

Heritage Impact Report
to meet the requirements of Section 38(8) and (3) of the National Heritage Resources Act

**Proposed Solar Facility
Onder Rietvlei Portion 3 of Farm 18
Aurora, Western Cape**

prepared for
Aurecon South Africa (Pty) Ltd

27 July 2011 by Quahnita Samie

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Executive Summary

Aurecon South Africa (Pty) Ltd on behalf of *Solaire Direct Southern Africa (Pty) Ltd*, appointed *vidamemoria* heritage consultants to conduct the necessary heritage impact report for the *Proposed solar facility at Onder Rietvlei farm portion 3 of farm 18, Aurora*. Aurecon appointed OvP Landscape Architects to conduct the Visual Impact Assessment (dated February 2011) and the Archaeology Contracts Office to conduct the necessary Archaeological Impact Assessment (dated June 2011).

The report is aimed at satisfying the requirements of sections 38 (3) and 38 (8) of the National Heritage Resources Act (NHRA 25 of 1999) and is submitted to Heritage Western Cape (HWC) for comment as a component of a Basic Environmental Impact Assessment process¹.

The subject of this assessment is a proposed solar plant on approximately 20 ha of disturbed agricultural land and the construction of a 22 kV power line from the site to the new Vredelust substation to transfer solar generated electricity to the national grid.

Agricultural activities at Farm Onder Rietvlei have resulted in significant impacts including the complete removal of the original Leipoldtville Sand Fynbos. Rehabilitation of the site to the original fynbos vegetation after years of cultivation, grazing and high level disturbances would be highly unlikely. The context within which the site lies, was identified as possessing low intrinsic heritage value. Furthermore, no heritage resources were identified within the immediate context of the site. The site is therefore considered to possess a very low level of intrinsic heritage value whilst contributing to the cultural landscape through patterns of agricultural development in a very limited capacity.

The assessment reveals that the contextual and intrinsic significance of the site is considered to be low. The property could thus accommodate the proposed solar plant without having a detrimental impact on heritage resources. The proposed intervention would yield positive social and economic benefits without a negative impact on heritage resources. Within the landscape, the proposed solar farm could be easily screened and integrated into the surroundings. No archaeological impact is expected. The overall status of the impact is thus considered to be low as no heritage resources would be impacted on.

It is therefore recommended that the proposed solar farm be supported.

¹ National Environmental Management Act, 1998 (Act No. 107 of 1998), Regulation 543 of 18 June 2010.

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1. INTRODUCTION and BACKGROUND

Aurecon South Africa (Pty) Ltd on behalf of Solaire Direct Southern Africa (Pty) Ltd appointed *vidamemoria heritage consultants* to conduct the necessary Notification of Intent to Develop (NID) in terms of Section 38(1) of the National Heritage resources Act (Act 25 of 1999) for the *Proposed solar facility at Onder Rietvlei farm portion 3 of farm 18, Aurora*. NID dated 7 March 2011 was submitted to Heritage Western Cape for consideration and response dated 18 April 2011 requested 'a *Heritage Impact limited to a Visual Impact Study and an Archaeological Study*' (Refer Annexure A).

Aurecon have appointed *OvP Landscape Architects* to conduct the Visual Impact Assessment (VIA dated February 2011) and *Archaeology Contracts Office* to conduct necessary Archaeological Impact Assessment (AIA dated June 2011) as incorporated within this assessment.

The subject of this assessment is a proposed solar farm on approximately 20 ha of disturbed agricultural land and the upgrading of an existing power line from the site to the Vredelust substation to transfer solar generated electricity to the national grid. The proposed solar plant would change the character of a site located within an agricultural setting. Preliminary investigation revealed that the site appeared to be of low cultural significance, however, further archaeological and visual investigation as well as targeted public engagement was undertaken to determine significance. An assessment of limited scope was thus compiled.

The proposed solar plant triggers the following in terms of Section 38(1):

- (a) Construction of a powerline over 300m in length
- (c)(a) activity that will change the character of a site exceeding 5 000 m²

The proposed project also constitutes a listed activity in terms of the NEMA EIA Regulations (GN No. R543 of 18 June 2010) and triggers Activity 1 of Listing Notice 1 (Regulation R544): *the construction of facilities or infrastructure for generation of electricity*. Therefore, the application for a solar plant is to be considered in conjunction with all such applications at a national level.

Section 38 (8) states that provisions of section 38 do not apply to a development as described in subsection (1) if an evaluation of the impact of such development on heritage resources is required in terms of the environmental impact assessment process¹, provided that an evaluation fulfils the requirements of the relevant heritage resources authority in terms of the requirements as set out for a heritage impact assessment in terms of the NHRA and the comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account. A Basic Assessment Report (BAR) is to be submitted to Department Environmental Affairs by Aurecon on behalf of Solaire Direct.

This assessment report is thus submitted for comment as a component of the environmental impact assessment process in terms of Section 38(8) and is designed to meet requirements of section 38(3) of the NHRA.

¹ In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), Regulation 543 of 18 June 2010, Environment Conservation Act, 1989 (Act No. 73 of 1989) or the integrated environmental management guidelines issued by the Department of Environmental Affairs and Tourism, or the Minerals Act, 1991 (Act No. 50 of 1991), or any other legislation

2. LOCATION AND SITE CONTEXT

2.1 Locality and context

The proposed site is located approximately 10 km to the north of Aurora along the MR534 access route linking Aurora and Redelinghuys. The Vredelust substation is located approximately 14 km to the north east of the site. The area is known for its sandy soils and a large amount of potato farming has been and still is practiced in the vicinity of Aurora. Other land uses include cattle and citrus farming.



Figure 1: Regional Context (extract: S A Road atlas pg 9)

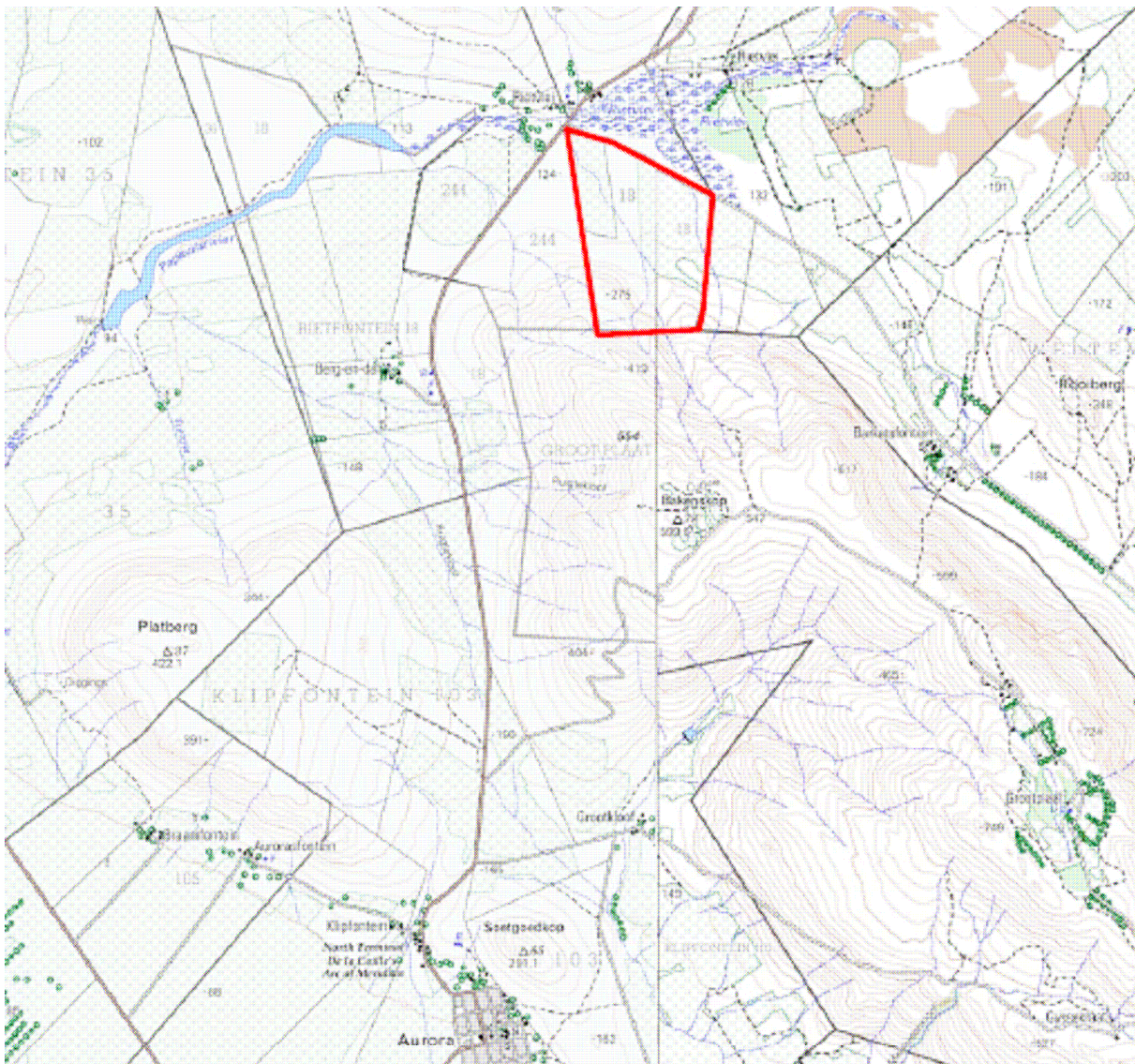


Figure 2: Locality of the proposed development site on 1:50 000 topographical map (3318 DC Belcher 2011: 6)

The area has a typical rural West Coast farmland character that is fairly open and simply organised by pivot irrigated agricultural fields. (OvP 2011: 11). The area has a rural and peaceful atmosphere, gently undulating and rising towards the koppies and dissected by angular farm roads and fence lines. Simple farm buildings are scattered throughout the landscape.



Figure 3: Site view looking north east depicting low hills and gentle undulations (OvP 2011: 28)

The size and boundaries of surrounding farms are irregular in form, extent and cover. There are no formal conservation areas close to the subject property. The proposed site lies within a valley 120 m to the north of Aurora is thus not visible from the town. The valley is held between two koppies, namely Tierneskop 2,5 km to the north at approximately 400 m elevation; and Bakenskop 2 km south-east at approximately 600 m (OvP 2011: 11) and is screened from surrounding towns and farmlands in the region. The saddle on which Onder Rietvlei Farm is situated is surrounded by land transformed by agricultural activity and where patterns of growth and harvest are defined temporarily.

In terms of vegetative cover the two koppies are in a fairly pristine condition, whereas the saddle has been largely transformed by agricultural use and planted windbreaks are typical of the landscape. The cultural landscape is derived from linear farm boundaries, angular junctions of cadastral lines and circular spill-point fields overlaid onto natural landforms of the koppies, marsh and seasonal streams (OvP 2011: 18-20).

2.2 Site description

Agricultural activities at Farm Onder Rietvlei have resulted in significant impacts including complete removal of the original Leipoldtville Sand Fynbos at the site. Rehabilitation of the site to the original fynbos vegetation after years of cultivation and grazing and high level of disturbance would be highly unlikely. Furthermore, the proposed site for the solar plant was previously used primarily for potato farming and limited stock farming. Farm buildings are located to the north of the proposed site and the site is screened by a row of fir trees on its western boundary.



