There are no receptors on the site itself and lands around the site, apart from people working on the farm and Eskom maintenance operatives. The farmsteads of Klipgats Pan and Klippan are within 5 km of the sites and would thus be visually impacted upon.

The impact on the users of the R357, local tarred roads and a number of gravel roads would be different for the preferred and alternative layouts. For the preferred layout, with 4 m high PV modules, the southbound traffic on the R357 would see the development closely by looking ahead and to the side. For a distance of about 4.2 km the view would last about 2.5 minutes if driving at 100 km/h. Northbound traffic would look straight at the development as they approach from the south and to the side. The buildings, access road and transmission lines associated with the development would also be seen. Should the 15.4 m high panels be installed, northbound and southbound traffic would both see the site for a longer period, about 7 to 8 minutes.

The local gravel road linking the R357 at farm Klipgats Pan with farm Klippan and an eastwards farm Mierdam does not lie within the viewshed. The local tarred road aligned north-south and linking the mine to the north with the R357 runs about 1.5 km to the west of the site and the proposed project would be held in view by drivers for about 3 km or about 2 minutes.

For the alternative layout (4 m high panels) the southbound traffic on the R357 would hold the development in view for a distance of about 5 km for about 3 minutes. Northbound traffic would view the development over a driving distance of about 10 km and for 6 minutes. In each direction the alternative layout would be noticed for a longer period of time because the development would be more extensive. The development would be visible for about 4 km or 3 minutes, travelling either west or east. This layout would be intermittently visible to the local tarred road discussed above. Should the 15.4 m high panels be installed, the north and southbound traffic would both see the site for about 7 to 8 minutes.

Figure 4-5 shows a photomontage of the alternative layout with and the proposed Mainstream wind energy facility in the background. According to the specialist impacts associated with the preferred layout would not affect a greater geographical area than the alternative layout.

Figure 4-5 Anticipated view of the proposed alternative site from the gravel road off the R357 which heads east towards Mierdam Farm. The view for the preferred layout would be very similar (K. Hansen)[31]

[31] Note that no suitable image could be found for PV panels, hence text has been used to illustrate the scale of the proposed project.

Due to the scale of the development, the numbers and types of receptors directly affected and the semi-industrial nature of the proposed project which is compatible with the industrial uses locally the potential visual impact is considered to be of medium to high intensity, local extent and long term and therefore of **medium to high (-)** significance, without mitigation for all alternatives. With the implementation of mitigation measures the intensity would be reduced to low to medium and as a result reduce the significance of the visual impact to **medium to low (-)** for all alternatives.

g) Mitigation measures

The following mitigation measures are recommended:

- All excess material shall be removed off-site, and all the ground shall be returned to original levels/gradients as far as possible;
- New structures should be placed where they are least visible to the greatest numbers of people, in places where the topography can offer shielding, where possible;
- Visibility of buildings and the local sub-station should be reduced by cladding the buildings in non-reflective colours and materials that will blend in with natural environment. E.g. cladding with local stone or plaster and paint with earthy tones for paint colours, roofs should be grey and non-reflective and doors and window frames should reference either the roof or wall colours;
- Finishing materials of the infrastructure (including support structures) should be of colours that are non-reflective and in dark matte colours such as dark grey or charcoal; and
- Information on the project should be provided to local people, such as through a poster at the entrance to the site.

h) Cumulative impacts

The visual impact of this proposed development was assessed in the context of the other renewable energy projects within the Copperton area that are in various stages of approval.

The local landscape may change in character from one which is agricultural and remote to one where there are isolated hi-tech developments, i.e. wind turbines and solar installations. The most visually significant developments, the wind energy facilities, are far apart from each other, excluding the proposed Mainstream Renewable Energy facility that is located close to this site. The solar installations would also be extensive but the scale of the landscape is sufficient to provide a setting for these developments as they are widely spaced and the area already has an industrial component. The local landscape character would be changed and made more industrial. The cumulative impact is assessed as medium (-) significance.

4.3.2 Impact on energy production

South Africa has experienced a shortfall in electricity supply in the past few years and continues to experience constrained electricity supply. The proposed project could impact on the ability of Eskom to provide electricity.

a) Description of the environment

Historical trends in electricity demand in South Africa have shown a consistent increase in demand. There are some years where the demand levels off or decreases but over the long term there is still an increase. Such a decrease in demand was seen in 2009 in line with the global recession, demand growth has since resumed. As a result, the reserve margin still remains low and Eskom is still short of capacity, a situation that is expected to continue until new base load capacity can be brought online from 2012 onwards. The reserve margin will again be constrained after 2018 should no new base load power stations be constructed. The proposed wind energy facility would be able to provide power to assist in meeting the energy demand within South Africa.

In Eskom's Medium Term Adequacy Report (Week 44 of 2011) it is anticipated that the reserve margin would vary between 6.8 % (2013) and 12.7 % (2011) of Eskom's capacity and it would be necessary to import 1 500 MW of electricity annually up until 2014[32].

As noted in **Section 1.2.6.d** of this report, South Africa aims to procure 3 725 MW capacity of renewable energy by 2016 (the first round of procurement). The proposed project could provide 100 MW, or 2.7 %, of this figure.

b) Impact assessment

Given the need for increased production capacity in South Africa, as well as the targeted renewable energy figure, the potential impact of the proposed project on energy production is considered to be of low magnitude, regional and long term and therefore of ***low (+)*** significance, without or with mitigation measures.

No difference in significance would result from the proposed alternatives.

c) Mitigation measures

No mitigation measures are recommended.

d) Cumulative impacts

As shown in **Figure 4-7** below five other renewable energy projects are proposed for the area, with a combined capacity of 900-950 MW. The potential cumulative impact of this proposed project on South Africa's energy production would remain of ***low (+)*** significance.

4.3.3 Impact on climate change

The establishment of a PV plant would reduce South Africa's future reliance on energy from coal-fired power stations which could in turn reduce the future volume of greenhouse gases emitted to the atmosphere, reducing the greenhouse effect on a regional, national and international scale.

[32] http://www.eskom.co.za/c/article/803/adequacy-report-week-44/ (accessed 15/11/11)

a) Description of the environment

Gases which contribute to the greenhouse effect are known to include carbon dioxide (CO_2), methane (CH_4), water vapour, nitrous oxide, chloroflurocarbons (CFCs), halons and peroxyacylnitrate (PAN). All of these gases are transparent to shortwave radiation reaching the earth's surface, but trap long-wave radiation leaving the earth's surface, acting like a greenhouse. This action leads to a warming of the earth's lower atmosphere, with changes in the global and regional climates, rising sea levels and extended desertification. This is turn is expected to have severe ecological consequences and a suite of implications for humans. Total greenhouse gas emissions reported to be emitted within South Africa for the 2008 year was approximately 435 million metric tons of CO_2 equivalent (UN Statistical division, 2011).

b) Impact assessment

Greenhouse gases released from a new coal-fired power station are primarily CO_2 with minor amounts of nitrous oxide (N_2O). The Medupi Power Station (4 788 MW), currently under construction near Lephalale in Limpopo, is expected to produce 29.9 million metric tons of CO_2 per annum. The emissions from Medupi Power Station would increase South Africa's CO_2 equivalent emissions (2008) by some 7 %. This is a significant increase in greenhouse gas emissions, given the aims of the Kyoto Protocol, which are to reduce overall emission levels of the six major greenhouse gases to 5 % below the 1990 levels, between 2008 and 2012 in developed countries. While South Africa, as a developing country, is not obliged to make such reductions, the increase in greenhouse gas emissions must be viewed in light of global trends to reduce these emissions significantly.

No greenhouse gases are produced by PV plants during operation, as PV plants use solar energy that generate the electricity. Although PV plants would not completely replace coal-fired power stations within South Africa, since these would still be required to provide base-load, they would reduce South Africa's reliance on them. This would assist in reducing future volumes of greenhouse gas emissions.

A life-cycle analysis looks at the entire chain of activities needed for electricity production and distribution, such as fuel extraction and transport, processing and transformation, construction and installation of the plant and equipment, waste disposal, as well as the eventual decommissioning. Every energy technology (solar, wind, hydro, coal, gas, etc.) has its own very distinct fuel cycle. A comparative life-cycle analysis for the current energy technologies used in Europe was conducted by AUMA (2000). The study focused mainly on emissions from the various energy technologies. Although the results of the analysis are not necessarily entirely accurate in the South African context, they offer a good proxy for a comparative assessment of coal-fired and wind energy facilities in South Africa. The results of the analysis are illustrated graphically in **Figure 4-6** below.

It is evident from **Figure 4-6** above that environmental impacts associated with renewables, as opposed to fossil fuels such as coal, are significantly less over the entire life-cycle.

While the proposed PV plant would not provide an equivalent amount of energy to a typical new coal-fired power station (100 MW compared to 4 788 MW), when considered with regards to climate change and given the spirit of the Kyoto Protocol, the impact is deemed to be of regional

extent, very low magnitude and long term and therefore of ***low (+)*** significance, without mitigation.

Figure 4-6 Matrix of environmental impacts by categories (AUMA, 2000)

c) Mitigation measures

No mitigation measures are recommended.

d) Cumulative impacts

As shown in **Figure 4-7**, five other renewable energy projects are proposed for the area, with a combined capacity of 900-950 MW. Furthermore, many more PV plants are proposed throughout South Africa. Given the number of PV plants proposed across the country, the potential reduction in future greenhouse gas emissions is considered to be of regional extent, low magnitude and long term, and therefore of *medium (+)* significance.

