Humansrus Solar 4 (Pty) Ltd. Solar farm development.

March 17

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Draft Environmental Impact Layout Report pertaining to the Humansrus farm 147; Humansrus Solar 4 (Pty) Ltd. project near Copperton. Compiled by Solek Renewable Energy Engineers.

Draft Environmental Impact Layout Report

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Abbreviations and Acronyms

- AC Alternate Current
- CPV Concentrated Photovoltaic
- DC Direct Current
- DEA National Department of Environmental Affairs
- EA Environmental Authorization
- EIA Environmental Impact Assessment
- IPP Independent Power Producer
- MV Medium Voltage
- MW Mega Watt (Power)
- MW_p Mega Watt Peak (Maximum peak power production)
- PV Photovoltaic
- SANRAL South African National Roads Agency Limited
- REIPPPP Renewable Energy Independent Power Producer Procurement Programme

1 Introduction

Humansrus Solar 4 (Pty) Ltd. Solar Energy Facility as an Independent Power Producer (IPP) is proposing the establishment of a commercial solar energy facility on the farm Humansrus 147, 10 kilometres south-east of Copperton in the Northern Cape and 50 kilometres south-west of Prieska. The facility is to be known as Humansrus Solar 4 (Pty) Ltd, of size 75 MW_{ACp}. The actual installed MW_{peak} for the facility can however be expected to be more than 75MW, typically 86MW_{peak} in order to produce the 75MWpeak contractual value for a longer duration within the project lifetime (PV degradation).

The proposed facility has a contracted peak capacity of be 75 MW_{ACp}. with a final estimated facility layout of approximately 220ha. The preliminary study area of 448ha has been assessed by the environmental specialists as part of Environmental impact assessments for two previous solar PV projects namely Humansrus Solar PV Energy Facilities 1 and 2. The footprint in the EIA preferred site is larger than what is physically required for the proposed development, so as to ensure ample development space is available after potential environmentally sensitive areas are excluded, as a function of specialist studies and recommendations. The estimated portion of land each component of the facility will typically occupy is summarised in the table below.

Table 1: Component size and percentage for the plant

Component	Estimated extent of 75 MW plant	Percentage of selected area (+ 220 ha)	Percentage of whole farm (±4769.4155 ha)
PV modules	200 ha (1.8 km^2)	90%	3.7%
Internal roads	18 ha (0.18 km^2)	9%	0.37%
Auxiliary buildings	2 ha (0.02 km^2)	1%	less than 0.1%

The proposed infrastructure includes CPV modules, or a series of solar PV arrays, inverters, internal electrical reticulation, and an internal road network. It will also be necessary to construct an onsite substation which would typically include a transformer to allow the generated power to be connected to ESKOM's electricity grid. Auxiliary buildings, including ablution, workshops, storage areas and fencing are planned to be erected. A distribution line will also be required to distribute the generated electricity from the site to the ESKOM substation and grid.

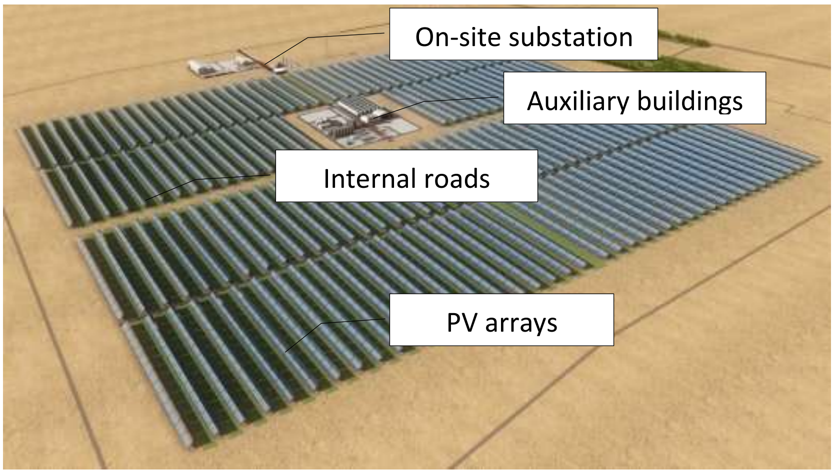


Figure 1: A typical layout of a solar PV plant

Determining the optimal layout is a costly process which would normally take place once an IPP tender has been awarded to the bidder. For the purpose of the environmental impact assessment, the typical layout, alternatives and a preliminary high level layout have been developed. This layout report aims to portray these layout options and the developed preferred high-level site layout.

The preferred preliminary layout design as presented within this impact report takes into account the site constraints and the EIA specialist recommendations. The final plant footprint will remain the same in terms of footprint location and size, but the exact location of the different components may change within the planned site boundary.

2 Layout Progression

As part of the Scoping process the preliminary study area has been considered and possible layouts have been mapped in order to get to an optimal layout in the light of both the environmental and project aspects.

The following section of the report will provide an overview of the layout progression and the considerations towards the different scenarios in layouts.

2.1 Preliminary Study Site

As part of the draft impact layout report different locations within an identified study site for the proposed facility were investigated. A preliminary study site of 448 ha area was identified as part of this scoping phase of this Humansrus Solar 4 (Pty) Ltd. Solar Energy Facility project. The preliminary study site has been selected due to a large portion of the area which was already assessed as part of two previous solar PV project developments (Humansrus Solar PV Energy Facility 1 and Humansrus Solar PV Energy Facility 2). It should be noted that both these previous projects were granted "Environmental Authorization" (EA) from the "Department of Environmental Affairs" (DEA).

The identified 448 ha study area is referred to as the "Preliminary Study Site". The appointed specialists undertook their baseline studies on the total preliminary study area in order to apply a risk averse layout development approach.

Figure 2 depicts the preliminary study area of the Humansrus Solar 4 (Pty) Ltd. project in white. More detailed discussions on the specific layouts are discussed in the following sub-categories under the layout progression.