Figure 4: gravel access road

Access to the site is from a gravel road serving local farms. The site is only visible to the public from this gravel access road. The site is thus fairly isolated and although tourists regularly visit the nearby town of Aurora, the road that passes by the site is infrequently used as connector route. Surrounding farms are the permanent home of a small number of farm workers and farm owners.

All natural vegetation was removed from the whole of the solar energy facility footprint by 2006 (Bergwind (2011: 6). The cultivation of potatoes persisted until 2008, however, by 2010 it is evident that cultivation of the area had ceased and it had been allowed to become fallow. The site is presently fallow and grazed but not cultivated.



Figure 5: Looking north-west over the fallow lands of the site. Note cattle grazing in this area. (Bergwind 2011: 11)



Figure 6: The north-west sector of the study site. It is highly disturbed and transformed from the original natural vegetation type and unlikely to be successfully rehabilitated. (Bergwind 2011: 12)

The Papkuil River and its associated wetland area, Rietvlei, are situated along the northern boundary to the site. Freshwater features consist of a drainage channel that crosses the site from the south to the northwest corner closest to the wetland. This drainage channel is disturbed and destabilized and now follows a path northwards where as in the past it flowed north eastwards (Belcher 2011: 14).



Figure 7: Aerial view of the site with the drainage channel (blue line), proposed layout for the solar panels (yellow rectangle) and estimated area that is seasonally inundated (Belcher 2011: 1)

The lower section of this channel, physically separated from the Rietvlei wetland by the road, is highly modified by past agricultural activities becomes seasonally inundated during winter months. There are also two artificial storm water channels located along the fence lines to drain the field during wet periods, which are of little freshwater significance.



Figure 8: The lower portion of the drainage channel (Belcher 2011: 10)



Figure 9: Furrows that have been constructed to drain these lands for agricultural purposes (Belcher 2011: 10)

3. IDENTIFICATION OF HERITAGE RESOURCES

Historical aerial photographs of the site and surrounding area indicate that the land was being cleared for agricultural use as long ago as 70 years ago.

The surrounding context is naturally coloured alternately vivid green during the wet winters and muted yellow during dry summers. Agricultural fields contrasts with the diversity of the indigenous flora on the steeper slopes and hilly flanks. As visual manifestations the circular spill-point fields are iconographic of agricultural use of the area and of the particular irrigation technology employed. Farm buildings are scattered throughout the landscape along rural gravel roads. (OvP 2011: 19)

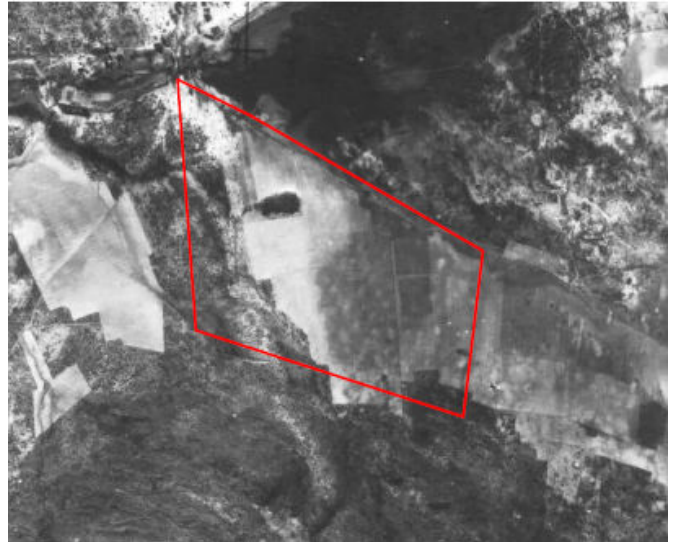


Figure 10: Aerial photograph 1942 (extracted from Belcher 2011: 11)



Figure 11: Aerial photograph 2011 immediate context

The cultural landscape is derived from linear farm boundaries, angular junctions of cadastral lines and circular spill-point fields overlaid onto natural landforms of the koppies, Rietvlei and seasonal streams (OvP 2011: 18-20).

In 1838 the Maclear Beacon was positioned near the original north terminal of the Arc of Meridian by Abbe de la Caille, the first surveyor to introduce Geodetic Surveying into South Africa. Sir Thomas Maclear was an Irish-born South African astronomer who became Her Majesty's astronomer at the Cape of Good Hope. The beacon is a declared provincial heritage site and is located in close proximity to Aurora on the Farm Papkuilsfontein.



Figure 12: Location of heritage site in relation to Aurora



Figure 13: Maclears Beacon

Apart from Maclears Beacon, no other heritage sites were identified. Furthermore, there are no declared or other heritage sites located within the Aurora context and site context.

In terms of archaeological resources, very little was noted at the site. In one area three small fragments of black mussel (*Choromytilus meridionalis*) were noted and at another point a single, very weathered silcrete flake was found. While the former perhaps represent items dropped by a LSA person crossing the landscape, the latter is likely MSA. A very obvious rock shelter is located just upslope of the proposed site and this was visited as well. It contained no archaeological remains at all besides one fragment of burnt bone. Its floor is water-washed, perhaps explaining the paucity of material (ACO 2011: 9).

Three old structures are located on the farm Onder Rietvlei (18/3). These are in a poor condition, however, plans are underway to restore structures.



Figure 14: View of the front of the 19th century house (ACO 2011:10)

External hearth has caved in and a large portion of the rear wall. Some internal walls have also been removed and parts of the structure are unstable. Some joinery is still present but most is damaged to some degree



Figure 15: View of the 19th century barn east of the (ACO 2011: 11)

Although parts are still relatively sturdy, one side wall is in danger of collapsing which would likely result in much of the remainder falling down.



Figure 16: gum treeline (ACO 2011: 8)

The large gum tree line located along and partly within the road servitude is considered as a heritage resource.

The cultural landscape thus comprises a number of elements that are to be taken into consideration within the assessment of impact on heritage resources. These are:

- linear farm boundaries and angular junctions of cadastral lines
- circular spill-point fields
- natural landforms of the koppies, Rietvlei and seasonal streams
- agricultural fields contrasting with the diversity of the indigenous flora
- farm buildings are scattered throughout the landscape along rural gravel roads
- notable vegetation including gum trees and wind breaks associated with the landscape

4. STATEMENT OF SIGNIFICANCE

The immediate context does not fall within a conservation or protected heritage area. In addition the subject property and the surrounding context is not located near to or visible from any protected heritage sites. Whereas the property can be seen to form part of the rural cultural landscape, the site is located within the saddle where land has been significantly transformed by agricultural activity and where patterns of growth and harvest are defined temporarily. The site is therefore not considered as an integral component of the cultural landscape.

The structures located on Farm Onder Rietvlei are considered to possess heritage value and conservation thereof would assist in retaining sense of place that farmhouses lend along gravel roads in the vicinity. It should be noted that the structures are to be retained. Furthermore, no demolition is proposed of any of these structures on the site and the proposed intervention will thus not have an impact. Future restoration and / or maintenance plans are welcomed for these structures, at which point the ruins would be of archaeological interest.

No archaeological material of any significance was found within the proposed footprint of the solar array. A large tree line falling partly within the road reserve was also noted along the power line route (refer to figure 16).

The Papkuil River and its associated wetland area (Rietvlei) are situated along the northern boundary to the site. There are also two artificial storm water channels located along the fence lines to drain the field during wet periods, which are of little freshwater significance.

The position of the site in the landscape indicates that it does not form part of an ecological connectivity area. Piketberg Sandstone Fynbos is found on the sandstone substrates east of the study area but this vegetation will be unaffected by the proposed solar facility.

The context within which the site lies was identified as possessing low intrinsic heritage value and no heritage resources were identified within the immediate context of the site. The site and its immediate context were thus identified as being of low heritage significance. The proposed development site may possess limited associational significance in the immediate context but is considered to be of low significance given that the site is highly transformed and possesses no known historical, social, technological or spiritual significance. The site is therefore considered to possess a very low level of intrinsic heritage value whilst contributing to the cultural landscape through patterns of agricultural development in a very limited capacity.

5. HERITAGE INDICATORS

Heritage indicators were identified to ensure that cultural significance would not be adversely impacted on by the proposed development. Heritage indicators are essentially concerned with the impact on the cultural landscape, impact on archaeological resources and the visual impact. Consideration is thus given to the elements that comprise the cultural landscape.

The **linear farm boundaries and angular junctions of cadastral lines** are to be respected within the landscape. No subdivision or boundary edges should detract from the existing patterns within the landscape. Similarly, **circular spill-point fields** should not be impacted on by interventions in the landscape.

In retaining cultural significance a positive response is required to the green framework, which is considered to be of scenic and aesthetic quality. The significance of the **green framework** lies within the relationship between the **natural landforms** of the koppies, Rietvlei and seasonal streams, **agricultural fields** contrasting with the diversity of the indigenous flora and **notable vegetation** such as gum trees and wind breaks associated with the landscape.



Figure 17: Viewpoint situated approximately 1.5 km north of the proposed solar farm site along the public access gravel road (MR 534) depicting the Rietvlei in the foreground and the hill forming part of Bakenskop

Site scale informants relate to farm buildings and relationship to thoroughfares, gravel roads, green edges, green framework and prominent views. Consideration should thus be given to the impact on built structures and character of access roads. No **archaeological material** of any significance was found within the proposed footprint of the solar array.

6. DEVELOPMENT PROPOSALS

Solaredirect is a company founded in 2006 and based in France with its manufacturing facility in Cape Town. The vision of the company is to:

- make solar power available and accessible
- have a minimum impact on the environment
- engage with local government and communities to ensure sympathetic integration of solar projects into the surrounding community, economy and environment
- support the local community by generate electricity locally using locally manufactured products and employing local labour

The proposal entails construction of a 10 MW photo-voltaic facility over an area of approximately 20 ha of disused agricultural land. The facility would link in to the Vredelust substation approximately 12 km to the north via a 22 kV power line that would be located parallel to the MR 529, just outside the road reserve on private property. The siting of the plant will be on the flatter areas of a 200 ha portion of the farm that has already been disturbed by previous agricultural activities (primarily potato farming). No alternative sites for a solar plant are being considered and alternatives for the power line are limited to which side of the road it will be built on.