4.3.4 Impact on local economy (employment) and social conditions

The establishment of the proposed PV energy facility would provide a number of direct, indirect and induced jobs. Direct jobs are created during manufacturing, construction and installation, operation and maintenance. The proposed project would also result in a large amount of expenditure in South Africa, both to procure services (e.g. transportation services) and materials (e.g. road building materials).

a) Description of the environment

Copperton falls within the Siyathemba Local Municipality (LM). The population of Siyathemba LM is 19 360 and this is split into 74 % Coloured, 14 % African, 11 % White and 1 % Other. The total number of households is 4 542. The main employment industry is farming, followed by mining. Agricultural activities extend to sheep, wheat, maize, lucerne, cotton, beans, vineyards and peanuts. There are 12 schools in the LM and, four clinics (one of which is in Prieska) and one hospital[33].

The site is located in a rural area and as such the population density is very low, with neighbours located kilometres away. Whilst Copperton itself was once a populated town, providing accommodation for the mine workers, this is no longer the case and the majority of houses have been demolished. A few houses are however still rented to retired farmers. According to the Pixley ka Seme DM SDF (2007) the 2001 population of Copperton (which fell under the DM's management, prior to being assimilated into the Siyathemba LM) was 37, with nine households. Employment opportunities in the immediate area stem from farming, the local accommodation lodge, Ietznietz, and Alkantpan weapons testing facility.

b) Impact assessment

Up to 100 operation and maintenance jobs would be created during the operational phase. Indirect and induced jobs would also result from the proposed project. It is important to note that the number of jobs does not equate to the number of people employed.

The operating expenditure of the proposed project would be roughly R 30 million per year, of which up to R 15 million per year would be spent in South Africa. Increased spending (procurement of goods and services) in South Africa would indirectly result in more employment opportunities. Increased employment opportunities (direct and indirect) would allow for an improvement in social conditions for those who obtain employment. The project would also result in an increase in the revenue of the LM through increased rates and taxes. This in turn could result in an increase in municipal spending on social programmes.

Based on the number of employment opportunities during the operational phase the potential impact on the local economy (employment) and social conditions is considered to be medium magnitude, regional and long term and therefore of ***medium (+)*** significance, with or without mitigation.

No difference in significance would result from the proposed alternatives.

[33] Taken from http://www.siyathemba.co.za/demographics.htm (accessed 02/01/11)

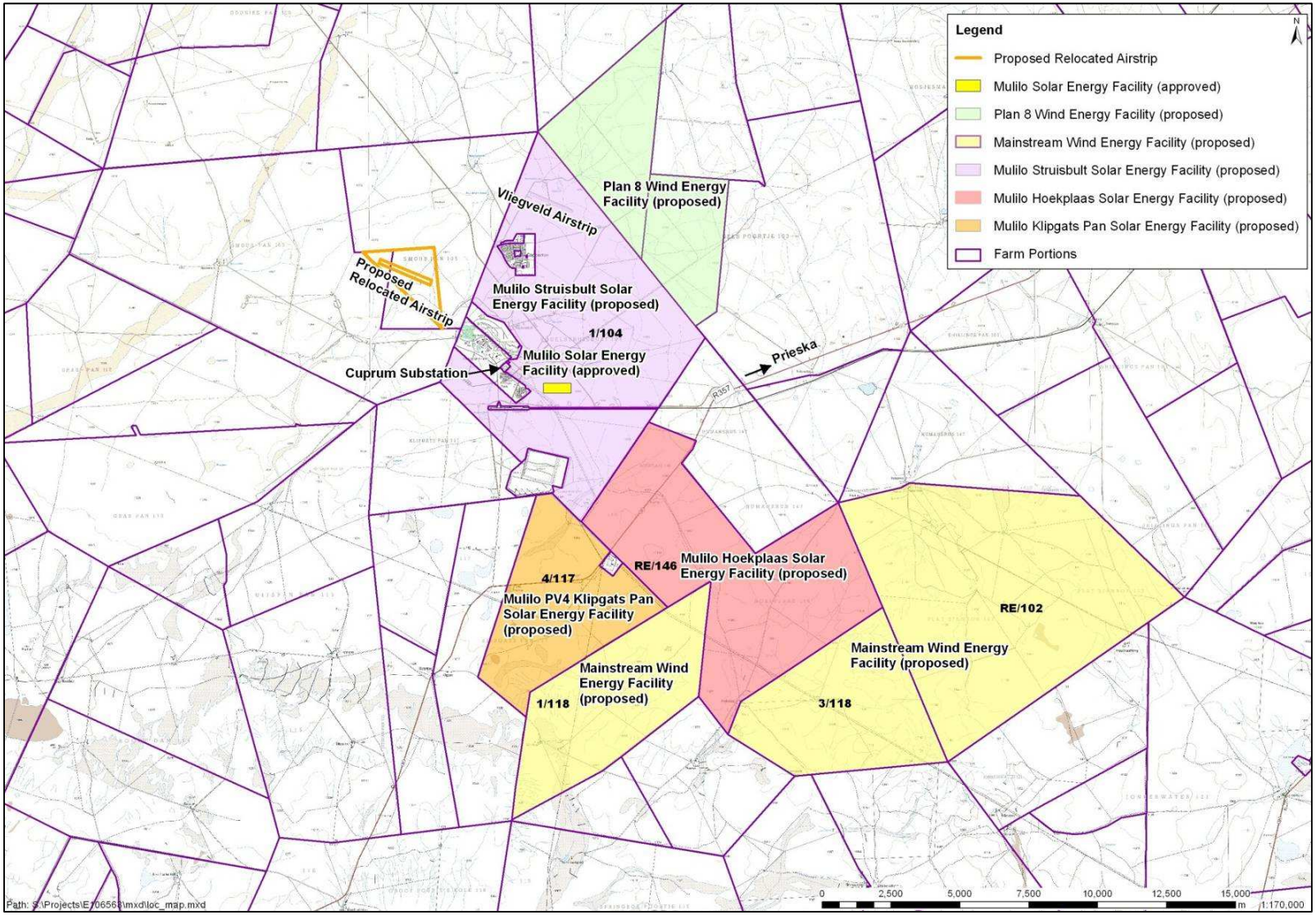

Figure 4-7 Proposed energy developments in the area surrounding Copperton

c) Mitigation measures

The following mitigation measures are recommended:

- Give preference to local communities for employment opportunities; and
- Base recruitment on sound labour practices and with gender equality in mind.

d) Cumulative impacts

As noted previously, five other renewable energy projects are proposed for the area, with a combined capacity of 900-950 MW. The potential cumulative impact of these proposed projects on employment and socio-economic conditions in the local area would remain of ***medium (+)*** significance.

4.3.5 Impact on agricultural land

The proposed site (Klipgats Pan Farm) is used as grazing land for livestock. The farm is split into two portions by the R357. The proposed solar energy facility (preferred and alternative) would have a footprint of 300 ha. Both the preferred and alternative sites are located south of the R357. For both sites the footprint of the proposed facility would reduce the area available for agriculture. As such Mr Kurt Barichievy of SiVEST (Pty) Ltd was appointed to undertake a desktop Agricultural Impact Assessment. A brief site visit was conducted on 5 and 6 December 2011. The study considered climate, geology, soils, terrain, land capability, current agricultural practices and agricultural potential. The desktop Agricultural Assessment and comment on the revised layout and technology alternatives for Klipgats Pan farm is included in **Annexure C**. The findings and recommendations of the study are summarised below.

a) Description of the environment

For the purpose of this study, agricultural potential is described as an area's suitability and capacity to sustainably accommodate an agricultural land use of the area. In most cases the agricultural potential is benchmarked against crop production.

Climate

Copperton area has an arid continental climate with a summer rainfall regime. The region typically experiences hot days and cold nights with the average summer temperature of approximately 33 ºC and the average winter night time temperatures of approximately 1 ºC. Most of the rainfall is confined to summer and early autumn. According to the Daily Rainfall Extraction Utility (Lynch, 2003) the MAP for the Copperton area is approximately 176 mm per year with 62 % of rainfall occurring between January and April. Considering that 500 mm is the minimum amount of rain required for sustainable dry land farming, the MAP of 176 mm is extremely low. Therefore without some form of supplementary irrigation, natural rainfall for the Copperton area is insufficient to produce sustainable harvests. This is reflected in the lack of dry land crop production within the area.

Geology

Both the proposed layouts (preferred and alternative) are underlain by tillite. Tillite consists of consolidated masses of unweathered blocks and unsorted glacial till. The proposed solar energy facility would completely be underlain by tillite.

Slope

The average gradient is less than 10 %, making this area ideal for intensive agriculture, with high potential for large scale mechanisation. The topography is thus not a limiting factor for agriculture.

Land use

The Klipgats Pan Farm consists of a mix of natural veld and vacant land which is used as general grazing land for livestock. Vast un-improved grazing land is interspersed by non-perennial stream beds. Stocking rates for the region are estimated at 1 small animal unit per 6 ha and 1 large animal unit per 35 ha. According to the land use data there are no signs of formal agricultural fields or cultivation on Klipgats Pan Farm.

Soils

The Environmental Potential Atlas for South Africa (ENPAT) for the Northern Cape Province shows the majority of Klipgats Pan Farm is dominated by a mix of both red and yellow apedal soil types. Apedal soils are weakly structured, tend to be freely drained and due to overriding climate conditions these soils will tend to be Eutropohic (high base status).The study area is classified as having an effective soil depth[34] of less than 0.45 m deep and therefore it is a limiting factor in terms of sustainable crop production. According to the Agricultural Geo-Referenced Information System (AGIS) the soils on Klipgats Pan Farm are associated with saline soils with a low water holding capacity, high pH and low organic matter content.

Agricultural potential

Restrictive climate characteristics, due to the strong summer rainfall regime, moisture stress and low winter temperatures reduce the agricultural potential of Farm Klipgats Pan. The ENPAT Database provides an overview of the study area's agricultural potential based on its soil characteristics although it does not take prevailing climate into account. The database indicated the study area is dominated by soils which are not suited for arable agriculture, but which can still be used as grazing land.