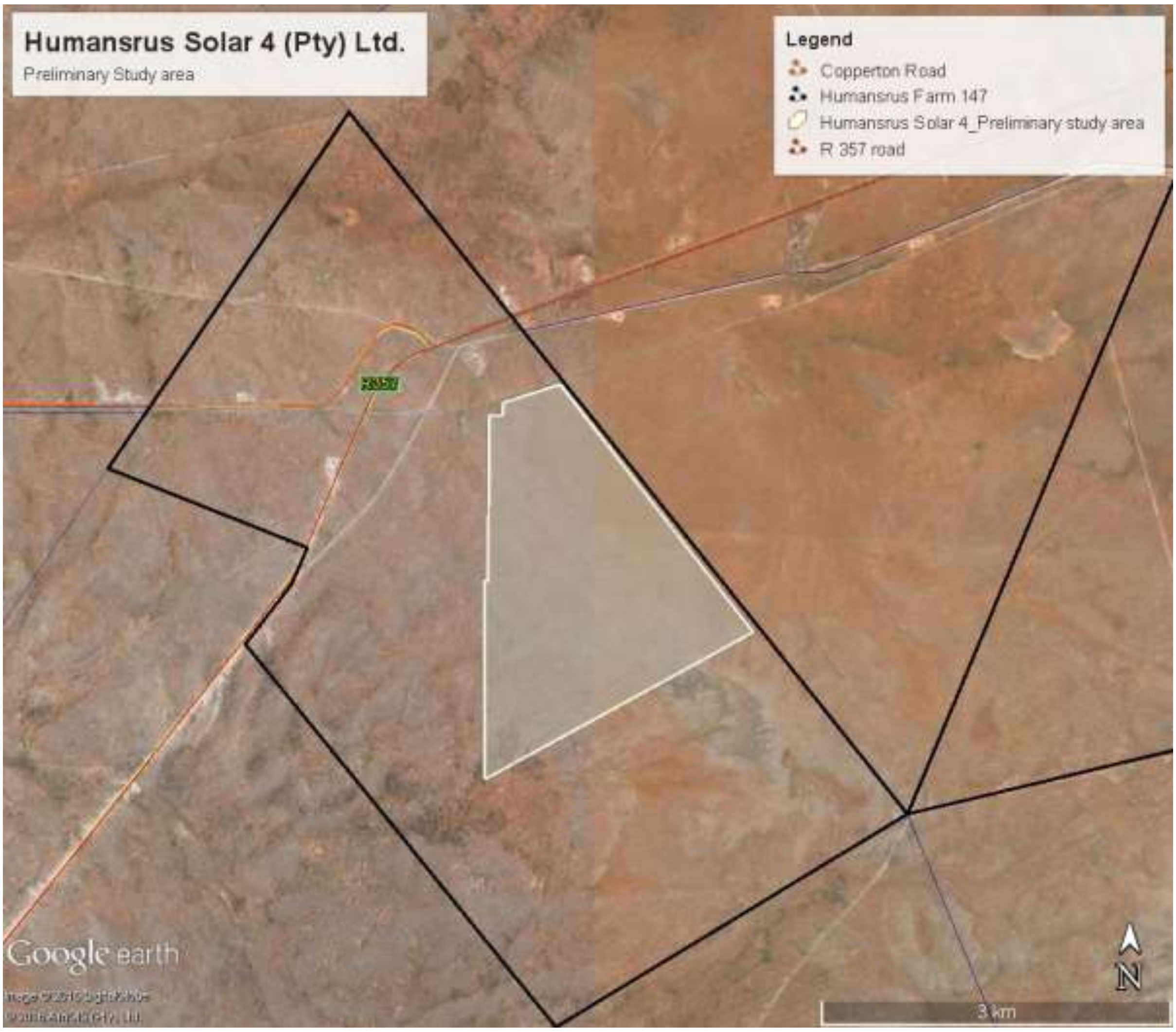


Figure 2: Humansrus Solar 4 Scoping Preliminary Study Site

The 448 ha area was identified because of its level surface, road access alternatives, and its close proximity to the ESKOM Kronos Sub-station. The low concentration of nutrients in the soil also means that vegetation is not very dense or high, eliminating the chances of casting shadows on the solar arrays.

In addition the land is considered to have a low agriculture potential, with limited carrying capacity, as stipulated within the Agriculture Potential specialist report. The usage of this low agricultural potential land for renewable energy generation purposes is believed to have little effect on food production and the corresponding food security. The low concentration of nutrients in the soil as well as low annual rainfall also means that vegetation is not very dense or high, eliminating the chances of casting shadows on the solar arrays or having an effect on food security.

Please refer to the DEIR engineering report (Humansrus Solar 4 (Pty) Ltd., March 2015) for more details regarding the expected infrastructure in terms of the corresponding layout. The infrastructure includes components such as frames, solar modules, roads, workshop and admin office area, laydown area, ablution, perimeter fencing and an onsite substation.

2.2 Possible Sensitive Areas

Possible sensitive areas were identified within the preliminary area given the fact that two previous projects underwent the required environmental process which included the identification of sensitive areas. Additionally a large portion of the preliminary study area of Humansrus Solar 4 (Pty) Ltd. overlaps with the preliminary study area of the previous two projects.

Ecological study and sensitive areas are included and mapped as part of this Environmental Impact assessment phase. These are included in order to evaluate the layout alternatives considered within the scoping phase and adapt the layouts accordingly in order to minimize the environmental impact.

The Preferred and alternative site layouts as part of the impact phase have been selected and excludes high sensitive areas. Note that the identified sensitive areas within the impact phase are stipulated under Section 2.3.2.1 in this report.

2.3 Layout Alternatives

The layout progression from inception to the impact phase is summarised within this section. This section further portrays and discusses factors influencing the development of these alternatives.

2.3.1 Initial Layouts (Scoping Phase)

As part of the scoping phase numerous layouts and technologies were taken into considerations which were depicted as two alternative layouts in the final scoping phase. Figure 3 and Figure 4 depicts these two proposed alternative layouts.