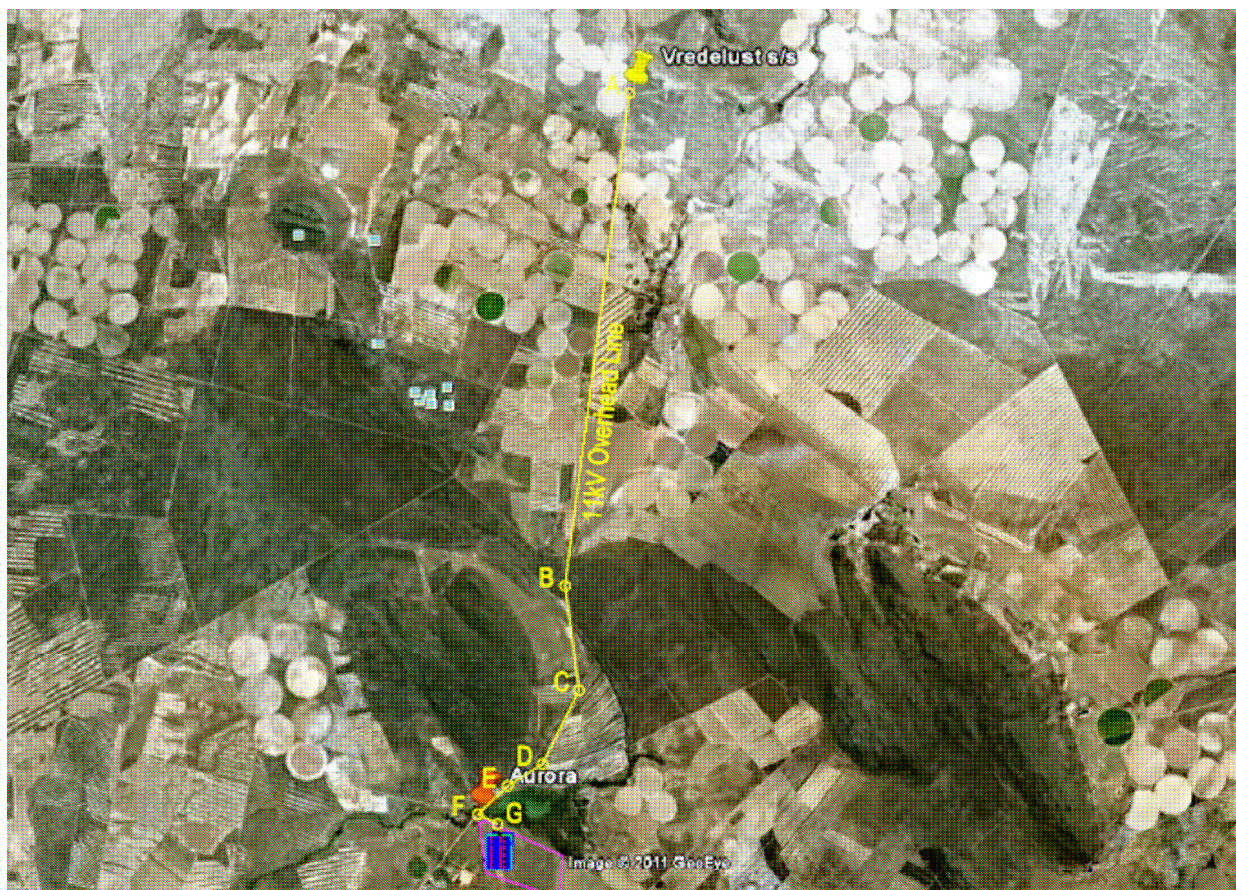


Figure 18: Site location and transmission line to Vredelust

It is assumed that clearing and minor grading will be required to provide a level surface for the installation of solar panels. A 6 m wide access road is proposed to connect the site to the existing private gravel road at the southern boundary. The site

construction camp will be established upon the southern side of the site comprising a guardhouse approximately 4 m x 6 m x 3 m. For security purposes, a 3 m high electrical fence will be constructed within the site boundary.



Figure 19: Site location and immediate context indicating portion proposed for solar farm

Panels would stand up to 1.5 m from the ground surface. The solar farm would consist of 40 392 modules to be arranged in arrays of 11 x 6 rows of modules, where each array delivers approximately 15,8 kWp, in separate strings. This results in a total number of 612 solar panel frames. The solar panel frames are each 1660 x 990 mm in size and spaced 8500 mm apart. Their supports are fixed onto 1500 mm long screw piles.



Figure 20: View towards north from the hill overlooking the site. Solar array would be located in the corner created by the tree lines. (ACO 2011: 7)

Following the construction phase the site will be commissioned and solar energy will be harnessed and transmitted to the substation. Routine maintenance and inspection may be required. The solar modules have an expected lifespan of between 20 and 30 years, after which they would be dismantled and removed or possibly replaced. Essentially all aboveground components of the installation are removable. Necessary associated services exist on the farm and no additional services infrastructure is required. Description of Solairedirect Photovoltaic modules is contained within Annexure D.

7. ASSESSMENT OF IMPACTS

The assessment of impacts is considered relative to heritage indicators and heritage significance.

7.1 Cultural landscape

The proposed solar farm would not have a negative impact on the elements contributing to the cultural landscape. As no subdivision is proposed and no formal boundaries are to be delineated, no impact is expected in terms of farm boundaries and established patterns within the landscape. Furthermore no circular spill-point fields will be impacted on by proposed solar farm.

The landscape, within which the site lies, was identified as possessing low intrinsic heritage value and no heritage resources were identified within the immediate context of the site. The site and its immediate context were thus identified as being of low heritage significance, contributing to the cultural landscape through patterns of agricultural development in a very limited capacity. The landscape is thus not considered as a resource of importance in terms of rarity, representivity or integrity.

In retaining existing mature vegetation, the proposed solar farm would not result in a negative impact on the green framework. Screening of the proposed intervention could partly be achieved through the existing wind break of beefwood trees when viewed from the west. There will be a low impact on the existing gravel road and no long-term traffic increase will be experienced. As no demolitions are proposed and the solar farm is set back from existing structures, no impact is expected in terms of structures located on the farm. However, proposals to upgrade the structures would result in a positive impact.

The landscape is considered resilient with the ability to accommodate change or intervention without experiencing a negative impact on its character and values. The overall status of the impact is thus considered as low as no heritage resources will be impacted.

7.2 Visual impact

Within the landscape, the proposed solar farm could be partly screened and integrated into the surroundings. Albeit the natural flora constitutes low growing species with low visual screening capacity, the line of beefwood trees mentioned previously has a high level of visual screening capacity when the site is viewed from the west. This wind break would contribute to integrating the proposed solar farm into the existing visual landscape.

The view catchment is limited to the areas at higher elevation than the site itself, specifically from the north and east along the existing gravel road connecting Aurora with Redelinghuys, i.e. the MR534. It is important to note that this road is not visible from the site until it turns east beyond the Rietvlei marsh. The landscape character is sensitive to non-agricultural development but has the capacity to screen low and fragmented objects.



Figure 21: View from gravel road (OvP 2011: 32)

The landscape character is sensitive to non-agricultural development but has the capacity to screen low and fragmented objects. Development areas that nonetheless are exposed, or partly exposed, could potentially be partially screened through additional tree planting. While such planting was suggested by the visual impact specialist, this need has been discounted in the BAR as the site would still be visible from higher locations, the adjacent road is not a frequently used tourism route and the solar facility would still be visible from the road to by-passers. A comprehensive landscape plan was therefore not considered to be warranted. The applicant has indicated that the solar panels would be covered with a thin film material that does not generate significant glare.

The extent of the impact is limited to the immediate surroundings (local), while the intensity of the impact is considered to be moderate where visual and scenic resources are affected to a limited extent. The 3 m high electrical fence is potentially more significant in visual terms and should therefore be as transparent as possible. Given the partial screening of the site and its isolated location, the installation would only be visible to a minimal number of people.



Figure 22: View towards the south and southwest showing current ground covering and the line of Beefwood trees adjoining the site (ACO 2011: 7)

7.3 Archaeological impact

No direct archaeological impacts would occur as a result of the proposed project. The archaeological assessment thus states no objection to the proposed development. No impact is expected along the proposed powerline route as archaeological material is very sparse in the region and the road reserve is generally disturbed due to grading activities or dense vegetation.

7.4 Freshwater impact

The proposed activity from a freshwater perspective is supported. The proposed intervention allows for the use of the land without any significant impact on the water resources in the area and allows for a limited conjunctive use with other low impact land use activities such as livestock farming. Activities associated with the development should be undertaken in a sensitive manner. Disturbance to the drainage channel located in the northwestern corner of the site, should be limited as much as possible. Furthermore, the solar panels would be attached to 1500 mm long steel screw piles and it can thus be expected that the long-term impacts of the proposed development would have a limited impact

7.5 Botanical impact

The present disturbed and highly altered condition of the study area from a botanical perspective indicates that there are no constraints that should prevent the proposed development from proceeding.

7.6 Impact relative to sustainable social and economic benefits

The socio-economic assessment concluded that the proposed solar facility would have social and economic impacts beneficial to the sub-region and its communities, including Aurora and Velddrift. Furthermore, no trade-offs would be necessary as impacts are considered to be positive or moderate with none causing unmanageable change.

The total investment cost is estimated to be about R 300 million and in operation the solar park is expected to generate approximately 16 full time employment opportunities. During the construction phase approximately 50 employment opportunities would be created. Furthermore, the developer intends to implement a policy regarding procurement and employment to benefit the local labour market, including training and skills programmes.

Findings of the socio-economic study (2011: 19 – 20) reveal that the project will result in a number of positive² socio-economic impacts namely:

- *Positive communication* (information and equity) throughout various phases of the project including the establishment of a Project Steering Committee to oversee the project
- *Positive community benefits* through negotiation of a community funding mechanism to be completed during the development phase to ensure that a percentage of revenue generated by the project directly benefits those living in the immediate vicinity as well as payment of a once-off amount of between 2.5% to 5% of gross profit (before tax) into a community trust for community projects
- *Positive local revenue* benefits to the local community through additional tax revenue and service charges for associated infrastructure
- *Positive employment benefits* including direct and indirect employment
- *Positive training and skills development* throughout the lifespan of the project
- *Positive economic benefits* to service providers, employment opportunities, training and skills development and the intervention as a drawcard for further investment opportunities

Moderate³ impacts identified are those relating to sense of place and sense of limits, namely:

- proposed facility will not alter existing character of the town
- for a short period during construction, increased traffic volumes will affect normal traffic flows

The proposed development is viewed as a sensible and sustainable renewable energy initiative at a scale that is financially viable, environmentally friendly and aesthetically acceptable. The project will thus result in high social and economic benefits for the local community in terms of service provision, employment opportunities and in terms of skills development and training.

² Benefiting the community over any period of time (Rode 2011: 18)

³ No appreciable socio-economic impact (Rode 2011: 18)

8. CONSULTATION WITH INTERESTED & AFFECTED PARTIES

Targeted participation was undertaken with the registered conservation body for Aurora, namely the Velddrift Heritage Foundation.⁴ Discussions were held with the chairperson of the foundation, Mr Willie Strooveld and the local Aurora representative, Ms Sheila Layshin. Discussions were also held with Ms Felicity Strooveld at the SA Fisheries Museum (located in Velddrift) and Ms Bia Struwig at the Velddrift Tourism Office.

The context within which the site lies, was identified as possessing no intrinsic heritage value and no heritage resources were identified within the immediate context of the site. Apart from Maclears Beacon, no other heritage sites were identified. This was confirmed by Mr Strooveld who noted that there are no declared or other heritage sites located within the Aurora context. The site and its immediate surroundings are thus identified as being of low heritage significance.

No heritage related comments and / or concerns were received during the public participation process, including comments on the draft basic impact assessment report undertaken as a component of the basic impact assessment process.⁵

9. DISCUSSION

The visual impact is likely to be minimal given the isolated nature of the site and mature trees restricting extended views across part of the site. The proposed development is thus unlikely to threaten the overall scenic character of the area as it exists. Security lighting must be kept to an absolute minimum and palisade fencing should be as transparent as possible and dark in colour. Due to the isolated location of the proposed site in conjunction with the screening effect of topography and landform, no significant visual issues are apparent. Although concerns about reflection have been considered, the applicant has indicated that the proposed solar panels would be covered with a thin film of material that does not generate significant glare.

No archaeological impacts are expected. The nature and extent of the proposed solar plant would have a very limited impact on freshwater resources.