By taking all the site characteristics (climate, geology, land use, slope and soils) into account, the agricultural potential for the majority of the study area is classified as being extremely low for crop production, while moderate to moderately low for grazing. This poor agricultural potential rating is primarily due to restrictive climatic characteristics and soil depth limitations. The site is not classified as high potential, nor is it a unique dry land agricultural resource.

a) Impact assessment

The footprint of the proposed project would result in the loss of 300 ha (preferred and alternative layouts) on the Farm Klipgats Pan. There are no centre pivots, irrigation schemes or active agricultural fields which will be influenced by the proposed development. The farm can be classified as having extremely low agricultural potential for crop production, while moderate to

[34] Depth to which roots can penetrate the soil (SiVEST, 2012)

moderately low potential for grazing . The proposed project would only influence a portion of Farm Klipgats Pan and the remaining land would continue to function as it did prior to the proposed solar energy facility. Consequently, the overall impact on agricultural potential and production is considered to be of very low intensity, local extent and long term and therefore of **very low (-)** significance with and without mitigation, for both alternative layouts, due to the site's low inherent agricultural potential.

It was noted in the specialist study that a full agricultural assessment was not considered to be necessary.

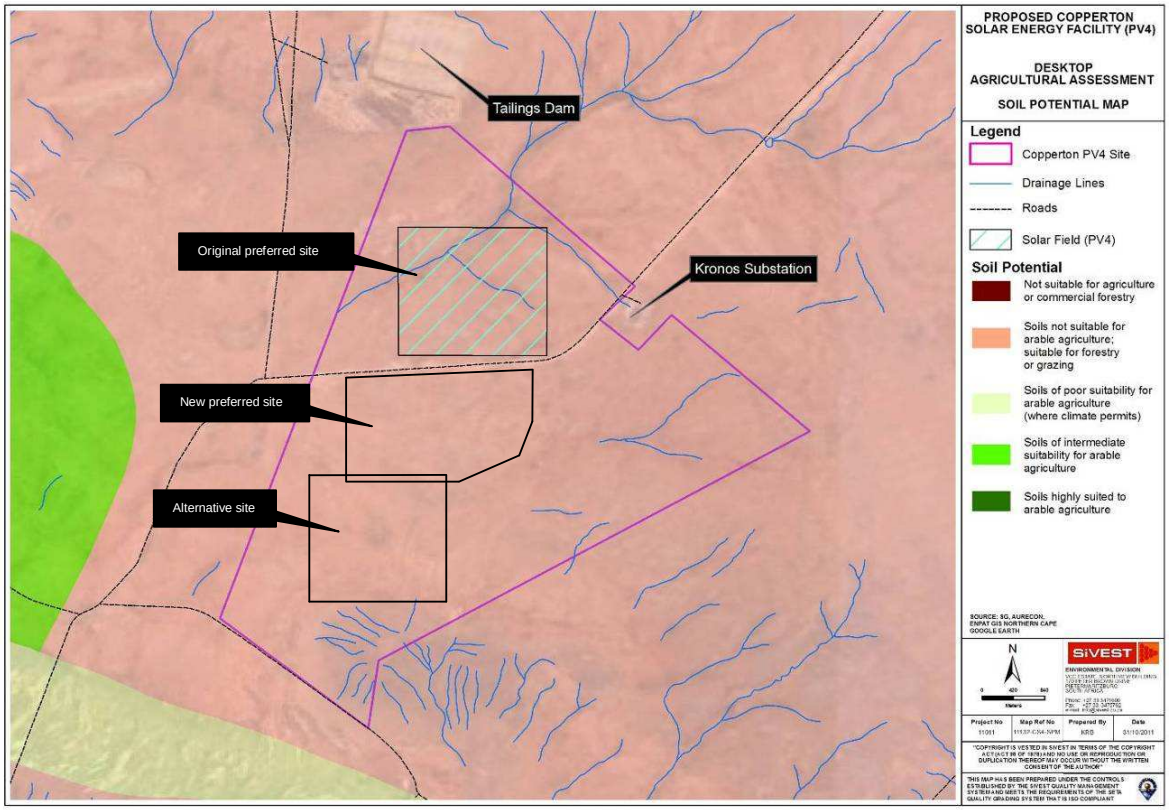

Figure 4-8 Soil Potential Map

b) Mitigation measures

No specific mitigation measures are recommended.

c) Cumulative impacts

The reduction in usable grazing owing to various solar projects (one approved and three, including this proposal, proposed) planned in and around Copperton could place increased pressure on adjacent land. However, due to the limited agricultural potential described above and on the other sites, the potential impact of this increased pressure is considered to be of very low (-) significance.

4.3.6 Impact on surrounding land uses

The predominant surrounding landuse is agriculture. However a few other land uses exist and the proposed project could impact on these surrounding land uses.

a) Description of the environmental

At the abandoned Copperton mine a PV power generation facility is proposed by Mulilo that recently received an Environmental Authorisation (DEA Ref. No. 12/12/20/1722). Further west of the site is Alkantpan, a weapons testing range, used by many countries for weapons testing. Other proposed activities in the area include a wind energy facility to the east proposed by Plan 8 (Pty) Ltd (DEA Ref. No. 12/12/20/2099), two PV plants to the west and north of the site on farms Hoekplaas (DEA Ref. No. 12/12/20/2503) and Struisbult (DEA Ref. No.12/12/20/2502) and wind and solar energy facilities proposed by Mainstream Renewable Energy (Pty) Ltd (DEA Ref. No. 12/12/20/2320/1 and 12/12/20/2320/2) of which the one site (Farm 118/1) borders directly to Klipgats Pan and the remaining two sites are approximately 5 km (Farm 118/3) and 8 km (Farm 102/RE) to the south.

Furthermore, a 1.7 km airstrip is located to the west of the site and is used by a number of aeroclubs (e.g. Aeroclub SA). The airstrip would however need to be relocated to Alkantpan should the wind energy facility (by Plan 8 (Pty) Ltd (DEA Ref. No. 12/12/20/2099)) receive approval. The current world record for paragliding (502 km) was set from Copperton. Copperton produces good thermal activity with minimal low level obstructions to facilitate safe launching and departures for paragliders and light aircraft.

Copperton town, consisting of a few dwellings and a small shop is also located immediately west of the site.

As noted in **Section 1.2.3** the proposed PV generation facility site falls within the general astronomy advantage area and is located approximately 13 km north of a SKA station (see **Figure 4-9** below). The Karoo Core Astronomy Advantage Area will contain the MeerKAT radio telescope and the proposed core planned SKA radio telescope that would be used for the purposes of radio astronomy and related scientific endeavours. South Africa, along with Australia, has been shortlisted to host the world's largest telescope, the SKA. South Africa's bid proposes that the core of the telescope be located in an arid area of the Northern Cape, with approximately four antenna stations in Namibia, three in Botswana, two in each of Mozambique and Madagascar, and one each in Mauritius, Kenya, Ghana and Zambia[35]. A final decision on the location is expected to be made in early 2012 by the SKA Board of Directors.

b) Impact assessment

Based on the distance to the nearest SKA station the proposed development could potentially impact on the SKA project. There are two major mechanisms that would result in detrimental effects on radio astronomy observations by PV facilities. The first effect is as a result of the electromagnetic interference generated from the power generation equipment. This is broadband interference, and would result in a complete shutdown of radio astronomy observations. Mulilo has however investigated radio frequency interference (RFI) shielding of

[35] http://www.ska.ac.za/bid/index.php (accessed 19/10/11)

the primary switchgear and insulated gate bipolar transistor (IGBT) components. Based on Mulilo's previous experience with RFI shielding, it is believed that a suitable system can be incorporated into the design and the South African SKA Project Office (SASPO) is invited to assist with this design at the appropriate time.

Without an accurate electromagnetic characterisation of the equipment being used, it would be difficult to determine a separation distance that would be required to ensure radio astronomy receivers are protected. Electromagnetic characterisation of the components can be accessed once detailed design is complete. However, SASPO has indicated that experience from other equipment that meets the various SANS standards in South Africa indicates that at least a 10 km separation distance would be required for equipment at ground level. Based on this fact, Mulilo has selected the current locations of the sites and performed a view shed analysis (refer to **Figure 4-9**) on them to ensure no line of site impacts were evident. Furthermore, the SKA station is located approximately 13 km away from the proposed PV plant.