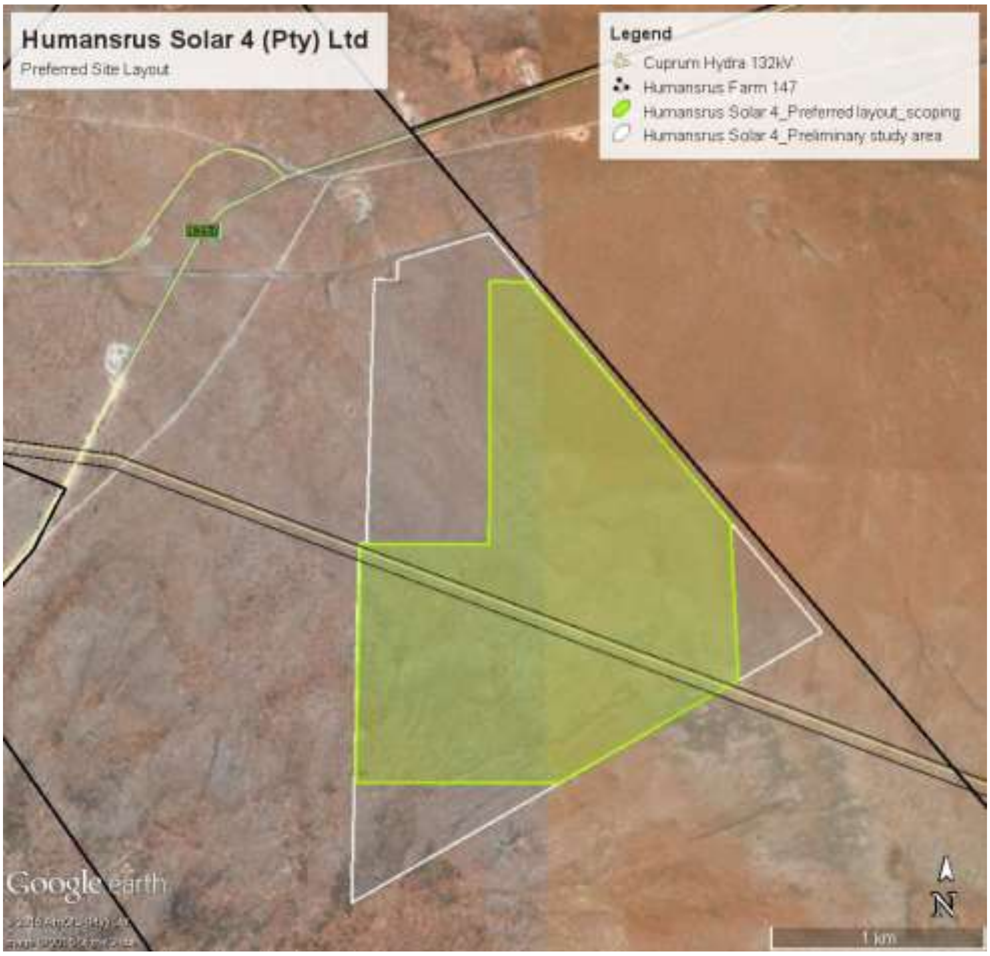


Figure 3: Scoping phase Proposed Preferred Site layout

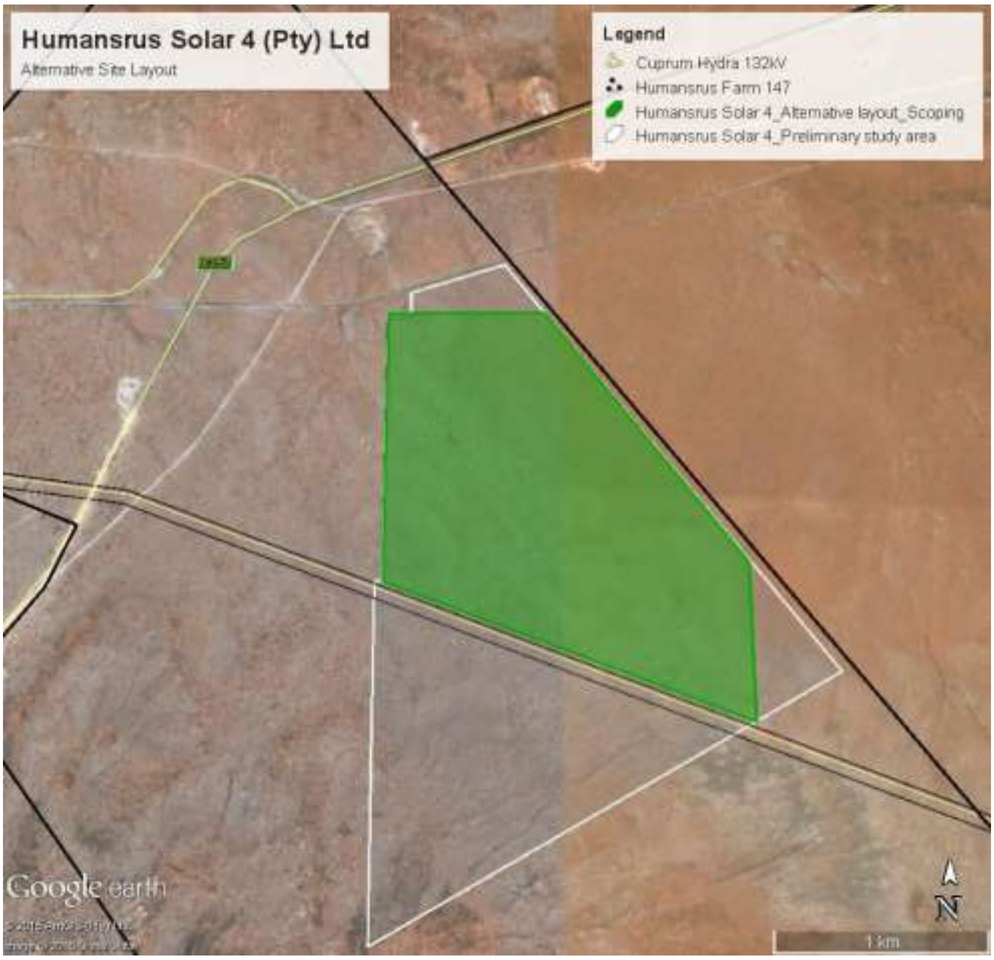


Figure 4 Scoping phase Proposed Alternative Site layout

The major points which lead to these two layouts within the scoping phase were:

- Development footprint area of approximately 270 ha , to ensure the project would be economically viable;
- Minimal disturbance to water washes and highly sensitive areas.
- Road access to the site with regard to distance and minimal disturbance to sensitive areas
- Grid connection taking into consideration distance and minimal disturbance to sensitive areas.
- Integration of site alternatives with the first two solar developments and its corresponding project site as approved under its “Environmental Authorisation”. Additional cognisance was given towards the project footprint of the third proposed project on the property and its alternatives.

The factor having the single biggest influence on the disturbance of ephemeral washes is the mounting technology. The preferred technology should allow arrays to be constructed over the ephemeral wash lines and sensitivity areas while having a minimal effect on the vegetation, mitigating the chances of erosion.

2.3.2 Proposed site alternatives (Impact phase)

The proposed site alternatives within the impact phase have utilised the two identified scoping layouts as departure point within the impact phase. In order to avoid identified sensitive areas the following layout alternatives have been selected. Based on specialist studies especially the ecological study, the sensitive areas have been evaluated and confirmed.

As mentioned above, the solar arrays will be placed in such a way that would have the least influence on the ephemeral washes while avoiding the ecological sensitive areas where practically possible. Although the annual rainfall within this region is extremely low, the hydrological features (drainage lines / ephemeral washes) were carefully considered and the most viable alternative selected.

Because of the relatively dry climate and low rainfall, natural vegetation tends to be denser within the drainage washes, thus the layout which has the smallest impact on the seasonal washes would generally also have the smallest impact on the vegetation.

Within the impact assessment phase various specialist reports were obtained and incorporated in order to develop mitigated layouts for the impact assessment phase. These mitigated layouts utilises the indicated sensitive areas and specialist feedback to reduce the environmental impact which the project could have. Two mitigated layouts were developed within the impact assessment phase namely the preferred layout and one alternative layout. For the remainder of this report these layouts will be referred to as the preferred and alternative layouts.

It should be noted that for the "final impact report" only one preferred site layout will be selected and the alternative layouts will be eliminated.

2.3.2.1 Layout influencers – specialist studies

Four specialist studies were conducted namely an ecology study, an avifaunal study, an aquatic study and a visual study. Neither of these specialist studies found any sensitive areas on the Humansrus Solar 4 preliminary study site nor on the specific preferred or alternative sites.

A description of these summary points is however given in the following sections.

2.3.2.1.1 Avifaunal specialist studies

The feedback received from the avifaunal specialist (Simon Todd Consulting, Simon Todd) was that there were minor sensitive areas to take cognisance of in terms of the design and overlaps with the ecology findings. According to the avifaunal report the borrow pits located on the property have a higher sensitivity than the rest of the development footprint. A 100 meter buffer area around both the borrow pits on the farm were proposed in the ecology report. This proposed buffer area does not affect the preferred site, but does reduce the useable area of the alternative site. The following diagram (refer to Addendum A for an enlarged version hereof) depicts the location of these borrow pits in relation to the alternative and preferred sites.

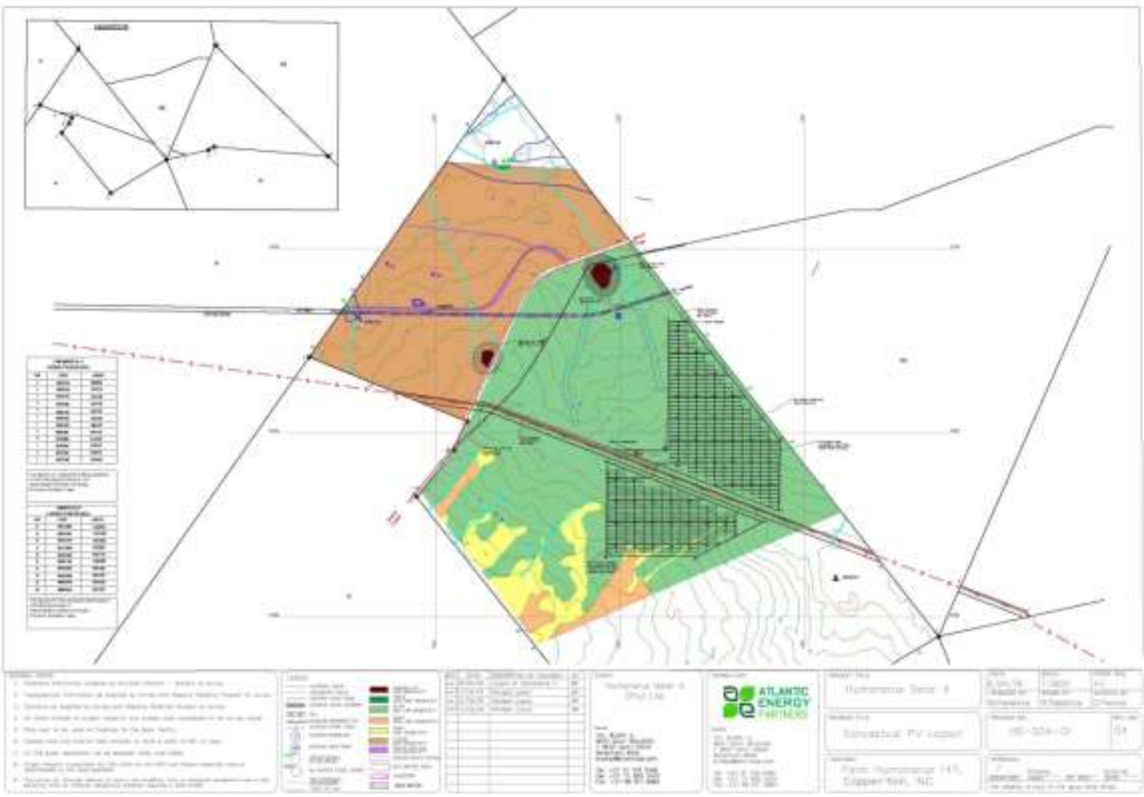


Figure 5: Detailed facility layout and exclusion areas

The avifaunal study found that the "*development is likely to have little, if any significant long-term impact on the avifauna of the wider area, especially after mitigation, and as such, is considered to have acceptable levels of impact overall.*" (Avifaunal report, December 2015).

