ha site is generally flat and low lying. Site preparation activities 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 array will be sited to remove steep slopes and undulations would normally occur 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 temporary construction camp if required; 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:

(1) It has not yet been determined whether a construction camp is necessary. An alternative being considered for the construction camp is worker transport shuttles to/from Kenhardt where workers would be accommodated.

- installation of structures to support the PV modules;
- construction of electrical and control room;
- construction of site office and storage facilities, including security and ablution facilities and associated septic tanks; and
- construction of inverter and transformer foundations and housing; and
- installation of cables.

The PV, electrical and structure equipments will be procured in South Africa where available, or from an international manufacturer when sourcing from within the country is not possible. It is expected that these components will be delivered to site via road in small trucks. Once the PV components have arrived on site, technicians will supervise the assembly of the panels and test the facility. The solar panels will be installed on mounting structures anchored to the ground through poles which will be screwed or piled into the ground.

Phased Approach to Construction

The development will be constructed in a phased approach. The exact size of each phase will be dependant on the various consents and authorisations to be obtained for the project, primarily the Power Purchase Agreement, as well as the interconnection technical constraints to be discussed and agreed with Eskom in the Interconnection Agreement. Installation of the full 190 MW could take up to 16 months to complete or more.

During the site preparation period, the workforce required for site security, manual labour, civil works, transportation of goods and other similar services will be most likely drawn from the local labour pool. During the first phase of construction, a highly-skilled team of solar energy technicians (the majority of which would likely be from overseas as a workforce with the required skills is not currently available in the South African market) will train a number of the potential employees preferably from the province, where available. Up to 300 people will be required to construct the total 190 MW plant, however any accurate employment number is dependant on how the phasing of the project is undertaken. For the purposes of the impact assessment we have assumed that the development will take place in consecutive phases rather than all at once.

4.5.2 *Operation*

Once each phase of the facility is complete and operational it is expected that it will have a lifespan of at least 20 years. Measuring the performance of the plant will be done remotely, through the use of a monitoring system. Day to day facility operations will involve both regular on site preventive and corrective maintenance tasks in order to keep the PV plant in optimal working order throughout the operational period. Intermittent cleaning of the panels will be carried out as necessary which is anticipated to be once or twice a year. Faulty components will be replaced as soon as problems are identified.

4.5.3 *Decommissioning*

Once the facility reaches the end of its lifespan the arrays may be refurbished or replaced to continue operating as a power generating facility or the facility could be closed and decommissioned. If decommissioned, all components would be removed and the site rehabilitated. The solar panels would be recycled as appropriate. The preferred panel manufacturer, First Solar, undertakes a module or panel collection and recycling programme in which the glass and encapsulated semiconductor material is processed into new modules or other products.

4.6 *CONSIDERATION OF ALTERNATIVES*

In terms of the EIA Regulations, Section 28(1)(c) and NEMA, Section 24(4), feasible and reasonable alternatives are required to be considered in the EIA process. *'"Alternatives", in relation to a proposed activity, means different ways of meeting the general purposes and requirements of the activity, which may include alternatives to –*

(a) the property on which, or location where, it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity; and
(f) the option of not implementing the activity (No Go)'.

This section outlines the alternatives considered in for the Olyven Kolk solar power plant.

4.6.1 *Site Location Alternative*

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 e.g. soil analysis. The Olyven Kolk site was identified based on a number of criteria including:

- **Solar resource:** Analysis of available data from existing weather stations and satellite records suggests that the site has sufficient solar resource to make a solar energy facility viable. The site is located in one of the most irradiated areas of the country.

- **Site extent:** Sufficient land was required to enable sufficient power supply and to allow for a minimum number of PV panels to make the project feasible.

- **Grid access:** Access to a substation with potential for more feed-in capacity and adequate transmission lines were key considerations for site location i.e. proximity to Eskom's Aries Substation.

- **Land suitability:** Sites that facilitate easy construction conditions (relatively flat land with deep soft soil and few rock outcrops or waterbodies) were favoured during site selection.