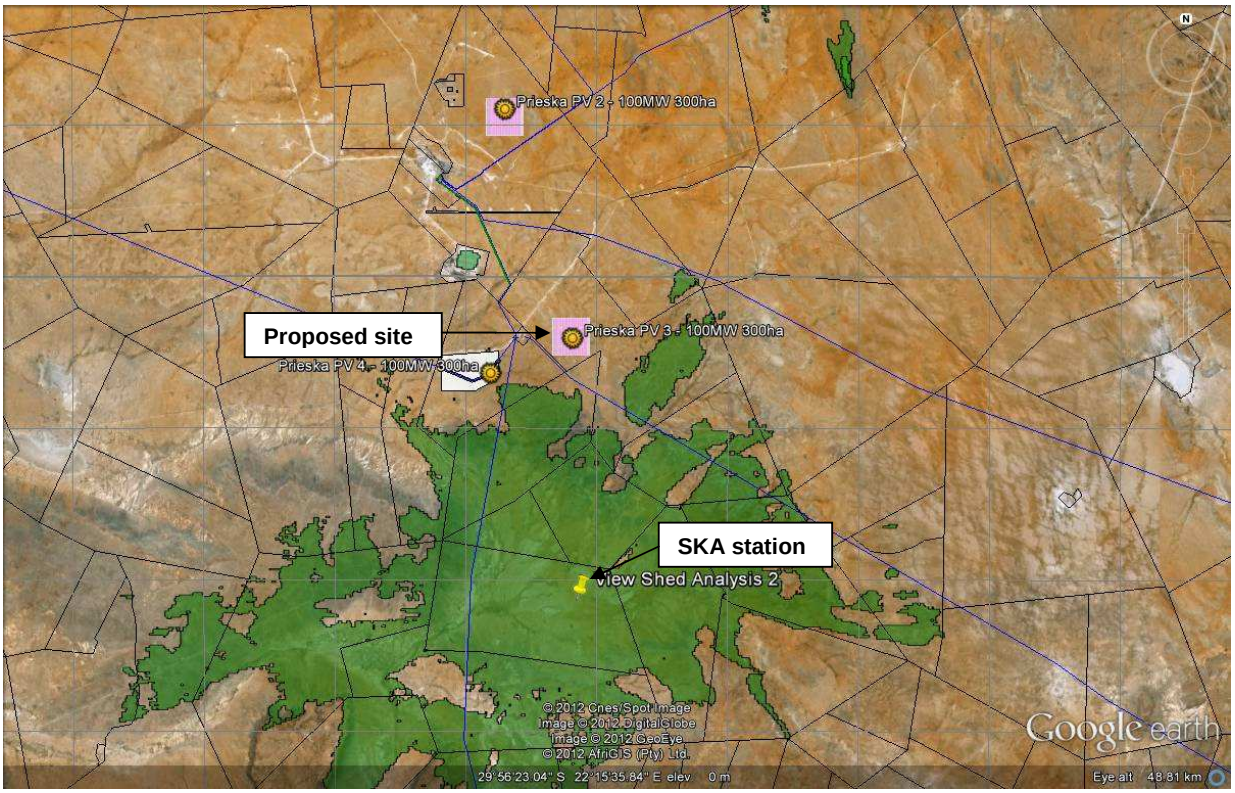

Figure 4-9 Results from a view shed analysis (areas indicated in green) undertaken by Mulilo to identify potential impacts on the nearest SKA station (courtesy Mulilo)

At heights greater than 50 m above ground, this separation distance would increase significantly due to the lack of potential topographical shielding. The second, and probably more significant mechanism, is that of the PV facility acting as secondary transmitters. That is, the solar panels would reflect distant radio signals from other transmitters onto the radio telescopes. This would result in detrimental effects to the radio astronomy facility. International practice suggests that energy facilities should not be in line-of site of any radio telescope receiver. This is not applicable to the conventional PV alternative, as the solar panels would be approximately 4 m in

height. See Figure 4. 9. However, in the case of the 14.5 m CPVs the proposed project is likely to be within the line of sight of the SKA station.

Based on the information available should the PV generation facility interfere with the SKA satellite station the potential impact is considered to be of low magnitude, regional extent and long term and therefore of ***low (-)*** significance, without mitigation for all alternatives. Note that the confidence in this impact is considered to be Unsure[36]. No difference in significance would result from the proposed alternatives. The confidence level of this impact would change once a detailed impact analysis is undertaken together with the SASPO.

As mitigation measures have not yet been determined it is not possible to ascertain the significance of the potential impact after mitigation at this point. However, it is anticipated that mitigation measures would be sufficient to reduce the significance of the potential impact to a level acceptable to SASPO, failing which the proposed project would not be allowed to proceed. The significance of the potential impact would only be determined after the detailed impact analysis is complete.

It should be noted that should the SKA project be awarded to Australia no impact would result from the proposed wind energy facility. This decision is due to be taken early in 2012 by the SKA Board of Directors.

c) Mitigation measures

It is anticipated that mitigation measures would be identified after the detailed impact analysis has taken place.

d) Cumulative impacts

It is anticipated that the potential impact on SKA would be reduced to a level acceptable to SASPO. Furthermore, it is expected that any other PV energy facilities would need to reduce their potential impact (including cumulative impact) to a level acceptable to SASPO.

4.4 CONSTRUCTION PHASE IMPACTS ON THE BIOPHYSICAL AND SOCIAL ENVIRONMENTS

The construction phase is likely to result in a number of negative impacts on the biophysical and the social environment. These could potentially include:

- Disturbance of flora, avifauna and fauna;
- Sedimentation and erosion of water ways;
- Impact on traffic;
- Visual impacts;
- Storage of hazardous substances on site;
- Noise pollution; and
- Dust impact.

[36] Limited useful information on and understanding of the environmental factors potentially influencing this impact is available.

The significance of construction phase impacts is likely to be limited by their relatively short duration, since the construction phase should last approximately 18 to 30 months. Many of the construction phase impacts could be mitigated through the implementation of an appropriate EMP. A life-cycle EMP is contained in **Annexure D** of this report, which specifies the mitigation measures that could be implemented to mitigate construction phase impacts, amongst others.

4.4.1 Disturbance of flora, avifauna, and fauna

Flora

It is anticipated that there would be loss of vegetation and ecological processes during the construction phase of the facility for both the preferred alternative and the alternative.

Avifauna

Given the considerable space requirements of commercially viable facilities (300 ha for this proposed project) the construction phase would result in temporary damage or permanent destruction of habitat larger than this area. This could have a lasting impact in cases where the site coincides with critical areas for restricted range, endemic and/or threatened species. The effect could be significant in some instances, allowing for the possible cumulative effects of multiple facilities in one area. Furthermore, construction activities could disturb breeding, foraging or migrating birds. Bird species of particular concern, which may be affected, include Red Lark and Sclater's Lark, Martial Eagle, Lanner Falcon, Ludwig's Bustard and possibly flamingo.

Fauna

Any affected fauna would generally be largely mobile and would relocate during the construction phase and are likely to recolonise the area, once the construction phase has been completed and the disturbed areas rehabilitated.

Based on the above the potential impact on flora, birds and fauna during construction due to disturbance, habit loss and displacement is considered to be of low to medium magnitude, local extent and short term and therefore ***low (-)*** significance without mitigation. With the implementation of mitigation measures this is anticipated to reduce to ***very low (-)*** significance. There would be no difference in significance as a result of the proposed alternatives.

The following mitigation measures are recommended:

- In all cases construction of access roads should be designed for minimal impact. All construction should take place within the footprint of the proposed PV plant;
- A rehabilitation plan for the site should be compiled with the aid of a rehabilitation specialist and adhered to;
- Compile and implement a vegetation rehabilitation plan with the aid of a rehabilitation specialist, for inclusion in the Construction EMP. The specialist is to recommend species to be used in rehabilitation as well as any special measures for rehabilitation such as shade-netting and alien vegetation removal;
- The construction phase should be closely monitored by an Environmental Control Officer who should identify any areas that would require rehabilitation in the post-construction phase. The restoration of those areas must follow the construction phase;
- Demarcate no-go areas identified during pre-construction monitoring;

- Low-lying depressions and watercourses should be avoided wherever possible;
- Shallow depressions and well defined pans should be avoided and buffered by at least 30 m; and
- The site should be cleared in sections as required for construction and not all at once.

4.4.2 Sedimentation, erosion and aquatic ecology

The sediment loads of any drainage depressions or pans may increase due to the excavations on the site, the laying of linear infrastructure such as roads across drainage lines and other construction related activities. This would be exacerbated during the wet season and during any intense rainfall events. Other potential impacts include the formation of barriers to drainage areas, increased invasion by alien plant species, especially perennial aggressive species such as *P. glandulosa* and the production and handling of wastewater.

The following mitigation measures are recommended:

- The proposed project should be located away from the no-go areas, including a 30 m buffer area around these no-go areas;
- Access roads should be positioned in such a way that no clearing within no-go areas is required and definite drainage areas should be avoided;
- Should additional access roads be required, these should be limited to one crossing point and built with culverts to prevent the impediment of water movement;
- The use of erosion control measures to minimise erosion at excavation / clearing sites or aggregate storage sites;
- Earth moving construction activities should take place in the dry season as far as possible; and
- Remove perennial alien species such as *P. glandulosa* at sites disturbed or cleared by construction activities.

4.4.3 Impact on heritage resources

As a result of the relatively undisturbed nature of the site, and the findings of the archaeology study on an adjacent property, it is likely that archaeological or cultural material would be found on site. Furthermore, due to the underlying geology of the Main Karoo Basin underlain by sedimentary rocks of the Karoo Supergroup, there is a possibility of finding palaeontological material. A large scale development such as the proposed project could have a negative impact on the archaeological and cultural heritage resources (including visual, landscape and sense of place impacts) by damaging or destroying such material or by requiring the material to be removed and stored *in situ*. A Heritage Impact Assessment (HIA) was conducted by Jayson Orton of the Archaeology Contracts Office (ACO) to assess the impacts of the solar energy facility on the heritage resources in the project area. Information for the study was sourced from published and unpublished archaeological reports, as well as a physical survey by the specialists of the project area on 10 to 13 December 2011. The HIA and comment on the revised layout and technology alternatives are included in **Annexure C**

A Palaeontology Impact Assessment (PIA) was also undertaken by Dr John Almond and included a desktop review and field-based assessment on 26 January 2012. The PIA and

comment on the revised layout and technology alternatives are included in **Annexure C**. The findings and recommendations of the studies are summarised below.

a) Description of the environment

In general the Karoo and Bushmanland area is documented to contain abundant stone artefacts from the Early (ESA) and Middle Stone Age (MSA), while occasional Later Stone Age (LSA) artefacts are also present. These artefacts are generally very well weathered in the form of background scatter. Excavations at Bundu Pan, 25-30 km northwest of Copperton, uncovered archaeological material regarded to be generally rare in South Africa and included findings of preserved Pleistocene faunal material, bones of wildebeest, warthog, extinct giant hartebeest, species of equid (horse/zebra), baboon, springbok and blesbok. Rock art in the form of engravings dating back to the period when indigenous people or Bushman lived in the area are widely known in the area. More recent heritage includes typical flat-roofed Karoo-style houses commonly found in the small towns and war graves and a British fort at Prieska dating from the Anglo-Boer War.