The mitigation measures to be included influenced the preferred layout by suggesting "*slight alterations to the alternative site layout, so that the development is an acceptable distance away from the borrow pit to avoid impacting sensitive species associated with this microhabitat*" (Avifaunal report, March 2016).

The mentioned sensitivity areas were excluded from the design (although most of these have an exact correlation with the ecology sensitivity map) and as was excluded from the footprint in this capacity (100 meter buffer area from the identified borrow pits).

2.3.2.1.2 Ecology specialist studies

The feedback received from the ecology specialist (Simon Todd Consulting, Simon Todd) was that there were minor sensitive areas to take cognisance of in terms of the design. Some mitigation measures were imposed, but no buffer areas were recommended and as such had a limited influence on the actual layout.

2.3.2.1.3 Aquatic specialist studies

Neither ephemeral washes nor sensitive areas have been identified in the preliminary study site by the aquatic specialist. No sensitive areas were further identified within the preferred layout or the alternative layout.

It can be concluded therefore that the necessity of a water use licence could be eliminated as no washes are disturbed or altered due to the development. No further mitigation measures are required from an avifaunal perspective.

2.3.2.1.4 Visual specialist studies

The feedback received from the appointed visual specialist consultant, "Visual Resource Management Africa" (VRMA, Stephen Stead), includes a 75m no-go buffer area from the R357 and Copperton road. This buffer area does not reach the preliminary study area nor either of the project sites. No further mitigation measures are required from an avifaunal perspective.

2.3.2.2 Impact assessment layouts

The impact assessment layouts utilises the scoping layouts and incorporates the specialist findings, recommendations and constraints (as mentioned in Section 2.3.2.1) as completed for the impact study phase. Due to the fact that no sensitive areas affecting either of the layouts have been identified in the impact phase, the layouts largely remained the same as in the final scoping phase.

2.3.2.2.1 Preferred Layout

The preferred site Layout is illustrated in Figure 6. The facility footprint has a final expected facility layout of approximately 220ha. The depicted preferred site layout has a development footprint of approximately 270ha.

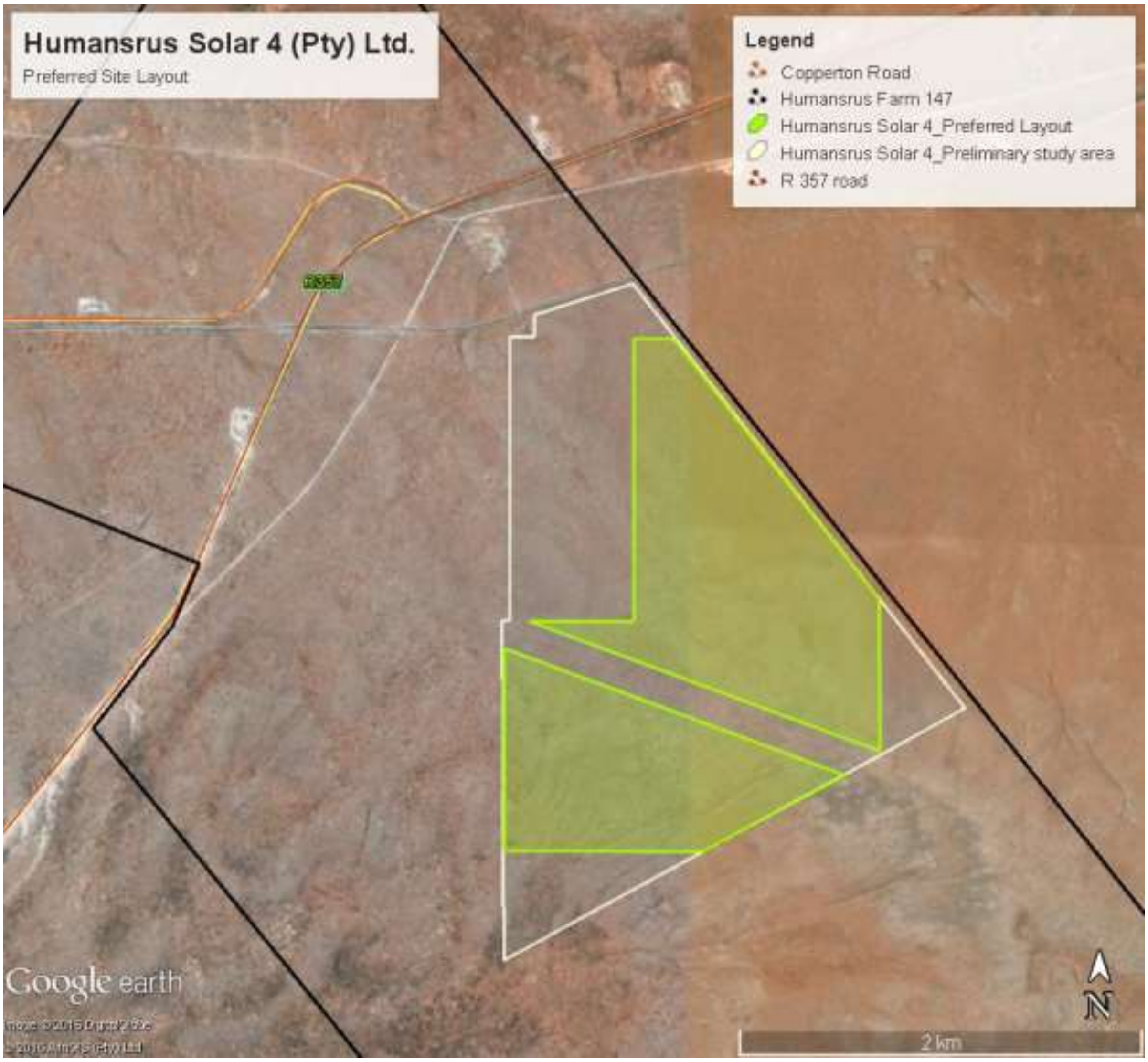


Figure 6: Preferred site layout (impact phase)

2.3.2.2.2 Alternative site Layouts

The alternative site Layout is illustrated in Figure 7. The facility layout is approximately 200-220ha.