As the transmission line would be located within an already transformed environment, both the visual and archaeological impact is not of concern. In addition, the cabling of the transmission line in the section of the route where gum trees occur will ensure their preservation.

The proposed solar farm responds positively to policy directives as set out within the Bergrivier Spatial Development Framework and Bergrivier Integrated Development Plan (Rode 2011: 7 -1), where economic opportunities are identified for isolated towns. The proposed development is therefore viewed as a sensible and sustainable renewable energy initiative at a scale that is financially viable, environmentally friendly and aesthetically acceptable.

⁴ Registration reference Velddrift Erfenis Stigting HWC/RCB/10/05. Written confirmation of discussion is to be submitted to HWC directly by the foundation.

⁵ Reference is made to Background Information Document dated 16 September 2010 and call for comments before 18 October 2010

The assessment revealed that the contextual and intrinsic significance of the site is considered to be low. The property could thus accommodate the proposed solar energy plant without a detrimental heritage impact. Furthermore, the proposed intervention could yield positive social and economic benefits without a negative impact on heritage resources. It is thus felt that the proposed solar plant should be allowed to proceed.

10. RECOMMENDATIONS

It is therefore recommended that:

1. this report be endorsed as responding to the request by HWC for a focussed study and meeting requirements section 38(3) of the NHRact
2. specialist studies as contained within this report be accepted as reasonable and independent
3. site rehabilitation with suitable vegetation is required as a component of the Construction Environmental Management Plan
4. proposed solar plant be allowed to proceed in terms of Section 38 of the NHRAct

References

- Archaeology Contracts Office (June 2011): *Archaeological Impact Assessment For A Proposed Solar Energy Facility On Onder Rietvlei 18/3 Near Aurora, Piketberg Magisterial District, Western Cape*
- Belcher T (Feb 2011) *Freshwater Screening Assessment for the proposed solar energy facility on Portion 3 of Farm 18 (Onder Rietvlei) in the District of Aurora*
- Bergwind Botanical Surveys and Tours c/o Dr David J McDonald (Feb 2011): Comment on botanical attributes of the site for the proposed Solar Energy Facility on Onder Rietvlei, Farm 18/3, Aurora, Western Cape
- CentroSolar Glas: *Specification solar glass: product data and technical information* (leaflet)
- Marquis-Kyle P and Walker M (1992): *The Illustrated Burra Charter – Making good decisions about the care of important places* as commissioned by Australia ICOMOS
- National Heritage Resources Act (Act 25 of 1999)
- OvP Landscape Architects (Feb 2011): *Visual Impact Assessment – (Basic Assessment)*
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- Solairedirect: *Solairedirect Photovoltaic modules* (leaflet)
- <http://www.panoramio.com/photo/21612396>

Our Ref: HM/Aurora/Portion 3 of Farm 18
Enquiries: Jonathan Windvogel
e-mail: jwindvog@pgwc.gov.za
Tel. (021) 483 9736
Date: 18 April 2011



INTERIM COMMENT

Heritage Western Cape hereby notifies:

Quahnita Samie
Vidamemoria Heritage Consultants
P. O. Box 50605
WATERFRONT
8002

of its Comments and Recommendations in terms of
Section 38(8) of the National Heritage Resources Act, 1999 (Act 25 of 1999)

For: Proposed solar facility

At: Onder Rietvlei Farm, Aurora

DECISIONS, COMMENTS AND RECOMMENDATIONS:

DISCUSSION:

I can hereby confirm that your application submitted terms of Section 38 of the National Heritage Resources Act 25 of 1999 is hereby assessed, as follows:

- **A Heritage Impact limited to a Visual Impact Study and an Archaeological Study is required.**

NOTE:

Please feel free to contact this office for any other information.

Yours faithfully

Andrew Hall

Chief Executive Officer/Director
Heritage Western Cape

www.capegateway.gov.za/culture_sport

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HERITAGE IMPACT ASSESSMENT FOR A PROPOSED SOLAR ENERGY FACILITY ON ONDER RIETVLEI 18/3 NEAR AURORA, PIKETBERG MAGISTERIAL DISTRICT, WESTERN CAPE

(Assessment conducted under Section 38 (8) of the
National Heritage Resources Act (No. 25 of 1999) as part of an EIA)

Prepared for

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24 June 2011



Prepared by

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EXECUTIVE SUMMARY

The UCT Archaeology Contracts Office was requested by Aurecon to conduct an Archaeological Impact Assessment for a proposed solar energy facility on the farm Onder Rietvlei 18/3 some 7 km north of Aurora. It is proposed to construct a 10 MW photo-voltaic facility over an area of approximately 20 ha of disused agricultural land. A 22 kV power line would run some 14 km north along the road servitude to link to the Vredelust substation.

The site was examined on 23rd June 2011. It comprised of disused agricultural land in a valley. The road servitude is either densely vegetated with fynbos or disturbed to some degree by road building activities. A telephone line and small power line run along the servitude.

No archaeological material of any significance was found within the proposed footprint of the solar array. The only archaeological resources of concern are two semi-ruined structures, a house and a barn, located in the farm complex very close to the road. Although not archaeological in nature, a large tree line falling partly within the road reserve was also noted along the power line route.

Given the existence of other overhead lines along the western side of the road it seems prudent to cluster the lines to reduce disturbance.

Subject to the approval of Heritage Western Cape, the project should thus be allowed to proceed.

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1. INTRODUCTION

The UCT Archaeology Contracts Office was requested by Aurecon to conduct an Archaeological Impact Assessment for a proposed solar energy facility on the farm Onder Rietvlei 18/3 some 7 km north of Aurora (Figure 1). It is proposed to construct a 10 MW photo-voltaic facility over an area of approximately 20 ha of disused agricultural land. The panels would stand up to 1.5 m from the ground surface. The facility would link in to the Vredelust substation some 14 km to the north via a 22 kV power line that would be situated within the servitude of the MR 534 road (Figure 2). Note that this substation has yet to be constructed but received approval in February 2011. No alternative sites for the solar array are being considered and alternatives for the power line are limited to which side of the road it will be built on, possibly crossing the road if necessary.

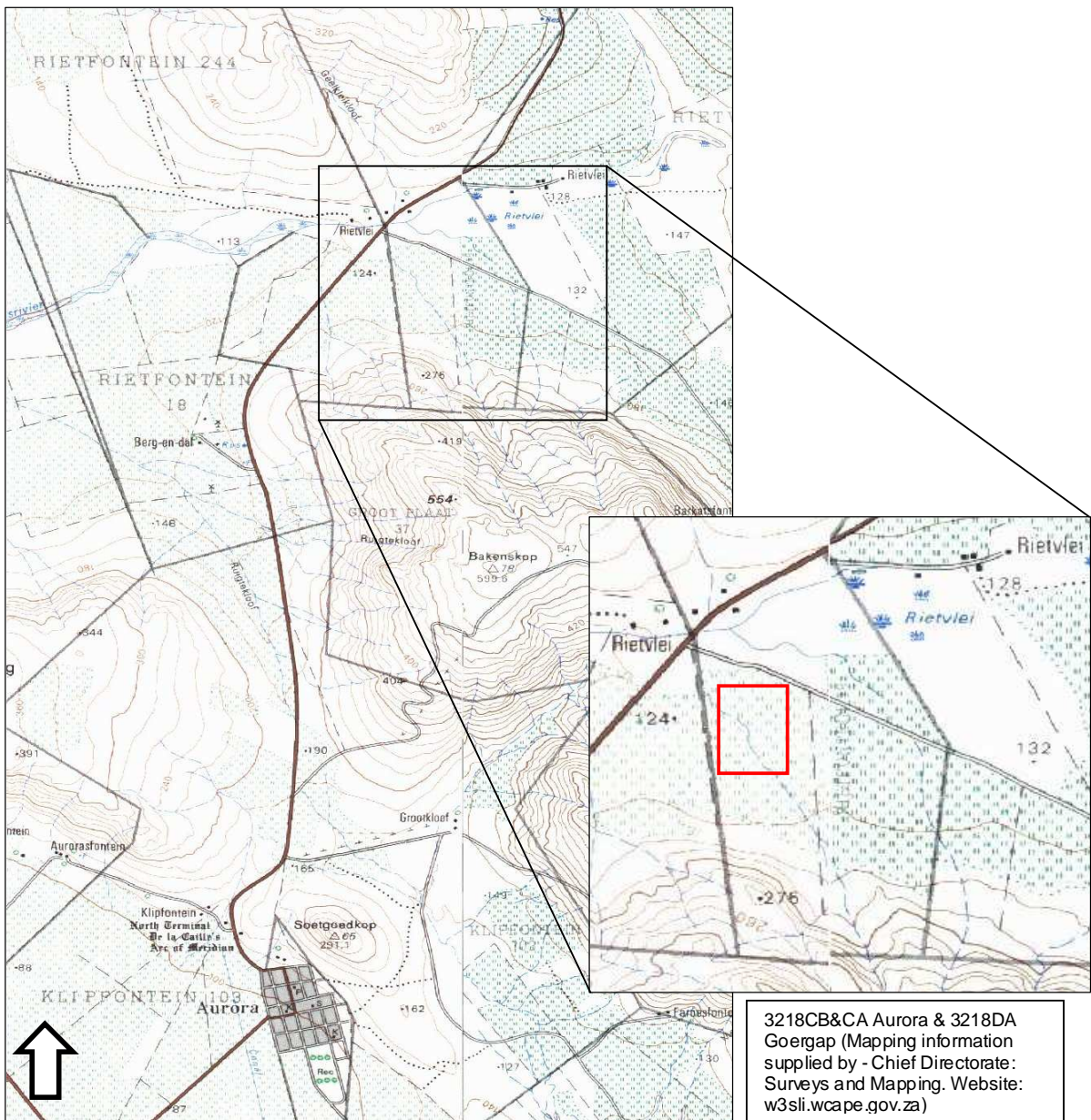


Figure 1: Map showing the location of the proposed solar facility 7 km north of Aurora.