Figure 4-10 shows the distribution of archaeological resources recorded during the survey. Three large clusters of LSA occupation material were found atop the elevated terrace at the far north end of the study area, in the southern area on elevated ground overlooking the pan to the west and at the ephemeral pans, just north of the R357. Most examples of MSA and ESA material were in the form of background scatter and included heavily weathered stone material such as hand-axes (see **Figure 4-11**). LSA material includes stone implements of quartzite, ostrich eggshell and bone fragments.

A number of ruined structures and artefact scatters were found. The ruined structures include a pillar, stone walls and structures associated with a historical farm house complex. Scatters of glass, ceramic and stone artefacts dating from the late 19th or early 20th century was also found around the farm complex and examples of these are depicted in **Figure 4-12**.

A windmill, watering/feeding troughs and a stone-lined dam comprise the cultural landscape. Two shale quarries located on the hill were used for sourcing the stone for construction of the farm buildings and are also of significance.

The R357 connecting Prieska and Vanwyksvlei via Copperton, is a generally scenic route and contributes to the sense of place created by typical undeveloped Karoo open space.

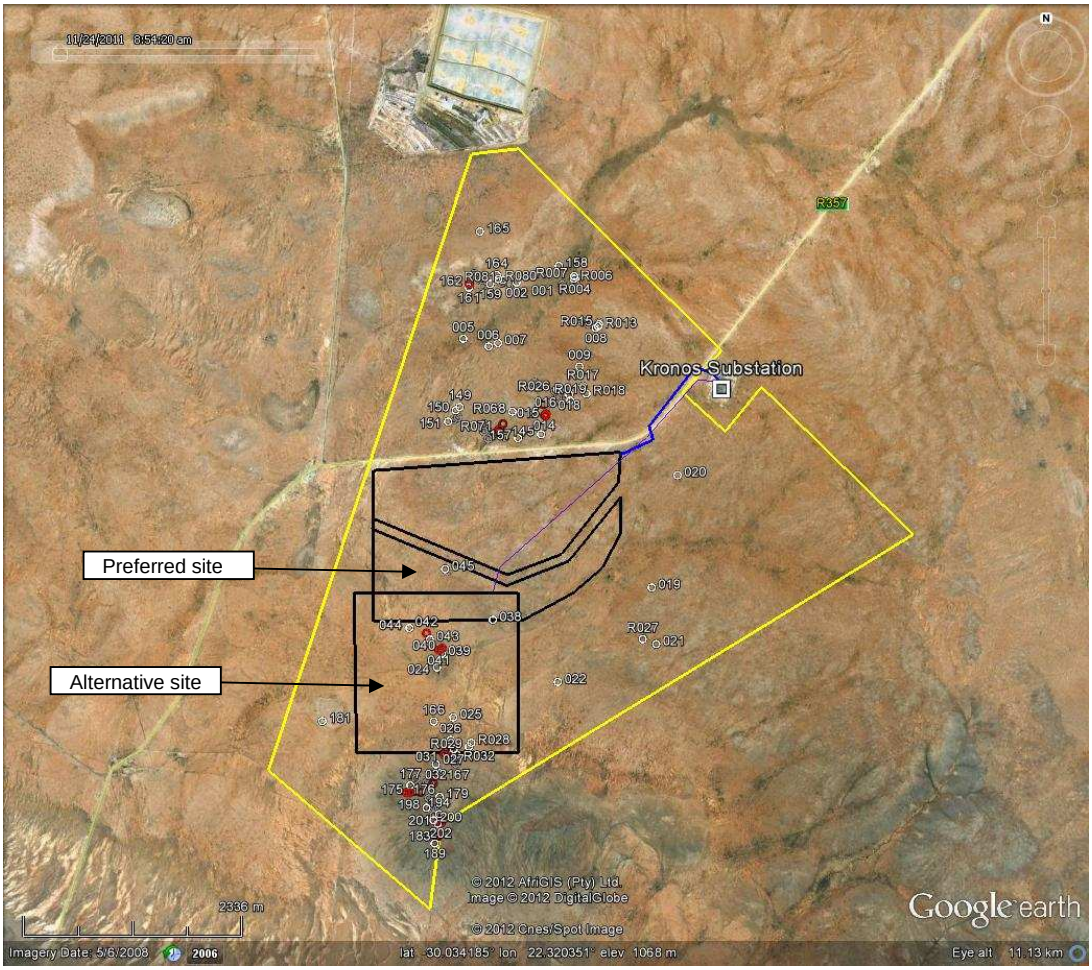

Figure 4-10 Aerial view of the study area taken from Google Earth and showing the distribution of recorded archaeological occurrences by their field numbers. Sites red symbols require mitigation, whereas the white ones do not (ACO, 2012)

Figure 4-11 Selection of isolated artefacts from the background scatter on Klipgats Pan showing the variability in materials and weathering states (ACO, 13/12/2011)

Figure 4-12 Glass and ceramics artefacts (ACO, 13/12/2011)

The geology of the study area consists of Permo-Carboniferous glacial sediments of the Dwyka Group (Karoo Supergroup) that overlie granitoid Precambrian basement rocks of the Namaqua-Natal Metamorphic Province and are locally intruded by Karoo dolerites and narrow kimberlite dykes of Cretaceous age. These older bedrocks are widely covered by a range of superficial deposits of Pleistocene to Recent age, including alluvium, down wasted coarse gravels, calcrete hardpans, and sandy to silty soils and pan sediments.

The main geological units mapped within the study region are indicated in **Figure 4-13**. The field visit on Klipgats Pan found that the poorly-exposed upper Dwyka Group bedrocks in the study area do not contain rich trace fossil assemblages, petrified wood or other fossil material. The only fossils recorded from the Dwyka succession here are ice-transported erratic boulders of Precambrian limestone or dolomite that contain small stromatolites (microbial mounds or columns) (see **Figure 4-14**). These boulders most likely originate from the Precambrian Campbell Rand Subgroup of the Ghaap Plateau. The overlying superficial sediments are of low palaeontological sensitivity for the most part.

No fossil remains were observed within the superficial sediments on Klipgats Pan. It is quite likely that fossil bones and teeth of mammals are preserved within buried Pleistocene fluvial and pan sediments as recorded on the adjacent farm Hoekplaas.

Karoo bedrocks on site are deeply weathered and at most sparsely fossiliferous and significant fossil material (e.g. mammal remains) at or near surface is probably very sparsely distributed in the study area.

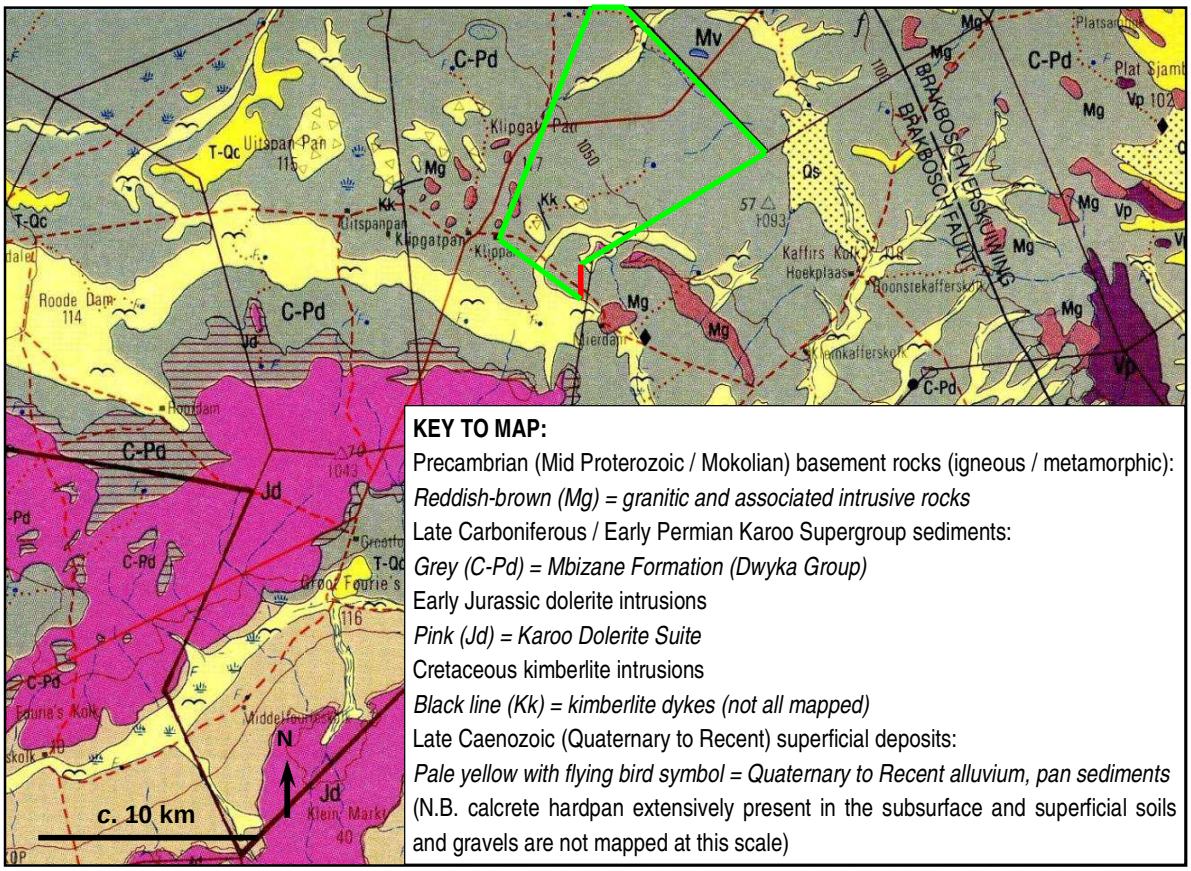

Figure 4-13 Extract from 1: 250 000 geology map 3022 Britstown showing approximate outline of the proposed solar energy facility near Copperton (green polygon) (J. Almond, 2012)

Figure 4-14 Small Dwyka erratic boulder of pale grey laminated carbonate (probably dolomite) showing small stromatolitic domes or columns (J. Almond, 26/01/2012)

b) Impact assessment

The construction and operation of solar energy facilities have the potential to produce a wide range of impacts that would affect the heritage qualities of an area. During the construction phase of the project, activities such as bulldozing of access roads to the site and excavation of cable trenches may result in the following impacts on the landscape and heritage environment:

- Displacement of pre-colonial and colonial archaeology material;
- Accidental damage and / or vandalism to the build environment, such as historical structures and ruins; and
- Negative visual impact of solar energy generation facilities on the cultural landscape, scenic quality and sense of place of the Karoo and Bushmanland.