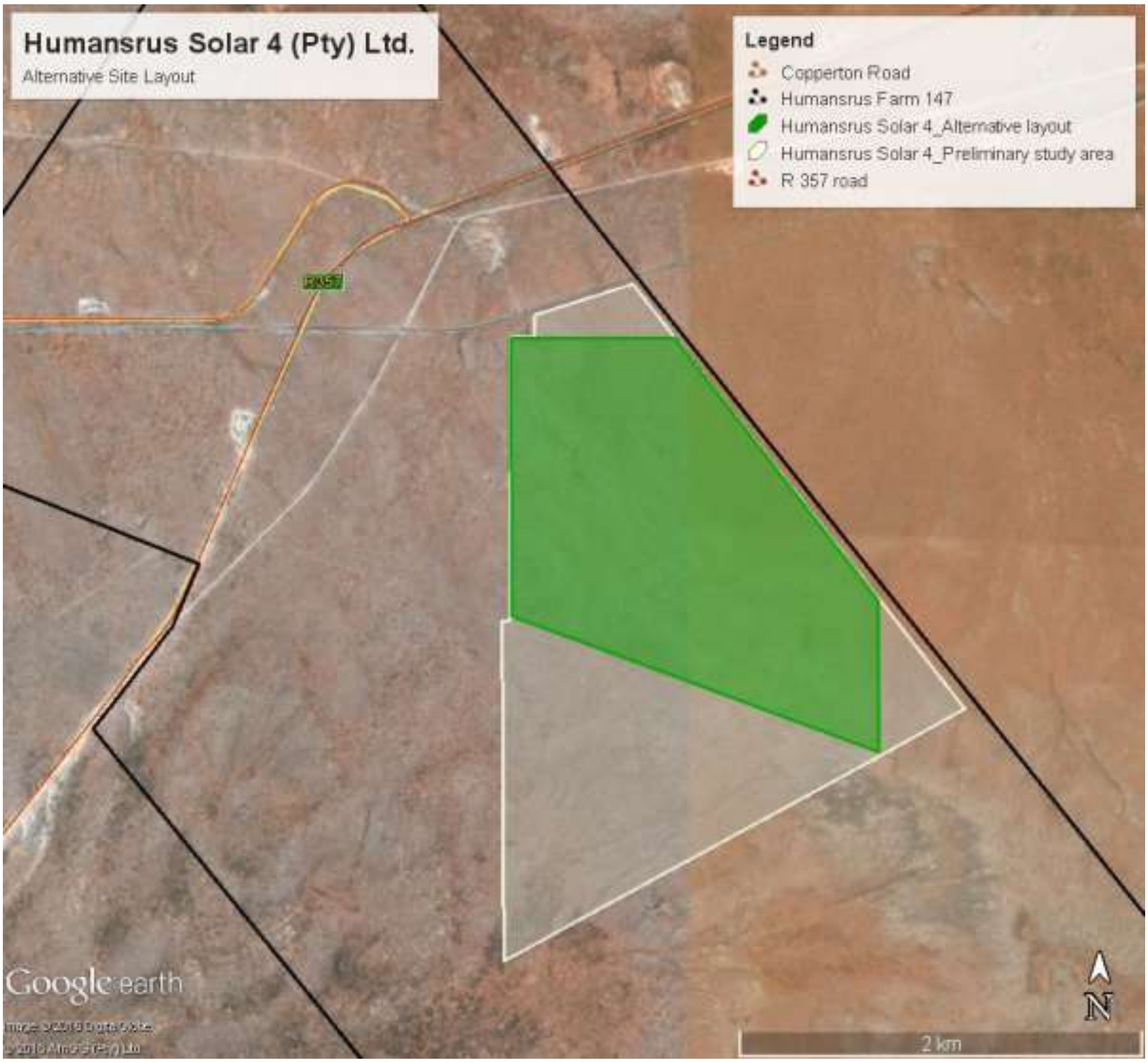


Figure 7: Alternative site layout (impact phase)

2.4 Facility layout and components

Figure 8 illustrates the preferred layout and depicts the preliminary component layout according to the preferred layout. Please refer to Annexure A for a detailed full-page layout of these components as well as a second figure depicting the detailed exclusion areas.

Please refer to the Engineering report (Humansrus Solar 4 DEIR Engineering Report March 2016) for a detailed list of components and corresponding explanations thereof.

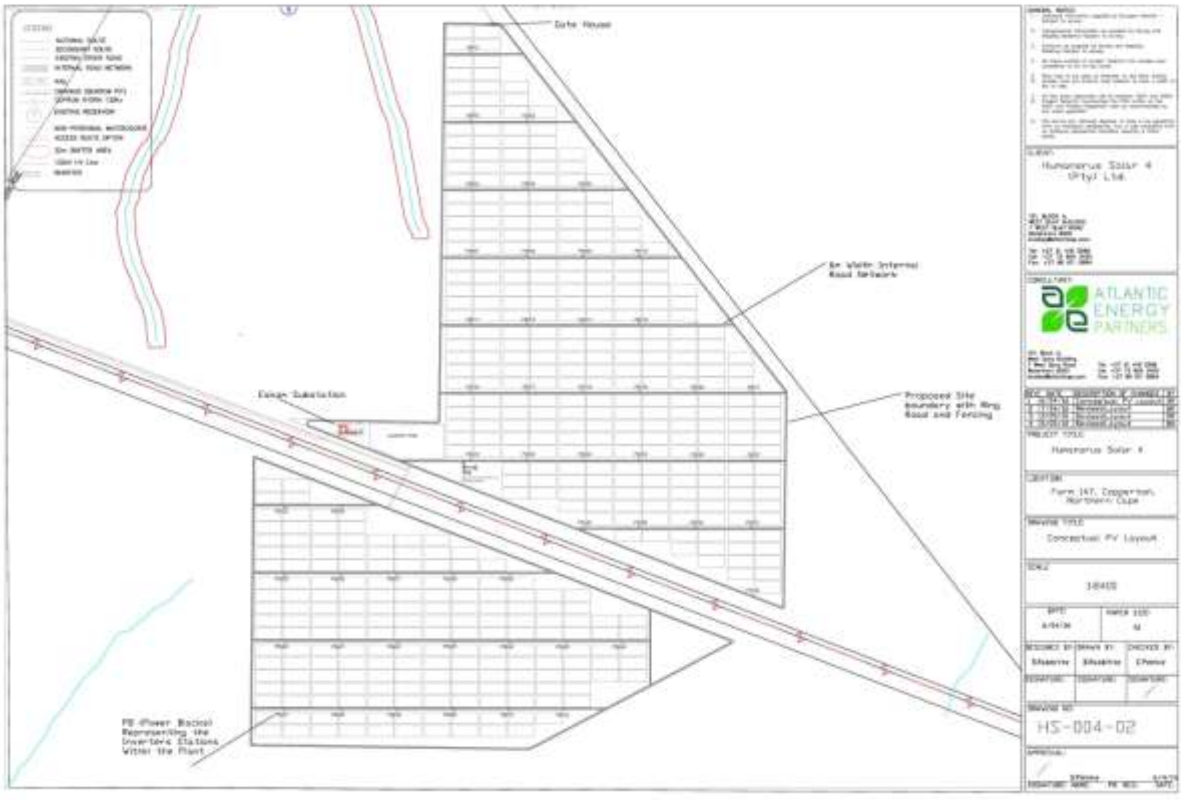


Figure 8: Humansrus Solar 4 - Preferred site layout and components

The components and infrastructure of the facility includes the ground-mounted structures, solar modules, cables, inverter rooms, access roads, auxiliary roads, auxiliary buildings (administration, security, workshop, storage and ablution), rainwater tanks, perimeter fencing with associated security infrastructure, an on-site substation, and electrical distribution line.

The exact position of these components will be determined with the final plant design after preferred bidder status is obtained. The final facility infrastructure of the preferred layout will have a planned development layout of approximately 220 ha and a development footprint of 270ha. The layout is aimed at having the lowest possible environmental impact while keeping the project economical viable.

2.4.1 General Explanation of the Layout:

A general explanation of the components of the layout will be discussed below. For a more detailed overview, refer to the Engineering Report of the impact phase.

2.4.1.1 Solar Panel Area

The solar arrays are put together with strings of solar modules connected in series, which can be mounted onto single or double axis tracking systems. In the case of concentrated PV double axis tracking systems is typically used. In the case of poly or mono-crystalline PV panels typically single axis or fixed-tilt frames are utilised.

Large PV facilities typically use single tracking axis frames which are constructed in a North-South direction. The single axis tracking technology enables the facility to increase the amount of electricity generated due to an optimised irradiation angle to the PV panels.

The standardised length of a solar array would typically be between 30 m and 200 m long. Where a tracker system is used, modules are controlled individually and standardised systems are preferred for economic and practical reasons. The solar modules will be placed in such a way that it would have the least influence on the washes and avoid the determined ecological boundaries where required.

2.4.1.2 Mounting of the Modules

As discussed in the Engineering Report, the foundation of mountings can either be laid in a small concrete block, driven piers, or a deep seated screw mounting system. The impact on agricultural resources and production of these alternatives are considered equal, although the concrete option will require greater inputs during decommissioning in order to remove the concrete from the soil. As far as practically feasible the poles would be driven in as far as possible from all washes and will take the ecological constraints into account.

Figure 9: Rammed or screwed mounting method on fixed frame (image www.expo21xx.com)

The physical process of ramming the anchors into the ground is done using specific ramming technology and equipment (typically self-powered vehicles on tracks). Figure 10 below shows equipment being used in the ramming process. Some of the ground covering in the medium sensitivity area will be cleared to do the frame installation accurately. Although the site is very flat, some minor excavation may be necessary in certain medium sensitivity areas.