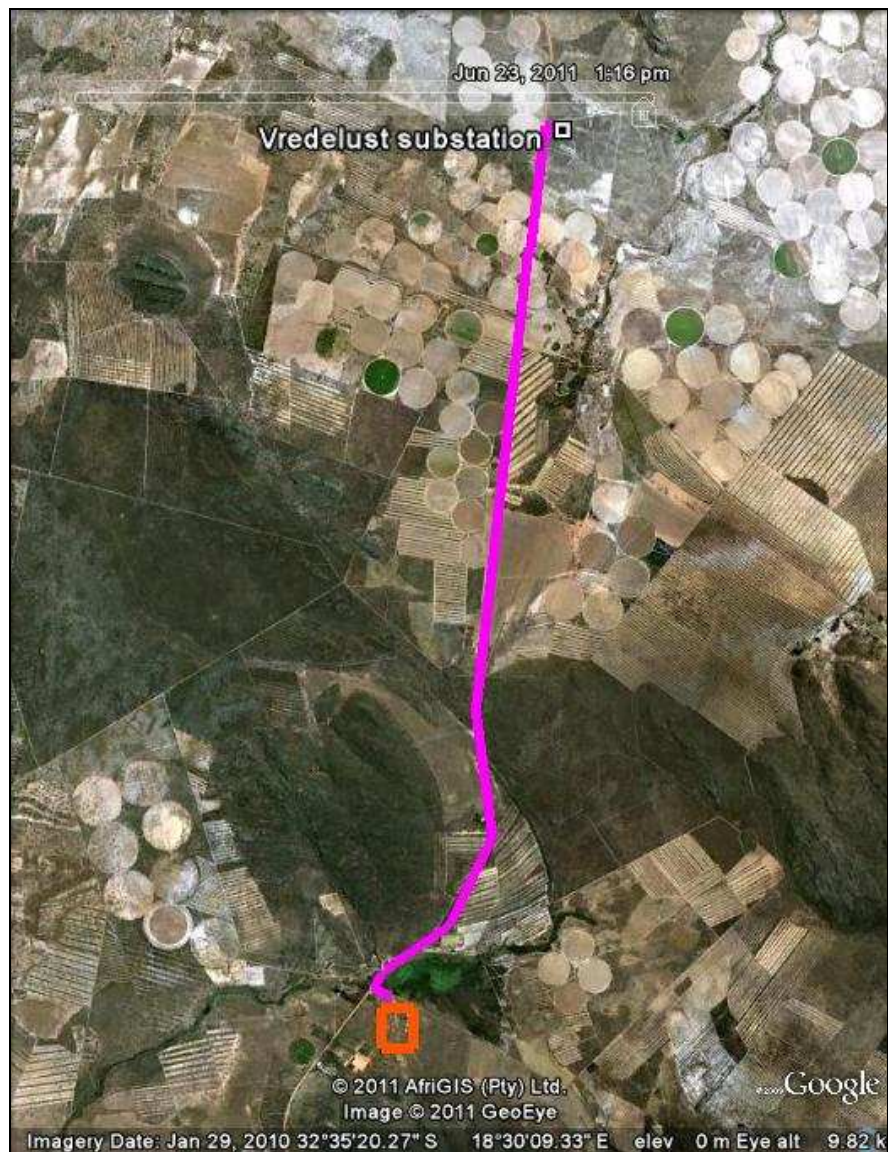


Figure 2: Aerial photograph showing the routing of the proposed 22 kV power line (pink) to the Vredelust substation. The solar array would be constructed within the orange rectangle in the south.

2. HERITAGE LEGISLATION

The National Heritage Resources Act (NHRA) No. 25 of 1999 protects a variety of heritage resources including palaeontological, prehistoric and historical material (including ruins) more than 100 years old (Section 35), human remains older than 60 years and located outside of a formal cemetery administered by a local authority (Section 36) and non-ruined structures older than 60 years (Section 34). Landscapes with cultural significance are also protected under the definition of the National Estate (Section 3 (3.2d)). Section 38 (2a) states that if there is reason to believe that heritage resources will be affected then an impact assessment resource must be submitted. This report fulfils that requirement.

Since the project is subject to an Environmental Impact Assessment, Heritage Western Cape (HWC) is required to provide comment on the proposed project in order to facilitate final

decision making by the Department of Environmental Affairs (DEA). A NID form was initially submitted to HWC and they in turn requested a Heritage Impact Assessment and a Visual Assessment. This report fulfils the former requirement.

3. METHODS

A field survey of the proposed solar array site and power line route was conducted on 23rd June 2011. A GPS-receiver was used to record finds and walk paths and the site and its surroundings were photographed. While the solar site was subjected to a detailed foot survey, the power line route was only examined from the vehicle with the exception of two areas that may have had increased potential to yield archaeological material. This included the stretch between the road and the substation site.

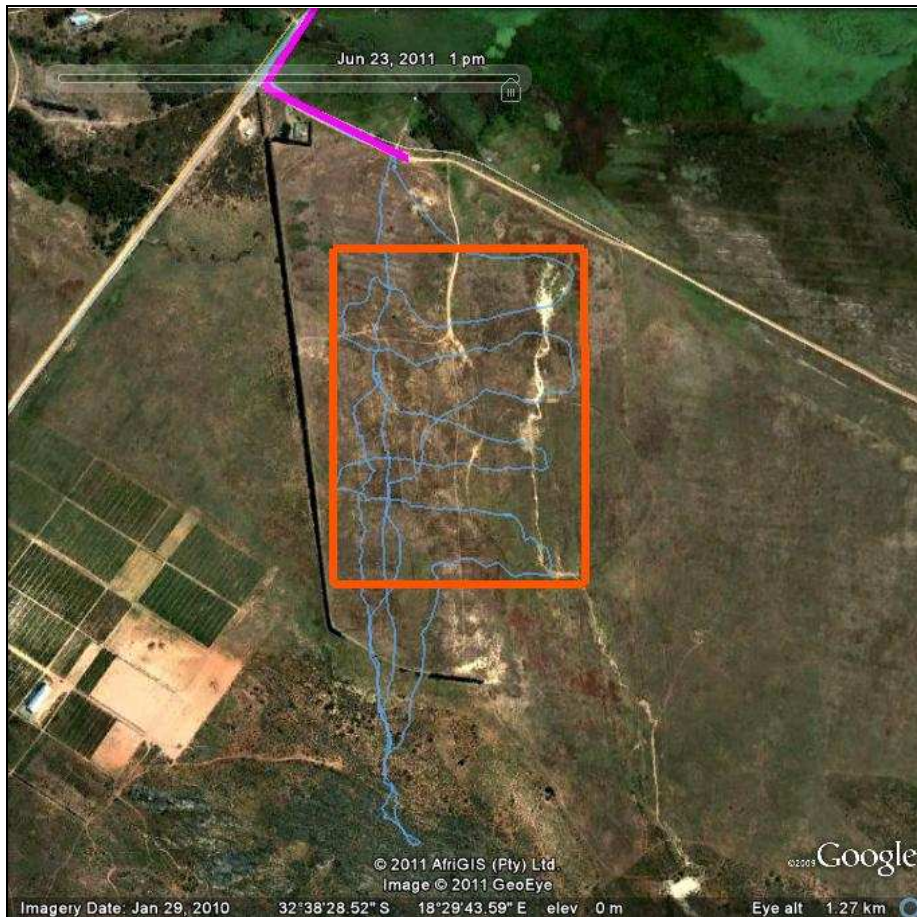


Figure 3: Aerial photograph showing the walkpaths recorded during the survey (blue lines).

3.1. Limitations

Although the power line route was not examined in detail, no impacts are expected as archaeological material is very sparse in the region and the road reserve is generally disturbed to some degree due to grading activities or very heavily vegetated. This limitation is not expected to have any bearing on the outcome of the report.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The land scheduled for use for the solar array is currently disused farm land which lies along the southern edge of the Papkuilsrivier and a small wetland (Figure 3). It had earlier been used for citrus farming and then potato farming but is now lying fallow. The land owner is trying to encourage regrowth of the indigenous vegetation. Several small water run-off channels cross the eastern part of the site. Figures 4 to 6 show aspects of the site as it now stands.



Figure 4: View towards the north from the hill overlooking the site to show its context. The solar array would be located in the corner created by the tree lines.



Figure 5: View towards the south and southwest showing current ground covering and the line of Beefwood trees adjoining the site.



Figure 6: View towards the west showing one of the water run-off channels and the ground covering on the site.

The power line would follow the road servitude. Much of this servitude is either heavily overgrown or else disturbed through road works and related activities. A telephone line and small power line run along the servitude. One stretch in the far north has been recently excavated. Figures 7 to 12 show aspects of the power line route progressively from south to north.



Figure 7: View south along the road towards the farm with dense fynbos in the road reserve. The solar array would lie in the field visible to the far left.



Figure 8: View south showing dense indigenous vegetation in the road reserve.



Figure 9: View south showing disturbed road reserve.



Figure 10: View south showing fynbos in road reserve.



Figure 11: View south showing tree lines along road. That on the west (right hand side) is far more extensive.



Figure 12: View north showing sand in road reserve. Note also the disturbed strip along the east side of the road.

5. HERITAGE CONTEXT

Little archaeological work is known to have occurred in the immediate vicinity, but more broadly the UCT Archaeology Department has conducted surveys in the area to the north and northwest recording numerous scatters of rock paintings in the local hills and artefact scatters in sandy deflation hollows (Manhire 1987). A few impact assessments have also been conducted by the Archaeology Contracts Office (ACO) in the region and have only documented isolated artefacts or small scatters of artefacts either on the lower mountain slopes or in sandy contexts that might have been old deflations now ploughed for agriculture (Orton 2007a, 2007b). Although the majority of this material is ascribable to the Later Stone Age (LSA), Middle Stone Age (MSA) material is known in the region, particularly from Diepkloof Rock Shelter to the west of Rhedelinghuys (Parkington 1999) and Elands Bay Cave at the coast (Parkington 1988; Volman 1984).

Early European explorers in the area include Simon van der Stel who reached Verlorenvlei in 1679 and Olof Bergh who crossed the vlei in 1682 (Mossop 1931; Taylor 1990). Bergh crossed the vlei at “Wittedrift” close to Redelinghuys and it is no doubt in commemoration of this that the pass from Redelinghuys to Aurora (the MR534 – Olof Bergh Pass) is named after this explorer. In terms of historical settlement, white farmers are likely to have employed Khoekhoe herders to herd cattle in the area from about 1720 onwards, but are only likely to have settled in the region themselves and begun building houses from the 1770s (Taylor 1990). The early dwellings were built in the typical Cape vernacular style with many of these long houses still in existence today, albeit frequently in ruin. These houses have also attracted study from University of Cape Town students (e.g. Gribble 1987, 1990; Swanepoel 1996; Taylor 1990; UCT School of Architecture 1980). In general, the Sandveld area preserves a large number of vernacular buildings in various states of repair. Those in ruin are classified as archaeology in terms of the NHRA.

6. FINDINGS

6.1. Solar array site

Very little was noted at the site. In one area three small fragments of black mussel (*Choromytilus meridionalis*) were noted and at another point a single, very weathered silcrete flake was found. While the former perhaps represent items dropped by a LSA person crossing the landscape, the latter is likely MSA. A very obvious rock shelter is located just upslope of the proposed site and this was visited as well. It contained no archaeological remains at all besides one fragment of burnt bone. Its floor is water-washed, perhaps explaining the paucity of material. A few artefacts were noted on the lowermost slopes of the mountain though.

6.2. Power line route

Three old buildings of significance occur on the farm. One is some 80 m from the road and was not visited. The other two are about 30 m and 20 m from the road respectively and are in very poor condition and perhaps better classed as ruins. These are described below.

6.2.1. Ruined structures

An old house stands to the west of the road, about 30 m from the road surface amongst some very large gum trees. It is 19th century in age. A survey diagram from 1834 indicates a house present to the west of the land but this probably represents one of the other buildings.