Both sites would affect pre-historical and historical archaeology. Although most of the pre-historical archaeology present on site is background scatter of low significance, important LSA archaeological sites do occur. Relatively little is known of Bushmanland archaeology and loss of any significant LSA sites would be a considerable impact. The alternative site includes three built structures and some ruins forming an old farm complex which should be avoided. These structures are likely less than 100 years of age and not legally protected. No sites were identified in the preferred location that would require mitigation measures from an archaeological perspective.

The R357, although scenic, is little used aside from a few local farmers and is not considered an important scenic route which makes the visual impacts very low. Given the general topography, no mitigation is proposed for the visual impacts.

Based on the above considerations the potential impact on the archaeological resources by the preferred site is considered to be of low magnitude, site specific and long term duration and therefore of ***low (-)*** significance, without mitigation. No mitigation measures are required. The potential impact on archaeological resources, including the built environment, at the alternative site is considered to be of high magnitude, local extent and long term and thus of ***high (-)*** significance. Should the historical built environment be avoided, through mitigation, the impact would have ***low (-)*** significance.

With regards to potential impacts on palaeontological resources, the construction of the facility would involve excavations into the superficial sediment cover (soils, alluvial gravels etc.) and potentially also into the underlying potentially fossiliferous bedrock. These include excavations for the PV tracker support structures, buried cables, internal access roads, any new power line pylons and associated infrastructure. Potential fossil heritage within the study area may be destroyed, disturbed or permanently sealed in and would no longer be available for scientific research or other public good.

The footprints for both the preferred and alternative sites are small and largely underlain by superficial deposits of low paleontological sensitivity. Extensive, deep bedrock excavations are not envisaged during the construction phase. As such, the impact significance on fossil heritage is considered to be of low magnitude, local extent and long term and therefore of ***low (-)*** significance, without or with mitigation, for all alternatives.

c) Mitigation measures

The following mitigation measures are recommended:

- The complex LSA sites on the hill to the south, as well as the historical buildings on the alternative site should be demarcated as a no-go area during construction;
- Destruction of these structures would require a detailed survey and recording of the entire complex, as well as a permit from the relevant heritage authority;
- Archaeological sites (areas indicated with a red dot on **Figure 4-10**) should be mitigated by excavation and sampling of sites before the start of construction should they be threatened by construction activities; and
- In the event of accidental uncovering of graves or substantial fossil remains (e.g. vertebrate bones and teeth, large blocks of petrified wood), work must stop immediately and SAHRA should be notified. An archaeologist / palaeontologist should be involved to assist with the investigation and procedures to address the situation.

d) Cumulative impacts

Considering the scale of archaeological research in other parts of South Africa, relatively little is known of Bushmanland and the loss of any significant LSA sites would impact on knowledge of the wider region. With many energy generation facilities planned in the region, the potential to lose many sites exists. The historical archaeological sites on the site are not yet legally protected, while no significant pre-colonial resources occur. Cumulative impacts are not of concern in this regard.

Given the low overall paleontological sensitivity of the Karoo bedrocks and Pleistocene to Recent superficial sediments of the region as a whole, the cumulative palaeontological impact of this development is not considered to be of a significance higher than the individual impact (i.e. low (-)).

4.4.4 Impact on local economy (employment) and social conditions

The project would generate between 70 and 100 jobs during the operational phase, which is expected to last the full period of the Power Purchase Agreement which is 20 years. The construction phase is expected to produce a maximum of 200 jobs (amounting to a total of 900 person months employment created over the construction period) depending on the procurement method used.

a) Impact assessment

Up to 100 operation and maintenance jobs would be created during the operational phase. Indirect and induced jobs would also result from the proposed project.

The operating expenditure of the proposed project would be roughly R 30 million, of which up to R 15 million would be spent in South Africa. Increased spending (procurement of goods and services) in South Africa would indirectly result in more employment opportunities.

Increased employment opportunities (direct and indirect) would allow for an improvement in social conditions for those who obtain employment. The project would also result in an increase

in the revenue of the Local Municipality through increased rates and taxes. This in turn could result in an increase in municipal spending on social programmes.

Based on the number of employment opportunities during the operational phase the potential impact on the local economy (employment) and social conditions is considered to be low magnitude, regional and long term and therefore of ***low (positive)*** significance, with or without mitigation.

No difference in significance would result from the proposed alternatives.

b) Mitigation measures

The following mitigation measures are recommended:

- Give preference to local communities for employment opportunities; and
- Base recruitment on sound labour practices and with gender equality in mind.

4.4.5 Impact on traffic

Construction vehicles are likely to make use of the existing roads to transport equipment and material to the construction site. These vehicles would include:

- 450 truckloads transporting 900 40-foot containers;
- Two to five digger loaders for land clearing; and
- Five to ten trucks with cranes to assemble the plant.

Transporting components to site is likely to necessitate the upgrading of sections of road to ensure clearances and bends are negotiable by trucks.

The potential impact of the project on transport is considered to be of low magnitude, regional extent and short term and therefore of ***very low (-)*** significance, with or without mitigation. The cumulative potential impact of energy projects on transport is considered to be of high magnitude, regional extent and short term and therefore of high (-) significance, with or without mitigation due to the significance of transporting wind turbine components. No difference in impact significance would result from the proposed alternatives.

The following mitigation measures are recommended:

- Ensure that road junctions have good sightlines;
- Implement traffic control measures where necessary;
- Transport components overnight as far as possible; and
- Engage with the roads authorities prior to construction to ensure the necessary road upgrades, permits, traffic escorts etc are scheduled.

4.4.6 Visual impact

Construction activities would include upgrading the site accesses, constructing new site roads, excavating for foundations and installations of above ground infrastructure. These are expected

to be most visible within 2 km, especially as the construction plant would be fitted with warning lights and sounds.

The potential construction phase visual impact is considered to be of medium intensity, site specific in extent and short term and therefore of ***low (-)*** significance, without mitigation. With the implementation of mitigation measures this would reduce to ***very low to low (-)*** significance. No difference in impact significance would result from the proposed alternatives.
The following mitigation measures are recommended:

- Minimise the construction period, where possible;
- Access road are to be kept tidy, and measures shall be taken to minimise dust from construction traffic on gravel roads;
- Topsoil should be removed, conserved and used for rehabilitation; and
- Site offices, if required, should be limited to single storey and they should be sited carefully using temporary screen fencing to screen from the wider landscape

4.4.7 Storage of hazardous substances on site

As at any construction site, various hazardous substances are likely to be used and stored on site. These substances may include amongst other things, diesel, curing compounds, shutter oil and cement. Utilisation of such substances in close proximity to aquatic environments such as pans is of greater concern than when used in a terrestrial environment.

Use of hazardous substances at a construction site is controlled by various pieces of legislation. The management and protection of the environment would however be achieved through the implementation of an EMP, which would *inter alia* specify the storage details of hazardous compounds and the emergency procedures to follow in the event of a spillage.

The potential impact of spillages is considered to be of low intensity, site specific in extent and long term and therefore of ***low (-)*** significance, without mitigation. With the implementation of mitigation measures this would reduce to ***very low (-)*** significance. No difference in impact significance would result from the proposed alternatives.

4.4.8 Noise pollution

An increase in noise pollution would be expected from the operation of heavy machinery during the construction period, as well as due to the increased traffic. The severity of this impact is likely to be reduced due to the low numbers of people in close proximity to the site.

The potential impact of noise is considered to be of very low intensity, site specific in extent and short term and therefore of ***very low (-)*** significance, without or with mitigation. No difference in impact significance would result from the proposed alternatives.

4.4.9 Dust impacts

Construction vehicles are likely to make use of the existing farm roads to transport equipment and material to the construction site. Earthworks would also be undertaken. These activities

would exacerbate dust especially in the dry winter months. The dust impact would be managed through the EMP, which would include procedures for dealing with dust pollution events including watering of roads, etc.

The potential impact of dust is considered to be of low intensity, site specific in extent and short term and therefore of ***very low (-)*** significance, without and with mitigation. No difference in impact significance would result from the proposed alternatives.

4.5 SUMMARY OF POTENTIAL IMPACTS

A summary of all the potential impacts from the proposed project assessed above is included in **Table 4.2**. While some difference in magnitude of the potential impacts would result from the proposed alternatives this difference was not considered to be significant for any of the potential impacts. As such, the table below applies to all proposed alternatives.