In the case where earth screws or rock anchors would be more suitable, the rammed pole would be replaced by one of the former. In the areas of high sensitivity, vegetation would be left in place to avoid the risk of erosion. In the unlikely case where brush or trees are high enough to cast shadows they would be trimmed to size.

Figure 10: Installation of frame foundation (Image from www.aceinfra.com and www.kaska.eu)

2.4.1.3 Grid Connection and Cabling

The electrical feeding line is proposed to be constructed to connect to the ESKOM Kronos Substation via a self-build powerline option. This electrical power line would run along the border fences and powerline (grid connection) corridor to minimise the effect on the environment.

A 75 MW installation will have various electrical components to meet the national grid code requirements in order to supply generated electricity onto the national grid. The installed infrastructure will ensure the correct conversion of produced power from the generated panel Direct Current (DC) to Alternate Current (AC). This conversion from DC to AC is done by means of inverter stations. A single inverter station is connected to a series of arrays and would be placed along the service roads to give quick and easy access.

A number of inverter stations will be installed, of which each of these inverter stations are connected to the on-site substation from where a power line is constructed. The power line is constructed from the onsite substation to the point of supply either directly to the ESKOM substation or onto an existing power line (loop-in/loop-out).

The final placement of the inverter stations and on-site substation would take the ground conditions into consideration, meaning that suitable areas with a minimal impact on the environment would be preferred. Interconnecting cables may be trenched if required, although the amount of trenching will be reduced as far as practically possible. Cabling would be mounted to structures as far as possible to avoid excessive excavation works and clearing of vegetation.

An inverter station would typically be built into a transportable container and will have an onsite footprint of 56 m² (14m x 4m). The on-site substation is expected to have a footprint of approximately 10’000 square meters (including a switching station, IPP transformer, IPP HV yard, ESKOM HV yard, switch gear and feeder bays).

2.4.1.4 Auxiliary Building Area

The main storage, workshop, ablution, and administration facilities are placed in an area where there will be easy access.

The final storage and administration areas would also be selected to minimise their impact on the environment by considering the ground conditions and the ecology of the surrounding areas. Since this area may host more human activity than most other parts of the solar facility, it is important to take the surrounding habitat into consideration.

The structure erected should not be more than 2000 square meters in area and is referred to in the preceding drawings as the Storage and Admin facility. Water to the facilities will be supplied by twenty 10 kl water tanks. These tanks will also be used as redundant water for operation of the plant.

2.4.1.5 Construction of Roads

In the case where access roads cross the washes or where they are in the close vicinity of the washes special care and precautionary measures must be taken to mitigate the risk of erosion due to ground disturbances. By incorporating precast concrete infrastructure into the construction of these roads the risk of the roads acting as water channels could be avoided.

Special attention to drainage, water flow and erosion will be given and potential risks will be mitigated by applying appropriate building methods. A storm-water management plan is developed and forms part of this impact assessment which has more detailed information towards consideration of storm-water infrastructure (Humansrus Solar 4 Storm water Management Plan, March 2016).

Please refer to the engineering report (Impact, March 2016) for more information and detail towards the different types of roads (main access road, internal roads, perimeter roads and internal tracks) as well as their corresponding properties.

3 Facility services

The Solar PV facility requires a number of services in order to be operational. The services discussed in this section do not refer to municipal services such as sewage and refuse removal (which is discussed within the Engineer Report), but rather refers to the facility requirements such as access roads (accessing the facility during construction and operations) and grid connections (evacuating the produced electricity).

3.1 Access to the site

Access to the site will be along appropriate provincial and local roads. The proposed access roads to the site are from the Prieska/Van Wyksvlei road. The road has a tarred section and a gravel section. In this impact phase of the project three access road alternatives are considered. All two access road alternatives provide access to the proposed site from the R357 Prieska Vanwyksvlei as access routes illustrated in Figure 11.

A Transport and Traffic Management Plan is included within this environmental impact phase as required by DEA regulations. This traffic management and transportation plan investigates, plan and describe implications around increased traffic loads and potential route scenarios. Please refer to the “Transport and Traffic Management Plan” (Humansrus Solar 4 Transport and Traffic Management Plan, March 2016).

Different access route alternatives towards the two site alternatives are described within this section of the report. Figure 11 depicts the footprint of the study area and the two proposed access road alternatives.

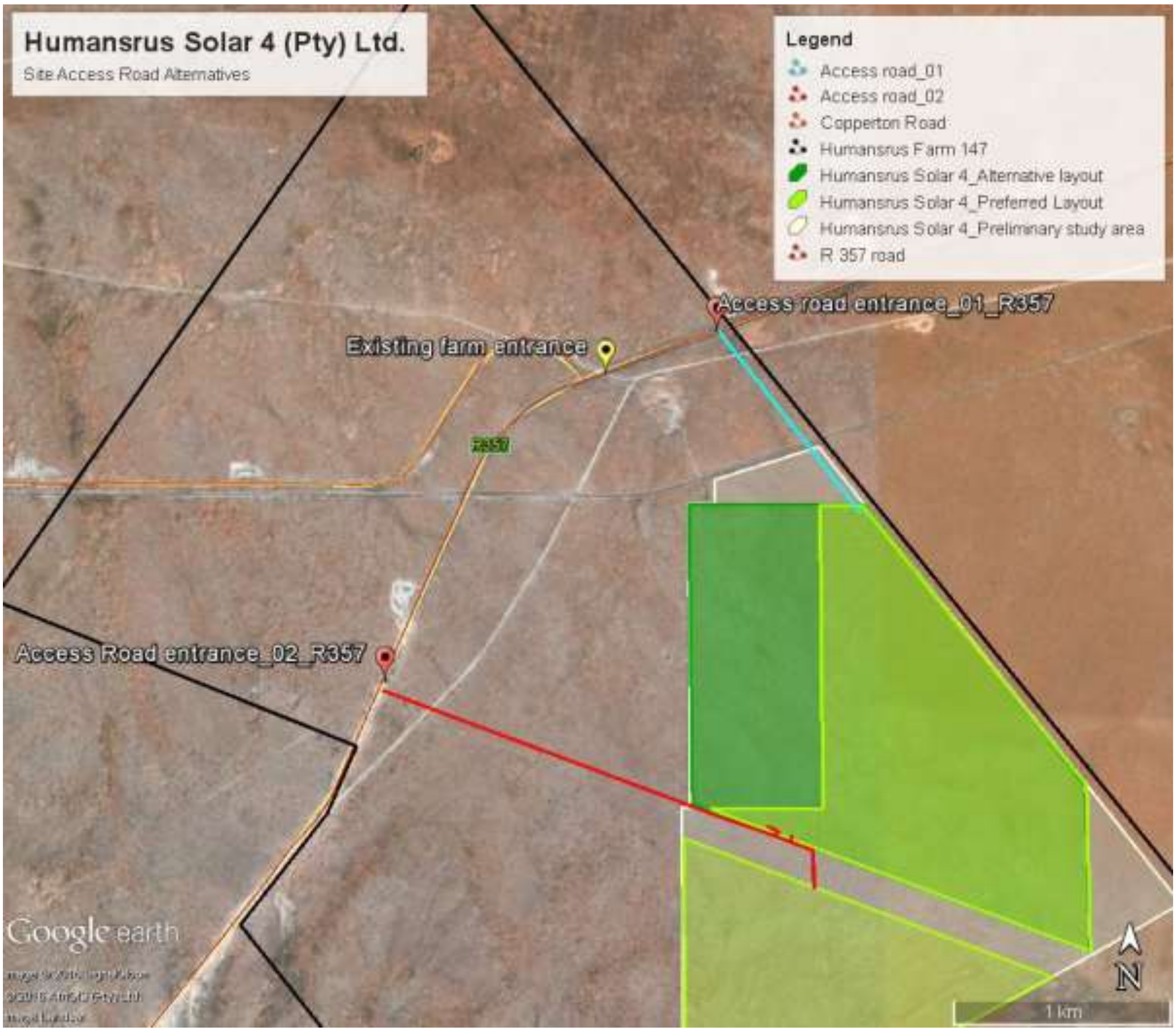


Figure 11: Alternative access roads to the proposed site alternatives

3.1.1 Road access alternative 1 (R357)

Access road alternative 1 has been investigated and provides access to the project site from the R357 (Prieska/Copperton road). The access is located close to the existing farm border.