- **Landowner consent:** The selection of sites where the land owners are supportive of the development of renewable energy is essential for ensuring the success of the project.

- **Environmental and socio-economic impacts:** Consideration was given to identifying a site with low agricultural potential, low levels of biodiversity value and potential visual impacts during site selection.

- **Workforce:** The availability of a potential work force in the surrounding area was taken into consideration.

4.6.2 Site Layout Alternatives

The PV plant layout and project component design have undergone a number of iterations primarily based on environmental and social considerations which were identified during the EIA process. The final design of the facility including the final layout, size, type and number of PV arrays has been determined using specialists recommendations including:

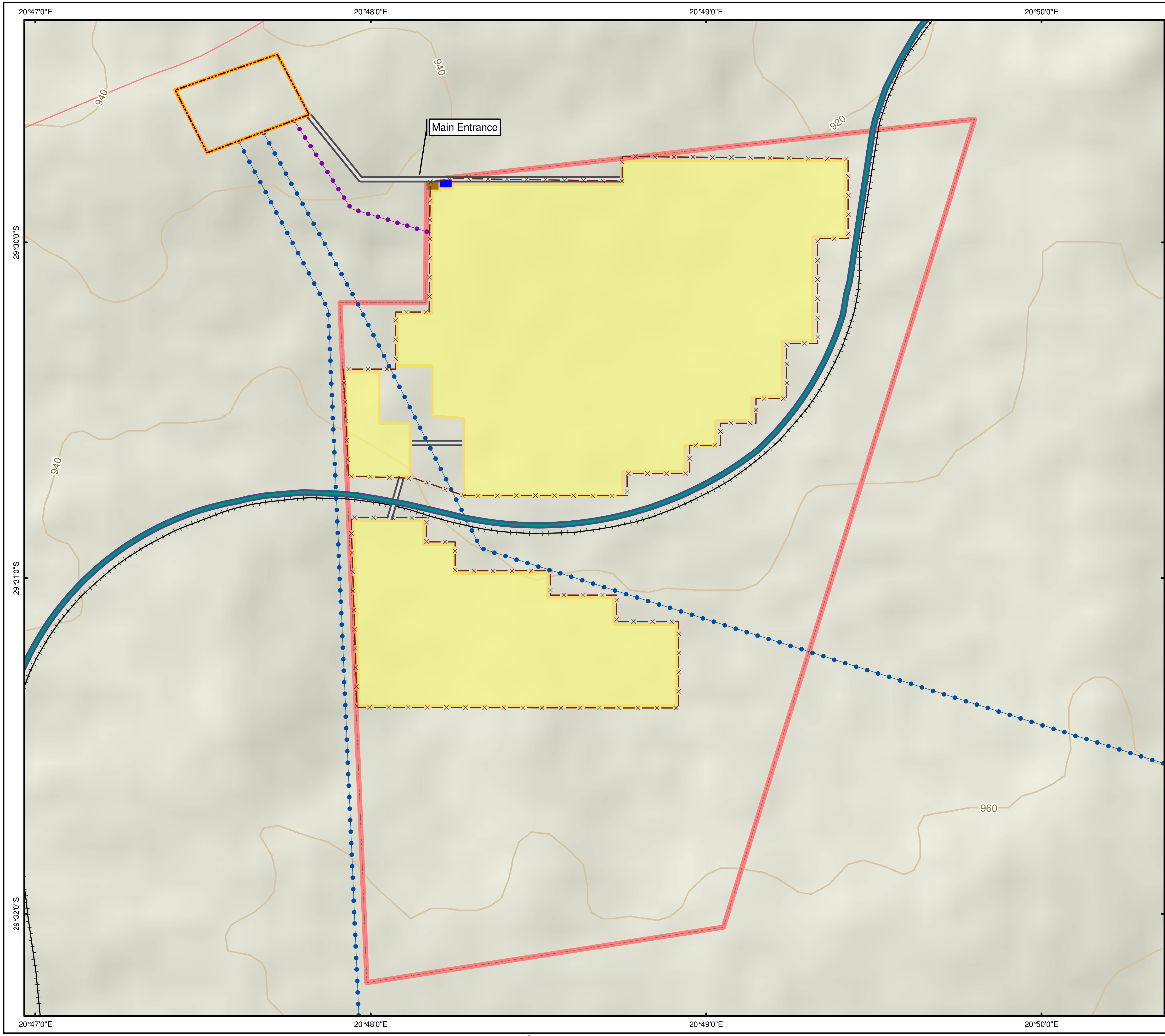
- Drainage analysis and avoidance of existing drainage lines; and
- Avoidance of ecologically sensitive areas of the site, important for flora and birds.