Table 4.2 Summary of potential impacts of the proposed project[37]

Potential impact	No mit/Mit[38]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[39]	Reversibility
OPERATIONAL PHASE								
Impact on botany:	No mit	Local	Low	Long term	**Low (-)**	Definite	Sure	Irreversible
	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Irreversible
Impact on birds	No mit	Local	Medium - Low	Long term	**Medium - Low (-)**	Probable	Sure	Irreversible
	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Irreversible
Impact on fauna	No mit	Local	Low	Short term	**Low (-)**	Probable	Low	Reversible
	Mit	Local	Low	Short term	**Low (-)**	Probable	Low	Reversible
Impact on surface water: Aquatic	No mit	Local	Medium	Short term	**Medium (-)**	Probable	Low	Reversible
	Mit	Local	Low	Short term	**Low (-)**	Probable	Low	Reversible
Stormwater	No mit	Local	Medium	Short term	**Medium (-)**	Probable	Low	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Low	Reversible
Visual aesthetics	No mit	Regional	Medium - High	Long term	**Medium - High (-)**	Definite	Sure	Reversible
	Mit	Regional	Medium - Low	Long term	**Medium - Low (-)**	Definite	Sure	Reversible
Impact on energy production	No mit	Regional	Low	Long term	***Low (+)***	Probable	Sure	Reversible
	Mit	Regional	Low	Long term	***Low (+)***	Probable	Sure	Reversible
Impact on climate change	No mit	Regional	Very Low	Long Term	**Low (+)**	Probable	Sure	Reversible
	Mit	Regional	Very Low	Long Term	**Low (+)**	Probable	Sure	Reversible
Impact on local economy (employment) and social conditions	No mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
	Mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
Impact on agricultural land	No mit	Local	Very low	Long term	**Very low (-)**	Probable	Sure	Reversible
	Mit	Local	Very low	Long term	**Very low (-)**	Probable	Sure	Reversible
Impact on surrounding land uses	No mit	Regional	Low	Long term	**Low(-)**	Probable	Unsure	Reversible
	Mit				Undetermined			
CONSTRUCTION PHASE								
Impacts on flora, avifauna and fauna	No mit	Local	Low	Medium term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Very Low	Medium term	**Very Low (-)**	Probable	Sure	Reversible
Sedimentation, erosion and aquatic ecology	No mit	Local	Low	Short term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible

[37] While some difference in magnitude of the potential impacts would result from the proposed alternatives this difference was not considered to be significant for any of the potential impacts. As such, the table applies to all proposed alternatives.
[38] Note that this refers to No mitigation and Mitigation.
[39] Conf.=Confidence in the assessment of the potential impact.

Potential impact	No mit/Mit[38]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[39]	Reversibility
Impact on traffic	No mit	Regional	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
	Mit	Regional	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
Impact on heritage resources:	No mit	Local	Medium	Long term	**Low (-)**	Definite	Low	Irreversible
Archaeology: Preferred layout	Mit				No mitigation required			
Archaeology: Alternative layout	No mit	Local	Medium	Long term	**Low (-)**	Definite	Low	Irreversible
	Mit	Local	Medium	Long term	**Low (-)**	Probable	Sure	Irreversible
Palaeontology	No mit	Local	Low	Long term	**Low (-)**	Unlikely	Low	Reversible
	Mit	Local	Low	Long term	**Low (-)**	Unlikely	Sure	Reversible
Impact on local economy (employment) and social conditions	No mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
	Mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
Impact on visual	No mit	Local	Medium	Short term	**Low (-)**	Definite	Sure	Reversible
	Mit	Local	Medium	Short term	**Very Low (-)**	Probable	Sure	Reversile
Noise pollution	No mit	Local	Very Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
	Mit	Local	Very Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
Storage of hazardous substances on site	No mit	Local	Low	Short term	**Low (-)**	Probable	Sure	Irreversible
	Mit	Local	Low	Short term	**Low (-)**	Unlikely	Sure	Irreversible
Impact of dust	No mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible

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5 CONCLUSIONS AND WAY FORWARD

The purpose of this Chapter is to briefly summarise and conclude the EIAR and describe the way forward.

5.1 CONCLUSIONS

The proposed project comprises:

- Construction of a 100 MW PV plant;
- Associated infrastructure including:
    - Upgrade of existing internal farm roads to accommodate the construction vehicles; and
    - Construction of a 132 kV transmission line to connect the proposed PV plant with Eskom's grid via the Kronos substation.

The following feasible alternatives were considered in the EIAR:

- Location alternatives:
    - One location for the proposed PV plant on Klipgats Pan; and
    - Electricity distribution via a 1.66 km or 2.14 km 132 kV connection to Kronos substation.
- Activity alternatives:
    - Solar energy generation via a PV plant; and
    - "No-go" alternative to solar energy production.
- Site layout alternatives:
    - Two layout alternatives.
- Technology alternatives:
    - Two technology alternative in terms of the solar panel type (PV vs. CPV);
    - Dual Axis tracking system to mount the panels; and
    - Four foundation options.

Aurecon submits that this Draft EIAR provides a comprehensive assessment of the environmental issues associated with each of the feasible alternatives of the proposed project outlined in the FSR and the associated Plan of Study for EIA. These impacts and alternatives were derived in response to inputs from consultation with I&APs, provincial and local authorities, and the EIA project team.

Table 5.1 provides a summary of the significance of the environmental impacts associated with this proposed project.

Table 5.1 Summary of significance of the potential impacts associated with the proposed development[40]

OPERATIONAL PHASE IMPACTS		No Mit	With Mit
1	Impact on botany	L	L
2	Impact on birds	L-M	L
3	Impact on fauna	L	L
4.1	Impact on surface water Aquatic	M	L
4.2	Stormwater	M	VL
5	Visual aesthetics	M-H	L-M
6	Impact on energy production	L+	L+
7	Impact on climate change	L+	L+
8	Impact on local economy (employment) and social conditions	M+	M+
9	Impact on agricultural land	VL	VL
10	Impact on surrounding land uses	L	Undetermined
CONSTRUCTION PHASE IMPACTS			
11	Impacts on flora, avifauna and fauna	L	VL
12	Sedimentation, erosion and aquatic ecology	L	VL
13	Impact on traffic	VL	VL
14	Visual impact	L	VL
15.1	Impact on heritage resources Archaeology: Preferred layout	L	Not required
15.2	Archaeology: Alternative layout	L	L
15.3	Palaeontology	L	L
16	Impact on local economy (employment) and social conditions	M+	M+
17	Impact on visual	L	VL
18	Noise pollution	VL	VL
19	Storage of hazardous substances on site	L	L
20	Impact of dust	VL	VL

KEY

H	High Significance	VL	Very Low Significance
M-H	Medium to High Significance	N	Neutral Significance
M	Medium Significance	H+	High positive significance
L-M	Low to Medium Significance	M+	Medium positive significance
L	Low Significance	L+	Low positive significance
VL-L	Very Low to Low Significance		

[40] While some difference in magnitude of the potential impacts would result from the proposed alternatives this difference was not considered to be significant for any of the potential impacts. As such, the table applies to all proposed alternatives.

5.2 LEVEL OF CONFIDENCE IN ASSESSMENT

With reference to the information available at the feasibility stage of the project planning cycle, the confidence in the environmental assessment undertaken is regarded as being acceptable for the decision-making, specifically in terms of the environmental impacts and risks. The EAP believes that the information contained within the FSR and this EIAR is adequate to inform Mulilo's decision making regarding which alternatives to pursue and will allow DEA to be able to determine the environmental acceptability of the proposed alternatives.

It is acknowledged that the project details will evolve during the detailed design and construction phases to a limited extent. However, these are unlikely to change the overall environmental acceptability of the proposed project and any significant deviation from what was assessed in this EIAR should be subject to further assessment. If this was to occur, an amendment to the Environmental Authorisation may be required in which case the prescribed process would be followed.

5.3 OPERATIONAL PHASE IMPACTS

With reference to **Table 5.1**, the most significant (**medium to high (-)**) operational phase impacts on the biophysical and social environment, without mitigation was for the potential impacts of the proposed solar energy plant on visual aesthetics. With the implementation of mitigation measures the impact on visual aesthetics would decrease to **low-medium (-)**. It is not currently known what the significance of the impact on surrounding land uses would decrease to, however it is anticipated that, if required, mitigation measures agreed to in consultation with SKA would decrease to a level acceptable to SKA. It should be noted that two potential positive impacts on energy production, climate change and local economy (employment) and social conditions would result and these would be of **medium (+), low (+)** and **low (+)** significance (respectively), with and without mitigation measures.

In terms of differences in the significance of potential impacts of the feasible alternatives, there are none and as such Mulilo should choose their preferred alternative based on technical and financial considerations.

5.4 CONSTRUCTION PHASE IMPACTS

None of the negative construction phase impacts were deemed to have a significant impact on the environment, given their duration (approximately 18-30 months) and localised extent. The construction impacts were assessed to be of **very low to low (-)** significance, with and without mitigation measures with the implementation of the recommended EMP. It should be noted that a potential positive impact on local economy (employment) and social conditions would result and would be of **low (+)** significance, with and without mitigation measures.

5.5 RECOMMENDATIONS

Chapter 4 has outlined mitigation measures which, if implemented, could significantly reduce the negative impacts associated with the project. Where appropriate, these and any others identified by DEA could be enforced as Conditions of Approval in the Environmental Authorisation, should DEA issue a positive Environmental Authorisation. The mitigation measures are outlined below:

Operation phase impacts:

Botanical impacts

- A rehabilitation plan for the site should be compiled with the aid of a rehabilitation specialist and adhered to.
- Shallow depressions and well defined pans should be avoided, with buffer zones of at least 30 m around pans.