Alternative site access road 1 is considered as it provides direct access from the R357 road to the North corner of the proposed preferred site.

3.1.2 Road access alternative 2 (Prieska/Van Wyksvlei road)

Access road alternative 2 has been investigated and provides access to the project site from the Prieska/Van Wyksvlei road. Alternative site access road 2 is considered as it provides direct access from the Prieska/Van Wyksvlei road to the east of the road and gives easy access to the planned on-site substation and lay-down area of the preferred site.

It should be noted that specific road corridors for the landowner are allocated and planned for in order to maintain full access for the farmer to the remaining extent (where the solar facility is not developed) of the property.

Note that “Road access alternative 2” is the preferred access route.

3.2 Grid Connection and Power Line Routes

The following section describes the various grid connection routes considered within this scoping documentation.

Several "self-build" and "Loop-in/Loop-out" (LiLo) power line route options would have been investigated, however only self-build options are being considered within this impact phase. Due to the planned decommissioning of the Cuprum/Hydra 132kV powerline a LiLo grid connection option is eliminated from the grid connection considerations for this project.

As a result of current information available and an ESKOM recommendation to connect to Kronos substation a self-build grid connection to Kronos substation is selected. The distances of self-build power lines, upgrading of infrastructure and servitude alternatives have been taken into consideration.

Please note that the routes of power lines inside the project site and study area have a number of options and that this route options could change. The routes outside the study area and project site are however fixed to the route discussions in this report.

3.2.1 Self-build Grid connection to Kronos

The self-build option "Humansrus Solar 4_Selfbuild_PLine Kronos_sub1"connects from proposed onsite substation 1 to Kronos ESKOM substation. This proposed power lines route illustrated in Figure 12 follows the corridor east of the R357 road, crossing the Hoekplaas 146 property, towards the ESKOM Kronos substation.

Please note that due to the specific recommendations towards the no-go of a self-build grid connection by the visual specialist (VRM Africa), Solek takes cognisance thereof and moved the line beyond the 75 meter buffer from the Prieska/Van Wyksvlei road.

The grid connection distance from the onsite substation to the ESKOM Kronos substation is 7.2 kilometres. It is expected that other "Independent Power Producer" projects will utilise this similar route towards Kronos substation and as such a corridor adjacent to the R357 is kept open for this purpose.

It should be noted that the grid connection options will be assessed as part of a basic assessment process. The pylon structures are expected to be determined within detail design.

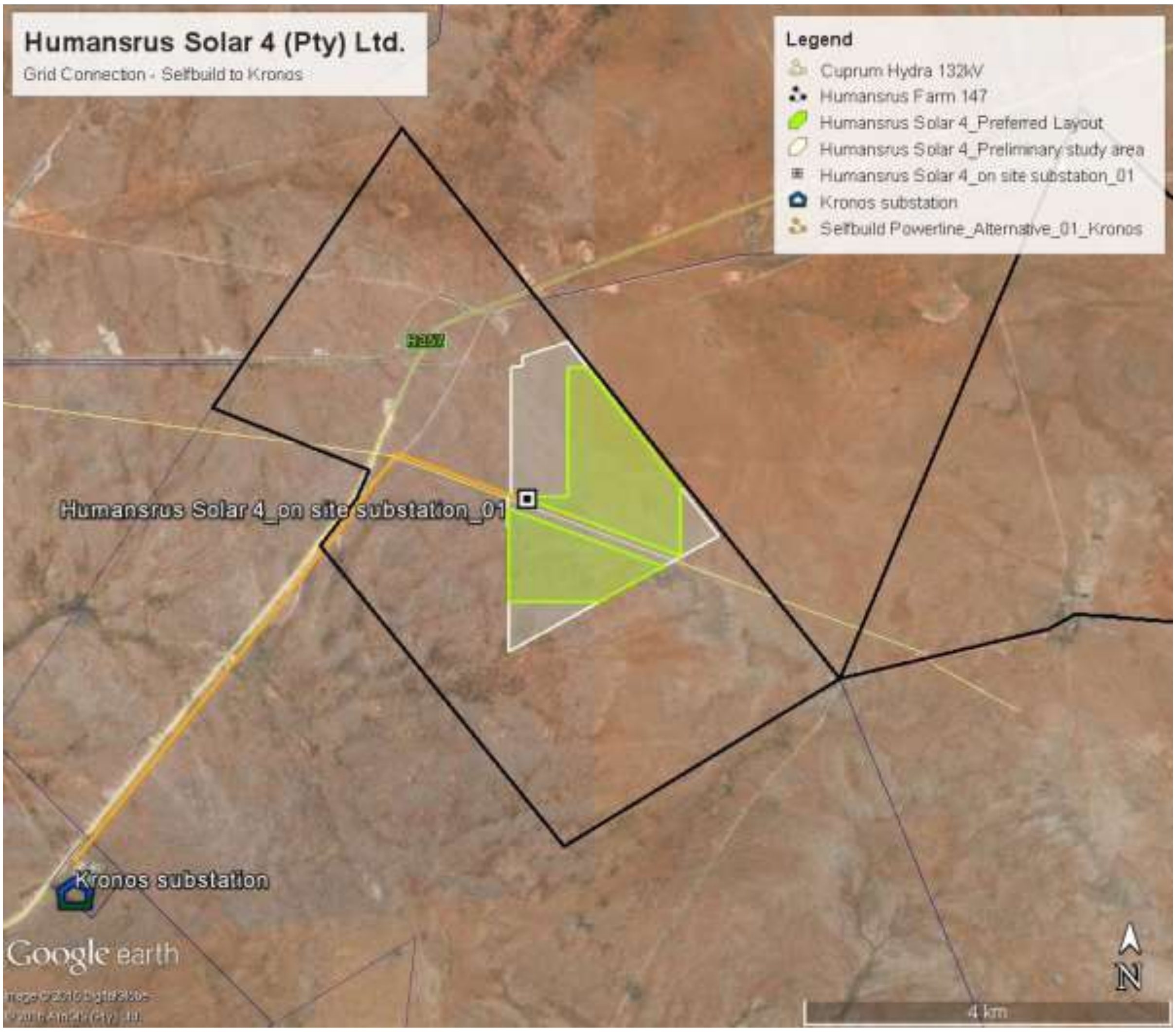


Figure 12: Grid connection Self-build Power Line to Kronos substation

4 Other Projects in the Area

When considering South Africa's irradiation distribution, the Northern Cape Province, and Prieska and Copperton area in particular, is known to be one of the most preferred areas for the generation of solar energy in South Africa and even in the world. This can be ascribed to the advantageous sun radiation specifications and the flat planes which are not intensively used except for grazing. The global irradiation in the specific area is between 2200 and 2600 kWh/m^2.

Other solar projects (proposed or in development process) in close vicinity to Humansrus Solar 4 PV project is indicated on the map below. Some of these projects have already been awarded preferred bidder status in the previous REIPPP rounds, while others are still in the planning phase.