An indicative site layout was initially developed (see ***Error! Reference source not found.***), Site Layout Alternative 1. After field surveys, each specialist prepared site sensitivity maps identifying habitats or areas of various sensitivities for each receptor or resource. These were overlaid with Site Layout Alternative 1. After a mitigation workshop held in July 2011 by the EIA team, particular areas posing additional environmental and social constraints or specific unsuitable locations for the arrays were identified by the specialists and communicated to the technical team. *Figure 4.5* illustrates the areas of sensitivity on site including areas considered unsuitable by the environmental specialists based on potential impacts to drainage lines, ecology and avifauna. The technical team then generated a revised 'buildable areas map' based on these environmental and social constraints as well as further technical constraints and from there developed a revised layout of the arrays, Site Layout Alternative 2 (see *Figure 4.6*). This process has encompassed the consideration of layout alternatives in the EIA process and Site Layout Alternative 2 is the preferred layout and is considered to be the final layout.

Based on the constraints identified, the size of the plant has decreased from an output capacity of up to 200 MW to 190 MW, and significant changes have been made to the site layout. The aim of considering layout alternatives was to balance the technical and financial objectives of maximising the output of the proposed facility with the other critical environmental and social constraints including physical environment, visual, botanical, fauna, heritage, archaeological, paleontological and avifauna.

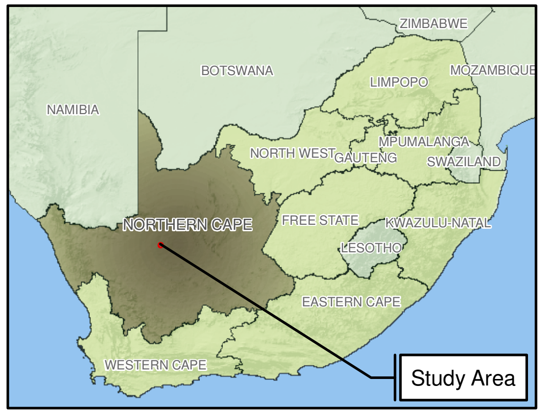
The evolution of the changes to the project specifications from the 200 MW plant to the 190 MW is illustrated in *Figure 4.4* to *Figure 4.6*, below.

It is reiterated that Site Layout Alternative 2 is the preferred and final layout design applied for in this EIR. However, in the event of amendments to the layout, any changes will be submitted to the DEA prior to construction.



Legend

- Secondary Roads
- Railway Line
- Proposed Access Roads
- Railway Service Road
- Fence
- Existing 400kV Transmission Lines
- Proposed Grid Interconnection
- Accommodation Block
- Control Building
- Eskom Aries Sub-station
- Solar Panel Arrays
- Olyven Kolk Site



SCALE:

0 250 500 750 1,000

Metres

N

TITLE:

Figure 4.4
Site Layout Alternative1 -
Project Infrastructure - 200 MW Plant

CLIENT:

AES Solar Energy

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

DRAWING: Fig4.4_Site Layout Alternative 1-Infra_200MW_Rev2.mxd

REV: 2

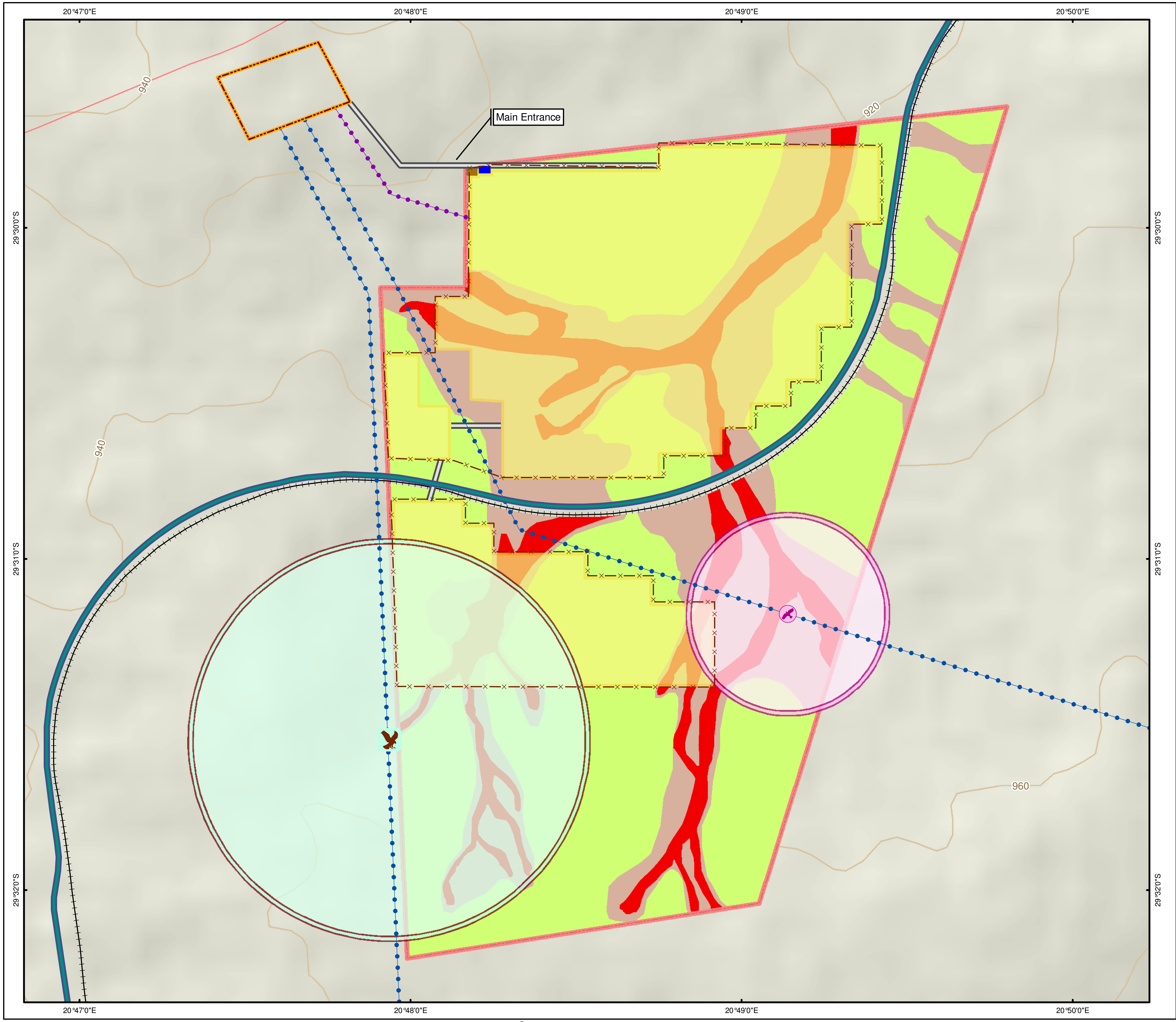
ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

ERM

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI)
Inset Map, Esri Data & Maps

SIZE: A3

C:\0126393_AES\Mapping\MXD\October2011\Fig4.4_Site Layout Alternative 1-Infra_200MW_Rev2.mxd