Avifaunal (bird) impacts

- Minimize the footprint of the development;
- Minimize noise and disturbance associated with maintenance activities at the plant once it becomes operational;
- Use bird-safe structures (ideally with critical air gaps greater than 2 m), should above-ground power lines be used. Exclude birds physically from high risk areas of live infrastructure and comprehensively insulate such areas to avoid bird electrocution;
- Minimise the length of any above-ground power lines and mark all new lines with bird flight diverters. Mark above-ground lines for their entire length as there is currently insufficient data to indicate high risk areas. Recommendations from bird monitoring could indicate high risk areas to remain marked in the future. Where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line; and
- Instituting a comprehensive impact monitoring scheme, and using the results of this scheme to inform and refine a dynamic approach to mitigation.

Faunal impacts

- Small ground level openings, 20-30 cm in height, should be allowed for in the electrical fence to facilitate the movement of small mammals and reptiles through the site.

Surface water impacts

- Monitoring, together with the development of an environmental management plan as operation proceeds will be the most effective strategy;
- Monitor both soil chemistry and erosion and mitigate if required;
- Implement erosion control measures should there be evidence of erosion;
- Should soil chemistry be affected (this is likely to be an increase in salinity), the nature of the washing mixture could be changed, or acceptable waste treatment employed;
- Remove perennial alien species such as *P. glandulosa* at sites disturbed or cleared, or where panel washing occurs;
- Install composting toilets that does not require water, septic tanks or soak-aways;

- Stormwater channels and "mitre" chutes should be constructed to direct the stormwater flows and minimize and control erosion. Each catchment covered by the site should have a separate drainage system and associated detention pond;
- Gravel roads should be graded and shaped with a 2 % crossfall back into the slope, allowing stormwater to be channelled in a controlled manor towards the natural drainage lines;
- Where roads intersect natural, defined drainage lines, suitably sized pipe culverts or drive through causeways should be installed or constructed;
- The minor storm design period should be used to determine the size of the earth channels. A return period of 1:5 years is applicable which approximates to an average intensity of 29 mm/hour; and
- The major storm occurrence (i.e. 1:25 year, 1:50 year & 1:100 year) should be used to calculate culverts in defined drainage lines and determine flood levels where necessary. The intensities for each occurrence are: 1:25 year – 45 mm/hour, 1:50 year – 52 mm/hour and 1:100 year – 60 mm/hour respectively.

Visual impacts

- All excess material shall be removed off-site, and all the ground shall be returned to original levels/gradients as far as possible;
- New structures should be placed where they are least visible to the greatest numbers of people, in places where the topography can offer shielding, where possible;
- Visibility of buildings and the local sub-station should be reduced by cladding the buildings in non-reflective colours and materials that will blend in with natural environment. E.g. cladding with local stone or plaster and paint with earthy tones for paint colours, roofs should be grey and non-reflective and doors and window frames should reference either the roof or wall colours;
- Finishing materials of the infrastructure (including support structures) should be of colours that are non-reflective and in dark matte colours such as dark grey or charcoal; and
- Information on the project should be provided to local people, such as through a poster at the entrance to the site.

Impacts on local economy (employment) and social conditions

- Give preference to local communities for employment opportunities; and
- Base recruitment on sound labour practices and with gender equality in mind.

Surrounding land uses impacts

- Implement measures recommended in the modelling study, as agreed to with SKA.

Construction phase impacts:

Flora, avifauna and fauna impacts

- In all cases construction of access roads should be designed for minimal impact. All construction should take place within the footprint of the proposed PV plant;
- A rehabilitation plan for the site should be compiled with the aid of a rehabilitation specialist and adhered to;

- Compile and implement a vegetation rehabilitation plan with the aid of a rehabilitation specialist, for inclusion in the Construction EMP. The specialist is to recommend species to be used in rehabilitation as well as any special measures for rehabilitation such as shade-netting and alien vegetation removal;
- The construction phase should be closely monitored by an Environmental Control Officer who should identify any areas that would require rehabilitation in the post-construction phase. The restoration of those areas must follow the construction phase;
- Demarcate no-go areas identified during pre-construction monitoring;
- Low-lying depressions and watercourses should be avoided wherever possible;
- Shallow depressions and well defined pans should be avoided and buffered by at least 30 m; and
- The site should be cleared in sections as required for construction and not all at once

Sedimentation, erosion and aquatic ecology impacts

- The proposed project should be located away from the no-go areas, including a 30 m buffer area around these no-go areas;
- Access roads should be positioned in such a way that no clearing within no-go areas is required and definite drainage areas should be avoided;
- Should additional access roads be required, these should be limited to one crossing point and built with culverts to prevent the impediment of water movement;
- The use of erosion control measures to minimise erosion at excavation / clearing sites or aggregate storage sites;
- Earth moving construction activities should take place in the dry season as far as possible; and
- Remove perennial alien species such as *P. glandulosa* at sites disturbed or cleared by construction activities.

Heritage resources (including palaeontology) impacts

- The complex LSA sites on the hill to the south, as well as the historical buildings on the alternative site should be demarcated as a no-go area during construction;
- Destruction of these structures would require a detailed survey and recording of the entire complex, as well as a permit from the relevant heritage authority;
- Archaeological sites (areas indicated with a red dot on **Figure 4-10**) should be mitigated by excavation and sampling of sites before the start of construction should they be threatened by construction activities; and
- In the event of accidental uncovering of graves or substantial fossil remains (e.g. vertebrate bones and teeth, large blocks of petrified wood), work must stop immediately and SAHRA should be notified. An archaeologist / palaeontologist should be involved to assist with the investigation and procedures to address the situation.

Impacts on local economy (employment) and social conditions

- Give preference to local communities for employment opportunities; and
- Base recruitment on sound labour practices and with gender equality in mind.

Transportation impacts

- Ensure that road junctions have good sightlines;
- Implement traffic control measures where necessary;
- Transport components overnight as far as possible; and
- Engage with the roads authorities prior to construction to ensure the necessary road upgrades, permits, traffic escorts etc. are scheduled.

Visual impacts

- Minimise the construction period, where possible;
- Access road are to be kept tidy, and measures shall be taken to minimise dust from construction traffic on gravel roads;
- Topsoil should be removed, conserved and used for rehabilitation; and
- Site offices, if required, should be limited to single storey and they should be sited carefully using temporary screen fencing to screen from the wider landscape

Noise impacts

- Implement measures as provided in the EMP, which includes procedures for dealing with noise.

Storage of hazardous substances on site

- Implement measures as provided in the EMP, which *inter alia* specify the storage details of hazardous compounds and the emergency procedures to follow in the event of a spillage; and
- Comply with the various pieces of legislation controlling the use of hazardous substances at a construction site.

Dust impacts

- Implement measures as provided in the EMP, which includes procedures for dealing with dust pollution events including watering of roads, etc.

5.5.1 Considerations in identification of preferred alternative

Following the finalisation in the EIAR, the next step in the EIA process is for Mulilo to identify their preferred option, utilising this EIAR together with technical, financial and other considerations to inform their decision.

The proposed project results in **low to medium (+)** significance impacts and **medium to high (-)** significance impacts, without mitigation, on the environment. The negative impacts of the proposed project are considered to be environmentally acceptable, considering the positive impacts and considering that the significance of impacts would reduce to **low-medium to very low (-)** with the implementation of mitigation measures.

In terms of differences in the significance of potential impacts of the feasible alternatives, there are none and as such Mulilo should choose their preferred alternative based on technical and financial considerations.

5.5.2 Opinion with respect to environmental authorisation

Regulation 32(2)(m) of the EIA Regulations requires that the EAP include an opinion as to whether the activity should be authorised or not.
The impacts associated with the proposed project would result in regional impacts (both biophysical and socio-economic) that would negatively affect the area. The significance of these impacts **without mitigation** is deemed to be of **medium or lower** significance. However, with the implementation of the recommended mitigation measures the significance of the negative impacts would be minimized and would be **low or very low**, for all but one impact.

Associated with the proposed project are positive impacts on energy production, climate change and local economy (employment) and social conditions of **low to medium (+)** significance.

Based on the above, the EAP is of the opinion that the proposed solar energy facility and associated infrastructure, including alternatives, being applied for be authorised as the benefits outweigh the negative environmental impacts. The significance of negative impacts can be reduced with effective and appropriate mitigation through a Life-Cycle EMP, as described in this report. If authorised, the implementation of an EMP should be included as a condition of approval.

5.6 WAY FORWARD

The Draft EIAR has been lodged at the Prieska (Elizabeth Vermeulen) Public Library, Ietznietz in Copperton and on the Aurecon website (www.aurecongroup.com - change "Current Location" to "South Africa" and follow the Public Participation links). All registered I&APs have been notified of the availability of the Draft EIAR by means of a letter which includes a copy of the Draft EIAR Executive Summary. The public will have until 22 May 2012 to submit written comment on the Draft EIAR to Aurecon.

The Final EIAR will be completed via the addition of any I&AP comments and the addition of a letter from Mulilo indicating which mitigation measures will be implemented. The Final EIAR will then be submitted to the Northern Cape DEANC and DEA for their review and decision-making, respectively.

The Final EIAR will be made available for review at the same locations as the Draft EIAR. Any comments received on the Final EIAR will not be included in a Comments and Response Report but will instead be collated and forwarded directly to DEA.

Once DEA has reviewed the Final EIAR, they will need to ascertain whether the EIA process undertaken met the legal requirements and whether there is adequate information to make an informed decision. Should the above requirements be met, they will then need to decide on the environmental acceptability of the proposed project. Their decision will be documented in an Environmental Authorisation, which will detail the decision, the reasons therefore, and any related conditions. Following the issuing of the Environmental Authorisation, DEA's decision will

be communicated by means of a letter to all registered I&APs and the appeal process will commence, during which any party concerned will have the opportunity to appeal the decision to the Minister of Environmental Affairs in terms of NEMA.

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