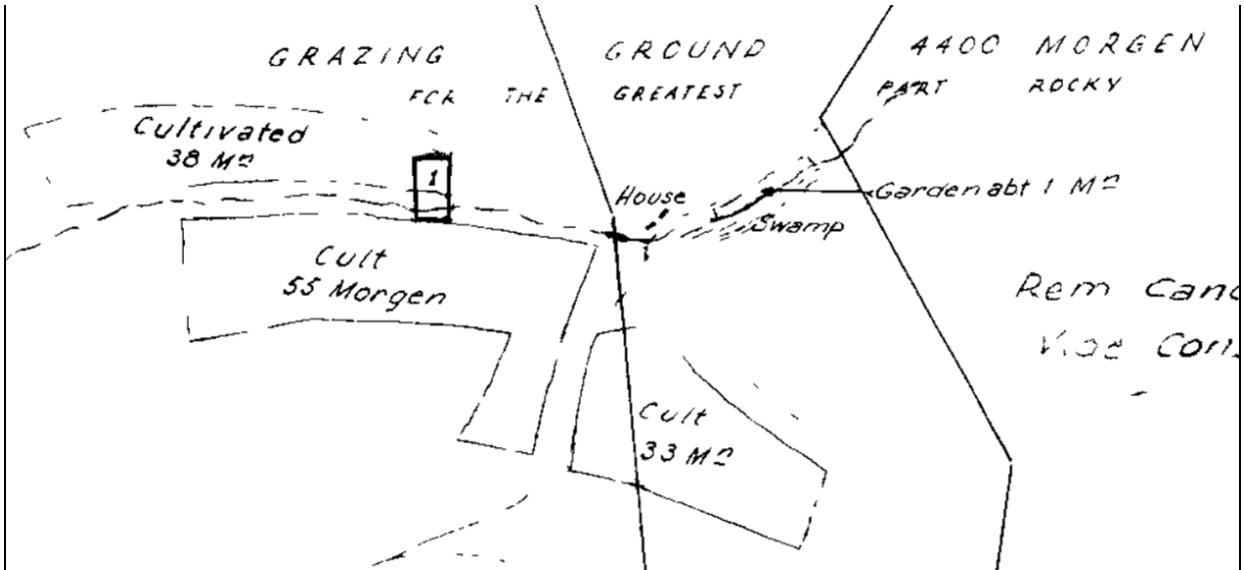


Figure 13: Extract from an 1834 survey diagram showing an early house at the western end of the wetland.

The house of concern here is in a very poor condition (Figures 14 to 16). Its external hearth has caved in and a large portion of the rear wall and adjoining Oregon pine woodwork has been removed to facilitate entry of a combine harvester. Some internal walls have also been removed and parts of the structure are unstable. Some joinery is still present but most is damaged to some degree. Plans are currently underway to attempt to restore this structure.



Figure 14: View of the front of the 19th century house.



Figure 15: View of the back and north end of the 19th century house showing the demolished section.



Figure 16: View of the south end of the 19th century house showing the caved in hearth.

The second building is an old barn, also 19th century in age. Although parts are still relatively sturdy, one side wall is in danger of collapsing which would likely result in much of the remainder falling down.



Figure 17: View of the 19th century barn east of the road.



Figure 18: View of the west end of the 19th century barn.

Also noted during the survey but under no threat is an historic graveyard dating to the 19th century and located some 115 m from the road. Its presence is mentioned only for the record.

6.2.2. Other

Although not covered within the ambit of an AIA, it seems prudent to note the presence of a large gum tree line located along and partly within the road servitude (Figure 11). This tree line has already been taken into account as the option of the power line switching sides of the road at this point is being considered. It is best to try to preserve as much of it as possible.

7. CONCLUSIONS

No direct archaeological impacts will occur as a result of the proposed project. As such, no objection to the proposed development is raised.

Given the presence of an Eskom power line in parts of the road servitude and a Telkom line, both of which run along the western side, it is felt that the new line would be better placed on the same side of the road to reduce the degree of disturbance.

8. RECOMMENDATIONS

No direct archaeological impacts will occur. Should other studies not dictate otherwise, it is recommended that the power line route pass through the farm complex on the east side of the road. Subject to the approval of Heritage Western Cape, the project should thus be allowed to proceed.

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Visual Impact Assessment – (Basic Assessment)



**Proposed Solar Energy Facility on
Portion 3, Onder Rietvlei Farm No. 18,
Aurora
Bergriver Municipality**

BASIC ASSESSMENT

Prepared for: Aurecon

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1. INTRODUCTION

OvP Associates were commissioned by Aurecon Consulting Engineers (lead environmental consultant) to undertake a basic visual assessment of the proposed Aurora Solar Energy Facility, abbreviated for the purposes of this document to ASEF. The Basic Visual Assessment forms part of the EIA process associated with this project.

The Basic Visual Assessment will be compiled as per the criteria, definitions and terminology as set out in the reference document: Oberholzer, B. 2005: **Guideline for involving Visual & Aesthetic Specialists in EIA processes**: Edition 1. CSIR Report No ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town; as per our standard practice.

The proposed project constitutes a listed activity in terms of the NEMA EIA Regulations (GN No. R543 of 18 June 2010) and triggers Activity 1 of Listing Notice 1 (Regulation R544):

The construction of facilities or infrastructure for the generation of electricity where:

- I. The electricity output is more than 10 megawatts but less than 20 megawatts; or*
- II. The output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare.*

The basic visual assessment document needs to read in context of the EIA process and in conjunction with all specialists reports associated with this proposal. Whereas this report focuses primarily on visual and aesthetic criteria; cognizance of other factors are acknowledged.

1.1 Background and Approach to the Study

Solairedirect Southern Africa (Pty) Ltd, abbreviated for the purposes of this document to Solairedirect, is a Cape Town based subsidiary of a large privately owned solar power producer in France. Solairedirect have applied for permission to develop a solar energy facility (including the installation of 612 solar panel frames and associated infrastructure).

The proposed project would take place on the Onder Rietvlei Farm (Portion 3 of Farm 18) located approximately 10km north of Aurora within the Berg River Municipality in the Western Cape . The proposed site for the solar farm would occupy approximately 20ha of a previously disturbed agricultural field (primarily potato farming) on the Onder Rietvlei Farm. Farm buildings are located to the north of the proposed site and the site is partially screened by a row of Beefwood trees on the western boundary. The surrounding land uses are agricultural, consisting primarily of potato and stock (goats, sheep and cattle) farming, as well as nature conservation on Tiernes- and Bakens- koppies.

We understand that change is inherent within a developmental context and that green energy initiatives ought to be promoted where applicable and appropriate. Agricultural land forms part of our cultural heritage and the impact of transformation of agricultural land to other land uses should not be taken lightly. However, change may have positive implications – especially if the changes reflect progress towards sustainable green energy generation.

The Department of Environmental Affairs and Development Planning (DEA&DP) *Guidelines for Visual Specialists* (2005:2) recommend that a visual impact assessment consider the following specific concepts:

- An awareness that 'visual' implies the full range of visual, aesthetic, cultural and spiritual aspects of the environment that contribute to the area's sense of place.
 - The considerations of both the natural and cultural landscape, and to their interrelatedness.
 - The identification of all scenic resources, protected areas and sites of special interest, together with their relative importance in the region.
 - An understanding of the landscape processes, including geological, vegetation and settlement patterns, which give the landscape its particular character or scenic attributes.
 - The need to include both quantitative criteria, such as 'visibility', and qualitative criteria, such as aesthetic value or sense of place.
 - The need to include visual input as an integral part of the project planning and design process, so that the findings and recommended mitigation measures can inform the final design, and hopefully the quality of the project.
 - The need to determine the value of visual/aesthetic resources through public involvement.
-

1.2 Terms of Reference

The DEA&DP Guidelines (2005:19&20) indicate that the proposed development of a solar energy facility requires a Level 3 Visual Impact Assessment. The specific objectives of this report, according to a Level 3 Assessment will be to:

- Identify issues and values relating to visual, aesthetic and scenic resources raised during the public participation processes (if applicable), and site visit.
- Describe the proposed project, including technical data, solar energy facility layout, major substation and transmission corridors, and their spatial characteristics.
- Describe the receiving environment, identifying landscape types, landscape character and sense of place based on geology, landforms, vegetation cover and land use patterns.
- Identify the view sheds, view catchment area and zone of visual influence, generally based on topographical informants.
- Identify important viewpoints and view corridors within the affected environment and including sensitive receptors.
- Provide an indication of distance radii from the proposed project to the various view points and receptors.
- Determine the visual absorption capacity (VAC) of the landscape, usually based on topography, vegetation cover or settlement patterns within the vicinity.
- Determine the relative visibility, or visual intrusion, of the proposed project.
- Determine the relative compatibility or conflict with the surroundings.
- Compare the existing situation with the probable effect of the proposed project, using visual indicators.
- Identify potential (positive and negative) visual impacts and cumulative impacts using established criteria.
- Provide mitigation measures and recommend management actions.

Aurecon has required of the visual specialist of the following tasks and deliverables:

- Review of existing documentation (scoping reports, survey information, architectural drawings) and the development proposal against accepted visual criteria;
 - Review of background data: aerial photographs, survey data, electronic contour information and full architectural digital drawings digital (supplied by Aurecon);
 - Site visit to record visual data; especially views overlooking the site and views from the edges of the site, towards understanding the spatial context of the proposal;
 - Description of the receiving environment in terms of its 'sense of place' as derived from natural and cultural patterns; and with respect to the site context;
 - Evaluation of the solar facility proposal layout overlaid onto a scaled aerial photographs of the area to determine visual change implications and probable outcomes
 - Evaluation of perceived visual impact of the proposal based on the layout plans measured against visual considerations; and, using accepted conventions for visual assessment;
 - Formulation of a professional opinion, inclusive of recommendations for mitigation,
 - Compilation of a basic visual assessment report document (based on the above) for submission to Aurecon (for review); subject to further refinement (Final Visual Impact Assessment Report) upon receipt of feedback.
 - Final submission of the Visual Impact Assessment to the environmental authorities.
-

1.3 Methodology

The method followed to produce this report has been to:

- a) Collect and review existing information:
 - b) Undertake an initial field survey during February 2011; which provided the opportunity:
 - To determine the actual or practical extent of potential visibility of the proposed development, by assessing the screening effect of landscape features;
 - To conduct a photographic survey of the landscape surrounding the development; and to record photographs of the site itself; and
 - To identify sensitive landscape and visual receptors within the spatial context and zone of influence of the site.
 - c) Undertake desk-top mapping exercises to establish the scenic character, extent of visibility, visual exposure to viewpoints and inherent visual sensitivity of the site.
 - d) Prepare panoramic view photographs of the proposed development site as viewed from critical points.
 - e) Assess the proposed project against defined visual impact criteria: visibility, visual exposure, sensitivity of site and receptors, visual absorption capacity and visual intrusion.
 - f) Assess potential impacts based on a synthesis of these criteria: nature of impact, extent, duration, intensity, probability and significance).
 - g) Articulate a professional opinion and recommend appropriate mitigation measures.
-

1.4 Assumptions and Limitations

- This report assumes that the information provided by others is correct.
 - The report relies on a combination of 1:500 000, 1:250 000 and 1:50 000 Topo-cadastral and Geological maps, Google Earth maps and GIS information.
 - It is further assumed that green energy initiatives are endorsed by the Bergriver municipality, and that there are no fatal flaws associated with the proposal.
-

2. THE PROPOSED DEVELOPMENT

2.1 Site Location

The proposed site for the ASEF is located approximately 10 km north-west of the town Aurora along a publicly accessible gravel road between Aurora and Redelinghuys. As the site lies within a valley 120m above Aurora, it cannot be seen from the town.

The valley is held between two koppies: Tierneskop - lying 2,5 km to the north, at approximately 400m elevation; and Bakenskop - 2 km south-east, at approximately 600m. The precise location for the proposed ASEF is Onder Rietvlei Farm (No. 18, Portion 3), 1 286 ha in extent; within the Bergrivier Municipality of the Western Cape Province.