Legend

Lanner Falcon Bird's Nest
Martial Eagle Bird's Nest

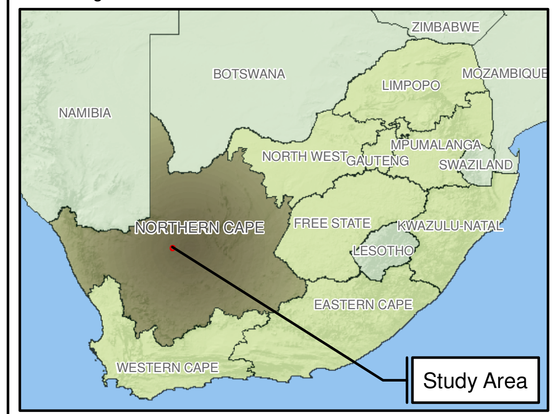
Bird Exclusion Zones
500m Buffer
1000m Buffer

Secondary Roads
Railway Line

Proposed Access Roads
Railway Service Road
Fence
Proposed Grid Interconnection
Existing 400kV Transmission Lines

Accommodation Block
Control Building
Eskom Aries Sub-station
Solar Panel Arrays
Olyven Kolk Site

Ecological Sensitivity
Medium
Medium - High
High



SCALE:
0 250 500 750 1,000
Metres
N

TITLE:

Figure 4.4