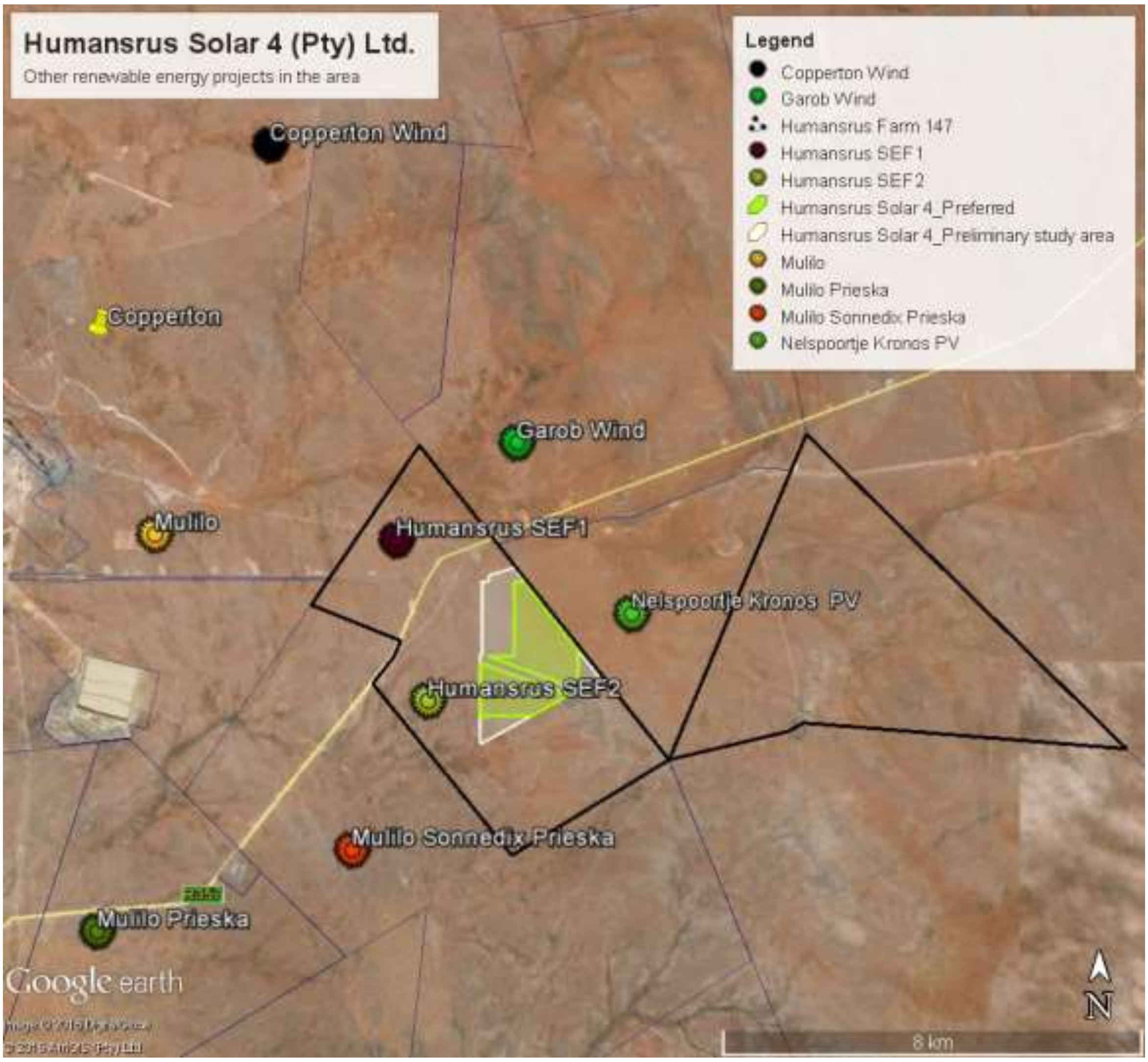


Figure 13: Other Projects in the Area

5 Conclusion

The Proposed site within the Preliminary Study site has been selected based on its level surface, road access alternatives, distance to the Kronos ESKOM substation and the low amount of possible sensitive areas within the site. These factors were considered in order to minimize ecological and environmental impact and optimise the overall project viability.

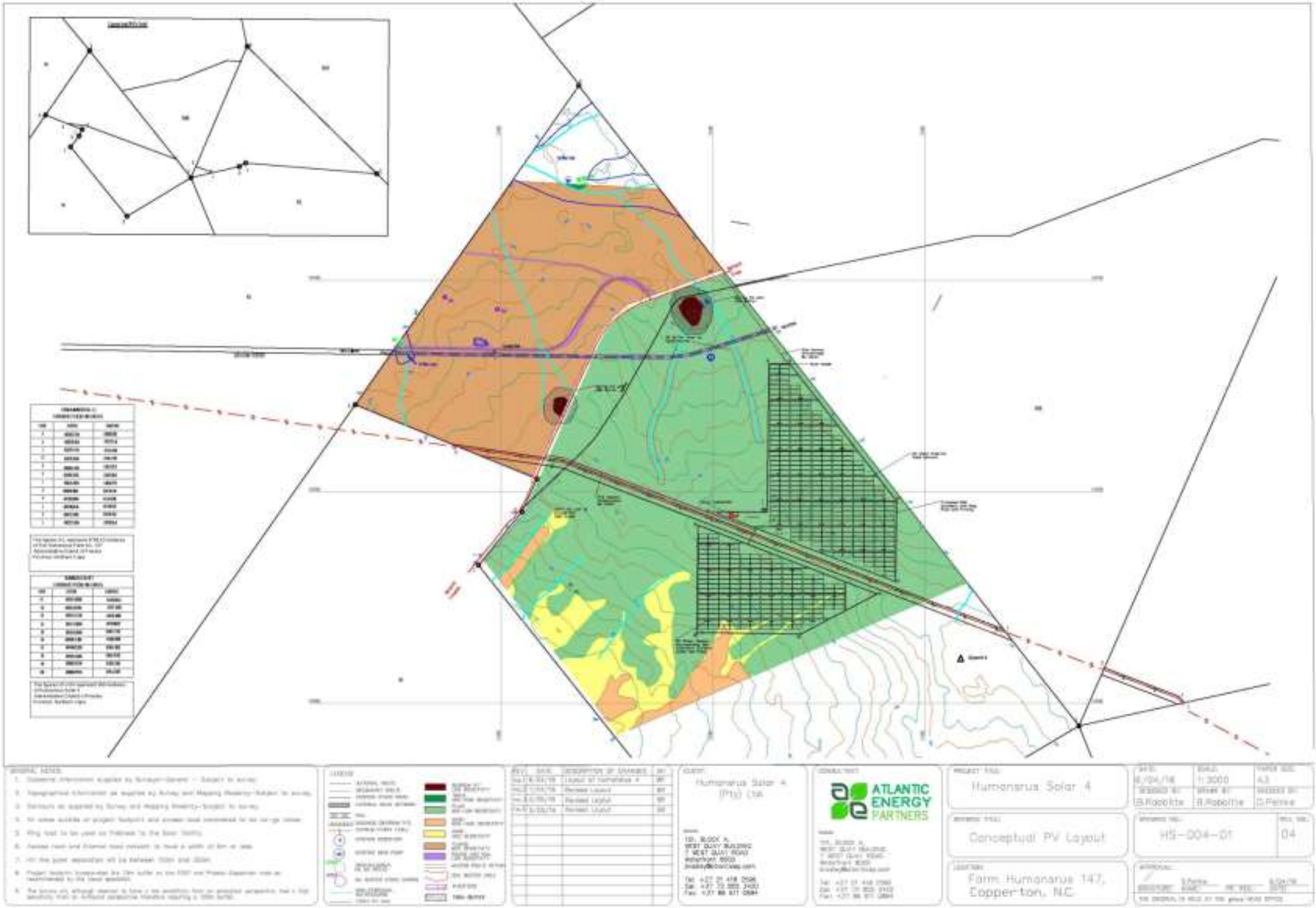
The outcome of specialist studies have been incorporated and included within this Environmental Impact Assessment phase and its corresponding reports. Feedback and confirmation regarding sensitive areas from the ecological, visual, agricultural and heritage specialist studies within the impact phase of this study is discussed and incorporated. No possible sensitive areas which affects the preliminary study area or either of the preferred or alternative sites have been found within the specialist studies.

It should be noted that the preliminary study areas of Humansrus Solar PV Energy Facility 1 and 2 projects have been assessed and were granted Environmental Authorization (EA) on this same property. The grid connection line and access route is proposed to be constructed along existing fences, routes or power lines.

Annexure A

1. **Annexure A Figure 1**: Detailed facility layout and exclusion areas
2. **Annexure A Figure 2**: Detailed component and preliminary facility plan

***Annexure A Figure 1**: Detailed facility layout and exclusion areas*



Annexure A Figure 2: *Detailed component and preliminary facility plan*