Redelinghuys is located approximately 18 km to the north east, with Piketberg approximately 20 km to the east. The farm can be accessed via a series of secondary, gravel roads. The proposed installation is positioned within the southern portion of the site (refer to site location map below).



Site Location and Immediate context Map:

Red Indicates the site boundaries, Blue the portion covered by solar panels



Proposed ASEF Site Layout: (information received from Aurecon)



Proposed new transmission lines: (information received from Aurecon)

2.2 Development Description

2.2.1 Prior to development:

The farm is currently zoned as Agriculture 1 and is situated outside the urban edge of Aurora. The site is currently used for cattle grazing and is no longer used for the production of crops. Previously potatoes and other crops were grown on the site. At present the property owner is investigating the possibility of registering portions of the farm for nature conservation.

The surrounding land is still used for agricultural purposes with food crops (such as potatoes, lucerne, and wheat); contributing to the agricultural pattern; and livestock (such as sheep, goats and cattle) grazing in surrounding pastures.

Besides an existing cottage immediately adjacent to the proposed site, very few residential dwellings are visible with the vicinity, though a few farm buildings are scattered beyond the northern boundary. The proposed site is currently screened by a row of Beefwood trees planted along the western boundary. These will remain unaffected by the intervention.

2.2.2 Construction phase

It is assumed that clearing and minor grading will be required to provide a level surface for the installation of solar panels. A 6m wide access road is proposed to connect the site to the existing private gravel road at the southern boundary. The site construction camp will be established upon the southern side of the site.

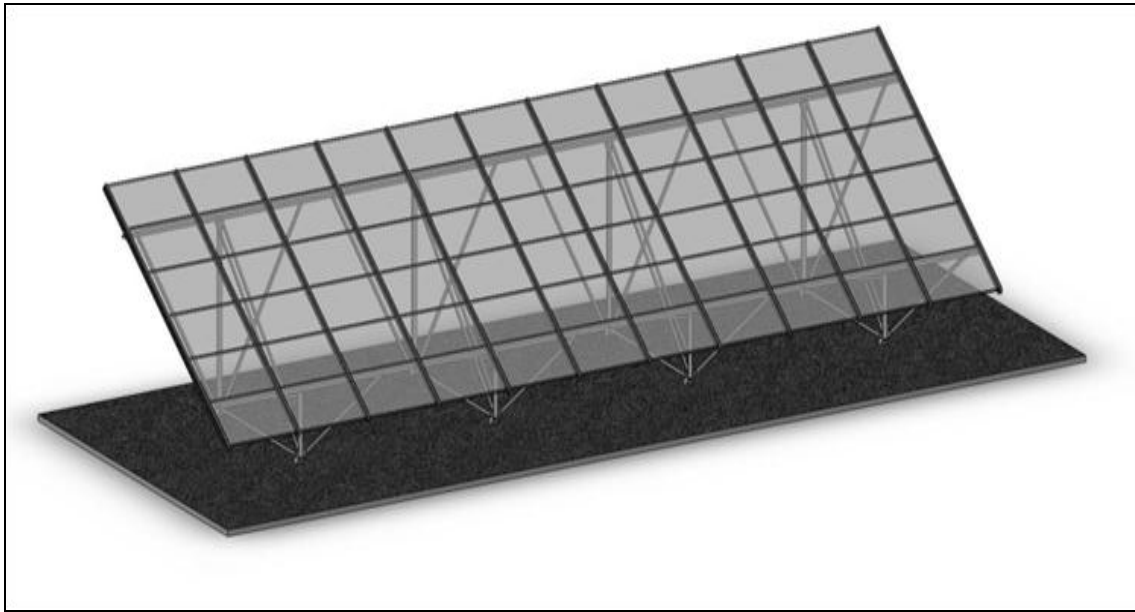
For security purposes, a 3m high electrical fence will be constructed within the site boundary. Within this fence-line, the solar panel modules will be installed. External lighting will also be installed.

In terms of the actual installation, the ASEF proposal consists of 40 392 modules to be arranged in an arrays of 11 x 6 rows of modules - (each array delivers approximately 15,8 kWp), in separate strings. This results in a total number of 612 solar panel frames.

These 612 solar panel frames are each 1660 x 990mm in size and spaced 8500mm apart. Their supports are fixed onto 1500mm long screw piles.

In addition, an entirely new transmission line will be constructed adjacent to the existing power lines, and connecting to a new substation.

A typical layout of the structure is as follows (information supplied by Aurecon):

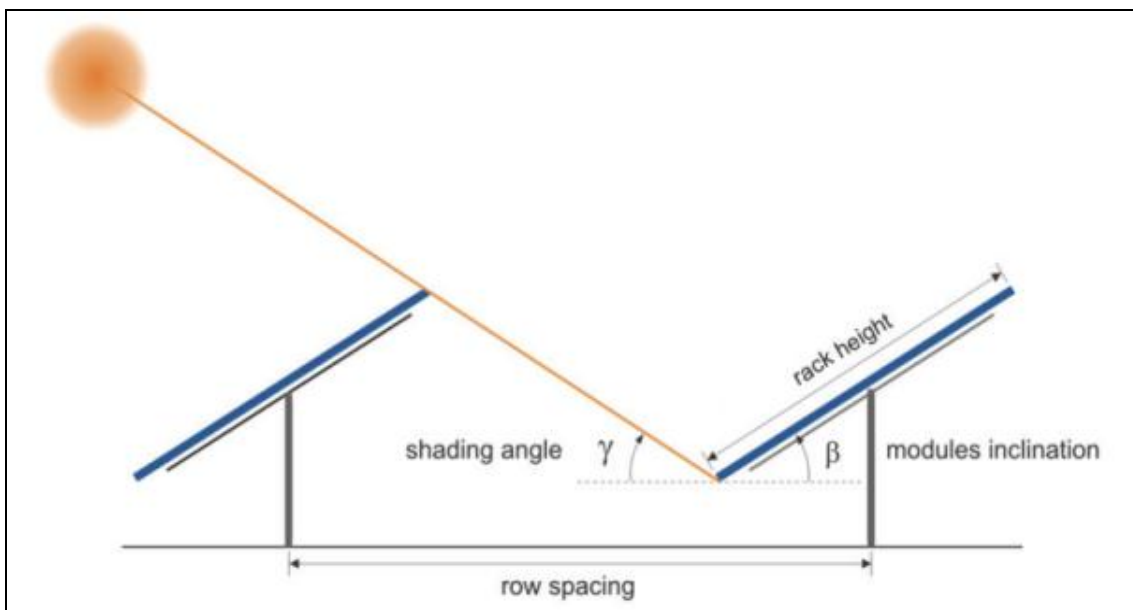


Each structure is inclined at an angle of 30° ,

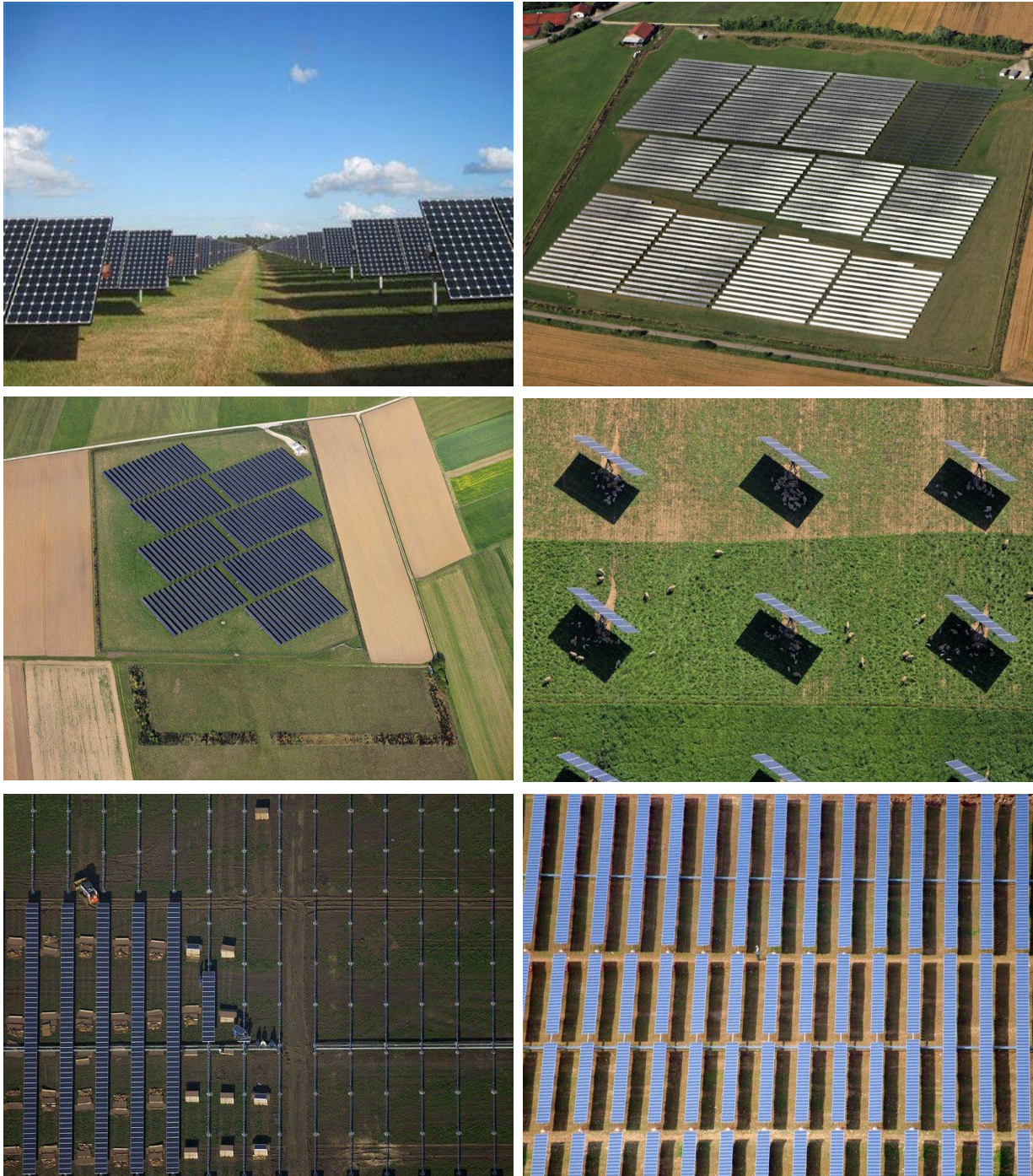
with a shading angle of 21° used to calculate the spacing between rows.

This spacing varies according to the natural slope of the site.

Shading and inclination angles will be as follows:



Precedent Imagery of similar solar energy installations (sourced variously):



These installations are typically associated within rural or agricultural environments, suggesting a certain compatibility of use. The positive (eco-friendly) character of solar (green) energy generation is worth expressing.

2.2.3 Operational phase

Following the implementation (construction phase) the site will be commissioned; and solar energy will be harnessed and transmitted via new transmission lines (running alongside the existing ones).

This is assumed to be a fairly passive process, within minimal human activity required. Routine maintenance and inspection may be required during the operational phase - thus intermittent vehicular traffic will occur. Maintenance of the transmission lines would also occur along the length of the installation.

The solar modules have an expected lifespan of between 20 and 30 years, after which they would be dismantled and removed, and possibly replaced. Essentially all above-ground components of the installation are removable.