Site Layout Alternative1 - Project Infrastructure - 200 MW Plant

CLIENT:

AES Solar Energy

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

DRAWING:	REV:
Fig4.5_Site Layout Alternative 1-Constr_ 200MW_Rev2.mxd	2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

ERM

Projection: Geographic, Datum: WGS84 Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI) Inset Map, Esri Data & Maps	SIZE: A3

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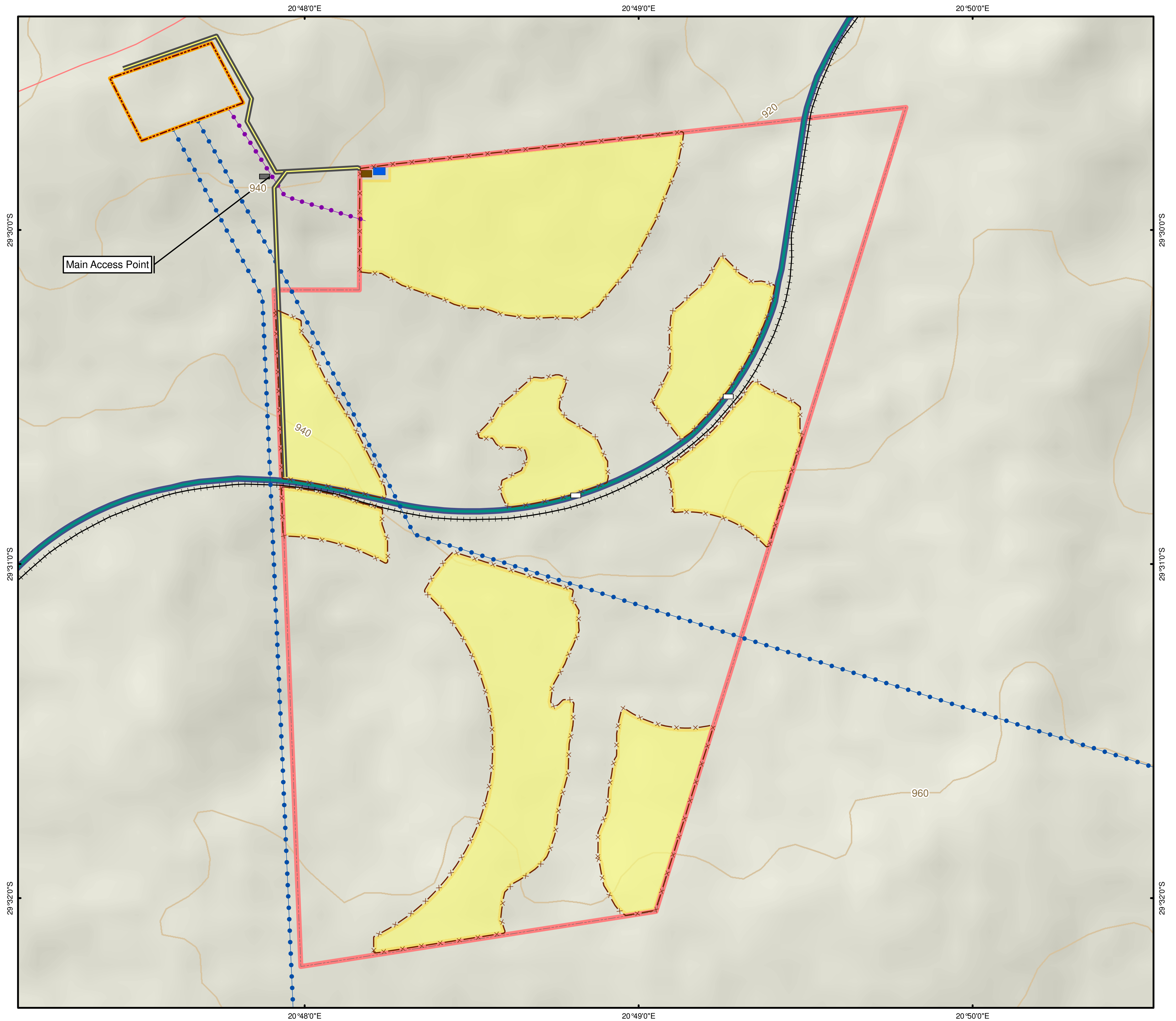
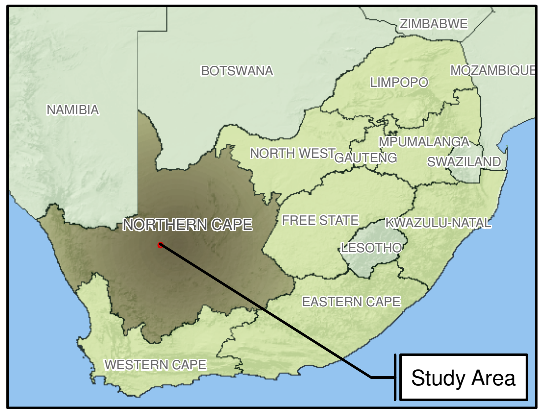


Legend

- Main Access Point
- Possible Site Access Points
- Secondary Roads
- Railway Line
- Proposed Access Roads
- Railway Service Road
- Fence
- Proposed Grid Interconnection
- Existing 400kV Transmission Lines
- Accommodation Block
- Control Building
- Eskom Aries Sub-station
- Solar Panel Arrays
- Olyven Kolk Site



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0 250 500 750 1,000

Metres

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TITLE:

Figure 4.6
Site Layout Alternative 2, v2
Project Infrastructure - 190 MW Plant

CLIENT:

AES Solar Energy

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

DRAWING:
Fig4.6_Site Layout Alternative 2v2-Infra_190MW_Rev2.mxd

REV:
2

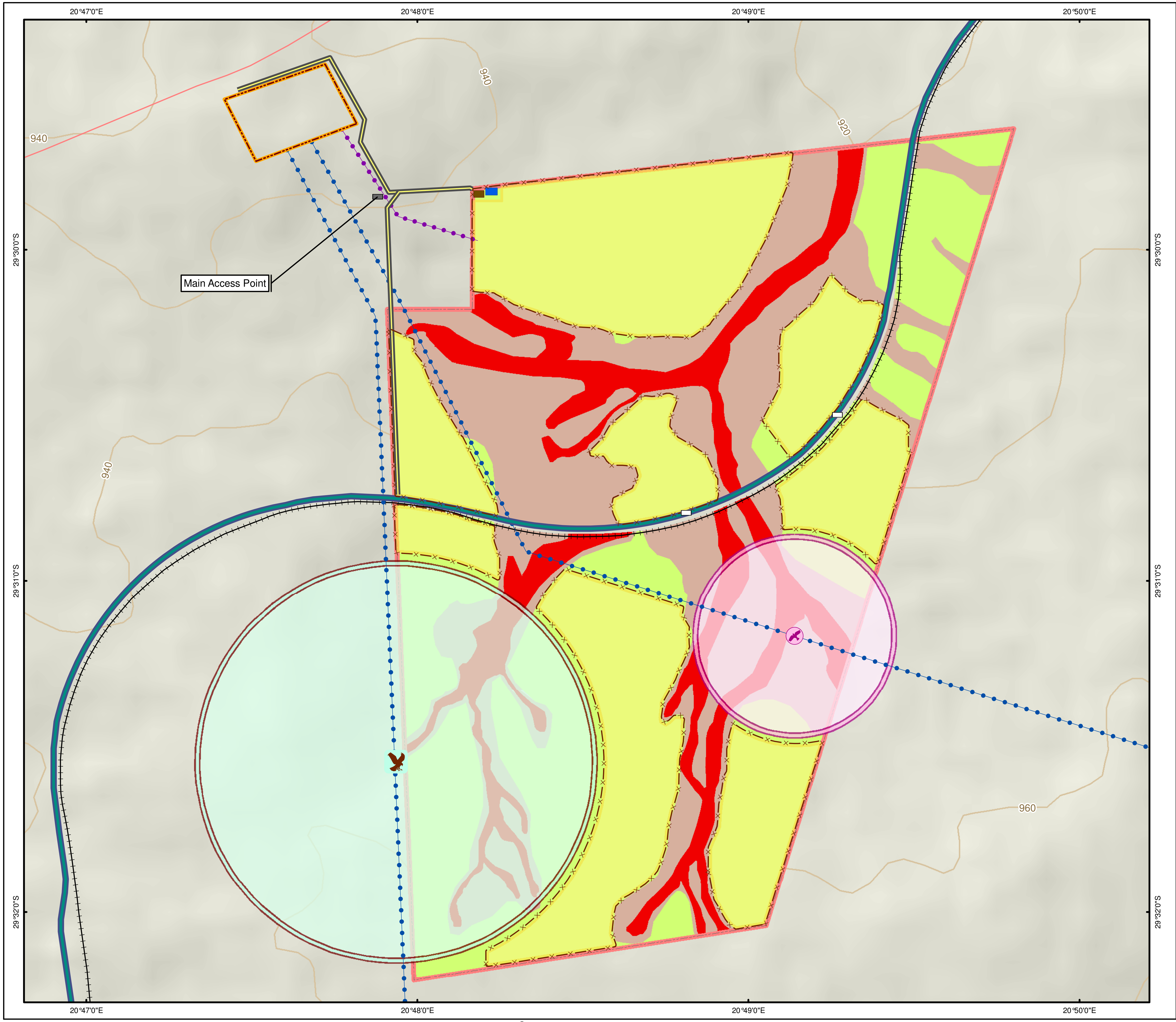
ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

ERM

Projection: Geographic, Datum: WGS84
Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI)
Inset Map, Esri Data & Maps

SIZE:
A3

C:\0126393_AES\Mapping\MXD\October2011\Fig4.6_Site Layout Alternative 2v2-Infra_190MW_Rev2.mxd



Legend

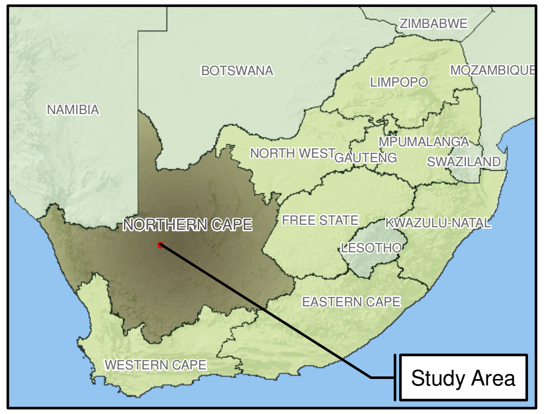
- Lanner Falcon Bird's Nest
- Martial Eagle Bird's Nest

Bird Exclusion Zones

- 500m Buffer
- 1000m Buffer
- Secondary Roads
- Railway Line
- Proposed Access Roads
- Railway Service Road
- Fence
- Proposed Grid Interconnection
- Existing 400kV Transmission Lines
- Accommodation Block
- Control Building
- Eskom Aries Sub-station
- Solar Panel Arrays
- Olyven Kolk Site

Ecological Sensitivity

- Medium
- Medium - High
- High



SCALE:

0 250 500 750 1,000
Metres

N

TITLE:

Figure 4.7
Site Layout Alternative 2 , V2
Project Constraints - 190 MW Plant

CLIENT:

AES Solar Energy

DATE: Oct 2011	CHECKED: IE	PROJECT: 0126393
DRAWN: LDT	APPROVED: SHC	SCALE: 1 : 20 000

DRAWING:	REV:
Fig4.7_Site Layout Alternative 2v2-Constr_1 90MW_Rev2.mxd	2

ERM
175 Lunnon Road,
Hillcrest. 0083
Pretoria, South Africa
Tel: +27 12 362 0008
Fax: +27 12 362-8368

ERM

Projection: Geographic, Datum: WGS84 Source: EnPat (2001) Chief Directorate National Geo-Spatial Information (NGI) Inset Map, Esri Data & Maps	SIZE: A3

C:\0126393_AES\Mapping\MXD\October2011\Fig4.7_Site Layout Alternative 2v2-Constr_190MW_rev2.mxd

4.6.3 *Grid Connection Alternatives*

The options of connecting the solar power plant to Eskom's national grid are subject to on-going discussions between AES and Eskom. The most efficient and practical option which is considered viable for the site is connection into the existing Eskom Aries substation located adjacent to the Olyven Kolk site via a relatively short overhead transmission line. Other alternative grid connection scenarios (direct connection to a 400 kV line next to the site, or direct connection to a 132 kV line far from the site) are not considered viable as they would either require building a 400 kV step-up transforming station on site or constructing a long 132 kV overhead transmission line. Construction of a 400kV transforming station would increase the footprint and cost of the project considerably. The 132 kV transmission line would also increase the cost of the project and result in increased impacts on birds, visual and vegetation when compared with the preferred option of a shorter connection to the adjacent substation.

4.6.4 *Technological Alternatives*

Solar energy is considered to be the most suitable renewable energy technology for this site, based on the site location, ambient conditions and energy resource availability. There are a number of different solar energy technologies that include:

- 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 considered to be the most environmentally suitable technology for the preferred site as large volumes of water are not needed for power generation purposes compared to the CSP option. CSP requires large volumes of water for cooling purposes. PV is also preferred when compared to CSP technology because of the lower visual profile.

The remaining types of technologies were evaluated and the preferred configuration was selected based primarily on the operating environment. The suitability of different types of PV solar panels was assessed including thin film and polycrystalline panels. Based on performance in high temperature environments similar to those typical of the Northern Cape, thin film panels were selected as the preferred option. The Olyven Kolk solar power plant will install fixed structures rather than tracking systems as they require less repair work and maintenance during the operational life of the project. This decision is based on the benefits demonstrated by fixed structures with a longer track record in other markets, showing their high reliance during long periods operation over time. High capacity inverters (typically 1MW) are considered more robust than smaller inverters and thus were selected as part of the preferred configuration.

4.6.5 No-go Alternatives

The no-go alternative implies that the proposed project would not be executed. Assessment of the no-go alternative will require an evaluation of the relative trade-offs between the economic and social development benefits and carbon offsets associated with the project against the environmental and social costs of the project.

Assuming that the solar power plant would not be developed at the proposed site, the site would remain in its current state. There would be no negative environmental and social impacts associated with the development of a solar power facility. The agricultural potential (although limited for this site) would not be lost due to the establishment of the facility. Similarly, there would be no positive impacts if the power plant is not executed, there will be no increase in electricity generation, no CO_2 offsets associated with the proposed development, no economic benefit to the landowners associated with the potential income generated through the operation of the facility and there would be no contribution to meeting South Africa's targets for renewable energy generation.

The direct benefits associated with both the construction and operational phases of the solar power plant such as increased employment opportunities and associated economic benefits would also not occur should the development not go ahead. It should be noted, that requests for employment opportunities have been found to be the overwhelming theme from respondents to consultation activities to date.