3. RECEIVING ENVIRONMENT

3.1 Description of the Affected Area and the Scenic Resources

This section describes the existing visual environment that will be affected by the proposed Aurora Solar Energy Facility (ASEF). It involves the identification of landscape types, landscape character and sense of place - generally based on geology, landform, vegetation cover and land use patterns.

3.1.1 Landscape types

Landscape types are generic classifications of landscape character and may occur anywhere in the country where the same combinations of physical and cultural landscape attributes are to be found.

The ASEF site is situated on a saddle between two koppies; with distant views extending towards the west and east. It borders onto the riparian margins of the Rietvlei marsh to the north, and onto the lower slopes of the Bakenskop to the south. In terms of vegetative cover, the two koppies are in a fairly pristine condition; whereas the saddle has been largely transformed by agricultural use.

3.1.2 Topography and Landforms

As described above, the Onder Rietvlei Farm is held by Tierneskop to the north and Bakenskop to the south. Stormwater shed by these two koppies collects within the Rietvlei marsh - to the south of the proposed site - and slowly feeds into the Papenkuils River. This in turn meets the sea at the Rocher Pan Nature Reserve approximately 22km downstream.

3.1.3 Landscape Cover/Vegetation

The saddle on which Onder Rietvlei Farm is situated is surrounded by land transformed by agricultural activity – of high cultural amenity value. Seasonal patterns of growth and harvest are defined temporarily. Planted windbreaks are typical of this farming landscape, and are a recurring feature. Thus the inclusion of windbreaks - for visual screening of the ASEF should be encouraged; especially as the indigenous flora (now only extant on the steeper slopes of Tierneskop and Bakenskop) - Graafwater Sandstone Fynbos - is low growing, with limited screening potential.

3.1.4 Settlement Patterns

There are no aggregated settlements within the visual catchment of the proposed site. Thus the cultural (or human) landscape pattern is derived from linear farm boundaries, angular junctions of cadastral lines, and circular spill-point fields overlaid onto natural landforms - the koppies, marsh and seasonal streams.

3.1.5 Views & View Corridors

The site is well enclosed by natural features (particularly the two koppies) and further, because it is situated on the saddle between the two koppies, its elevation further screens it from the surrounding towns and farmlands in the region. Thus the site is only visible to the public from the gravel access road (the view corridor) - which is only occasionally used.

3.1.6 Landscape Character

The spirit, or sense of place, is that quality imparted by the aspects of scale, colour, texture, landform, enclosure, and in particular, the land use. According to K. Lynch (1992) '*it is the extent to which a person can recognize or recall a place as being distinct from other places as having a vivid, or unique, or at least a particular character of its own*'. The quality of Genius Loci is a function of attributes such as the scenic beauty or uniqueness and distinctive character of the built and cultural landscape. The area has a typical rural West Coast farmland character that is fairly open and simply organised by the spill point (pivot-irrigated) agricultural fields. These are naturally coloured alternately vivid green (during the wet winters) and muted yellow (during the dry summers). The agricultural fields, being monocultures, have monochromatic (or flat) colour – contrasting distinctly with the diversity and subtlety of the various light, dark and grey-green hues of the indigenous flora on the steeper slopes and hilly flanks. As visual manifestations, these circular spill-point fields are iconographic of the agricultural use of the area, as well as of the particular irrigation technology employed. Simple farm buildings are scattered throughout the landscape along rural gravel roads. The area is imbued with a sense of peaceful tranquillity.

3.1.6.1 Landscape Character Sensitivity

The proposed ASEF site and its immediate surroundings are pastoral in nature and thus susceptible to the imposition of large monolithic object intrusion. However, low and fragmented (articulated) objects could be more easily screened and integrated into the surroundings. The natural flora constitutes low growing species with low visual screening capacity. However, the lines of windbreak trees which contribute to the cultural landscape - have far greater visual screening capacity. These could be used to integrate the proposed ASEF into the existing visual landscape.

3.1.6.2 Visual Absorption Capacity

“Visual absorption capacity” is defined as the ability of the receiving landscape to absorb physical changes without the wholesale transformation in its visual character and quality. This depends on the following characteristics of the environment:

- The density and distribution of similar developments in an area; (cumulative effects)
- The similarity between (or compatibility with) existing and new features to be introduced;

Other factors that may also influence visual absorption capacity relate to the setting of the proposed development in the landscape. A landscape may offer VAC on grounds of colour, texture and topography. Further, careful placement of the proposal against an appropriate background may serve to assimilate the development to a certain degree.

The foreground, formed by the distance between the observer and the development, plays an important role to either screen the development or to create a visual buffer by partial screening, and to distract attention from the development itself. Should approval be granted, the ASEF proposed would be the first of its kind in the region. Thus it will differ substantially from the surrounding landscape character, and would set a precedent for its typology. Immediate reaction to solar facilities concerns the reflection of light (glare) rather than impact of infrastructure. Whereas earlier generation solar facilities (elsewhere) have caused reflective glare, the solar panels proposed for ASEF are manufactured of materials that do not generate significant glare (refer to technical information supplied by Aurecon).

3.1.7 Synthesis

The proposed ASEF site is located within an established farming district. It borders onto the riparian margins of the Rietvlei marsh to the north; and onto the lower slopes of Bakenskop to the south. Topographically, the saddle, on which the site is located, is held by Tierneskop towards the north and Bakenskop towards the south. Low growing indigenous vegetation - the Graafwater Sandstone Fynbos - still grows on the upper reaches of the koppies; whereas the gently sloping and undulating foothill areas have largely been transformed by agricultural use. No towns or aggregated settlements are visible from the proposed site. The site has distant panoramic views towards the east while an existing windbreak screens the site towards the west. The only potential view corridor is the existing public access road (gravel surface) connecting Aurora with Redelinghuys; however this road is not visible from the site - until it turns east beyond the Rietvlei marsh. Considering the broader landscape, the patterns of pivot irrigated agricultural fields are occasionally interrupted by natural features. The landscape character is sensitive to non-agricultural development but has the capacity to screen low and fragmented objects. The VAC of the general vegetation cover is fairly low - due to the prostrate growing habit of the indigenous fynbos and cultivated crops; however planted windbreaks – which form part of the cultural landscape – can be used as screening devices. However, the introduction of sustainable energy initiatives could be seen to contribute to the productivity and biodiversity of the area. In this case, it may be preferable to express, rather than to screen the installation.

4. IDENTIFICATION OF VISUAL ISSUES

Due to the isolated location of the proposed site, in conjunction with the screening effect of topography and landform, there are no significant visual issues apparent. Although concern about reflection have been considered, the applicant has indicated that the solar panel system to be employed in this proposal would be manufactured of material that do not generate significant glare.

4.1 Permit Requirements

No relevant permits or licenses are required for the visual aspects of this proposed development.

5. VISUAL IMPACT ASSESSMENT OF PROPOSED DEVELOPMENT

The visual impacts identified above were assessed based on a synthesis of criteria as defined by the National Environmental Management Act (NEMA) regulations (2005:28).

5.1 Impact Assessment Criteria

NEMA suggests five visual impact assessment criteria according to which proposed development should be assessed. They are as follow:

5.1.1 Extent of the Impact

The spatial or geographic area of influence of the visual impact, i.e.:

- Site-related: extending only as far as the activity;
- Local - limited to the immediate surroundings;
- Regional - affecting a larger metropolitan or regional area;
- National - affecting large parts of the country;
- International - affecting areas across international boundaries.

The proposed location of the ASEF is geographically sheltered by two koppies (the Tierneskop and Bakenskop) and elevated above the existing towns in the vicinity. Therefore visual impact or visibility extent will only influence the immediate surroundings i.e. locally.

Although new transmission lines are proposed, these are to be positioned adjacent to existing, and would this compound an existing visual condition, rather than introduce an entirely new scenario.

EXTENT	National	Regional	Local	Site
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5.1.2 Duration of the Project

The predicted life-span of the visual impact:

- Short term - e.g. duration of the construction phase;
- Medium term - e.g. duration for screening vegetation to mature;
- Long term - e.g. lifespan of the project;
- Permanent - where the visual impact is irreversible.

Once implemented the ASEF infrastructure will remain for the duration of the life expectancy of the solar infrastructure (20 to 30 years). Thereafter, the infrastructure could be replaced. Therefore, for the purposes of this study, the visual impact is considered to be permanent.

Further, although the structures are removable with minimal damage to the environment however, once permission has been granted for the installation it will not be viable (from a financial perspective) to uninstall and to transfer the structures to another location.

DURATION	<i>Permanent</i>	<i>Long-term</i>	<i>Medium-term</i>	<i>Short-term</i>
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5.1.3 Probability of the Impact

The degree of possibility of the visual impact occurring:

- Improbable - where the possibility of the impact occurring is very low;
- Probable - where there is a distinct possibility that the impact will occur;
- Highly probable - where it is most likely that the impact will occur; or
- Definite - where the impact will occur regardless of any prevention measures.

Should the solar ASEF infrastructure be installed the impact will definitely occur however, it's severity might reduce over time as vegetation matures.

PROBABILITY	<i>Definite</i>	<i>Highly Probable</i>	<i>Possible</i>	<i>Improbable</i>
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5.1.4 Intensity of the Impact

The magnitude of the impact on views, scenic or cultural resources

- Low - where visual and scenic resources are not affected;
- Moderate - where visual and scenic resources are affected to a limited extent;
- High - where visual and scenic resources are significantly affected.

The magnitude of the development on views, scenic and cultural resources would be moderate for the extent is limited.

INTENSITY		High	Moderate	Low
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5.1.5 Visual Impact Significance

The significance of impacts can be determined through a synthesis of the aspects produced in terms of their duration, intensity, and extent and be described as:

- Low - where it will not have an influence on the authority decision;
- Medium - where it should have an influence on the authority decision and (in the case of negative impacts) requires management actions to avoid or mitigate the impacts; or
- High - where it would influence the authority decision and (in the case of negative impacts) requires management actions to avoid or mitigate the impacts.

Although the impact will permanent and will occur definitely its extent is limited and intensity moderate therefore, it is of medium significance and will require management actions to avoid or mitigate the impacts

EXTENT	National	Regional	Local	Site
DURATION	Permanent	Long-term	Medium-term	Short-term
PROBABILITY	Definite	Highly Probable	Possible	Improbable
INTENSITY		High	Moderate	Low

5.2 Impact Assessment and Mitigation Measures

A number of key criteria have been addressed towards the identification of potential visual impacts (positive and negative) upon the receiving landscape and on visual receptors.

These criteria include **visibility** (View Catchment Area and Zone of Visual Influence (ZVI)), particular **receptors** and their sensitivity, degrees of **visual exposure** and **visual intrusion**.

5.2.1 Visibility (View Catchment and Zone of Visual Influence (ZVI))

5.2.1.1 View Catchment

View Catchment: The geographic area defined by the context's topography, from which the project will be visible, or view catchment area.

The view catchment of the proposed ASEF is limited to the areas at higher elevation than the site itself i.e. in excess of 140m above sea level. These are limited to the Tierneskop (400m) and Bakenskop (600m) landforms to the north and south respectively. The view corridor along the gravel road connecting Aurora with Redelinghuys will experience high visibility once it crosses the Rietvlei marsh in a north-easterly trajectory.

5.2.1.2 Zone of Visual Influence

Zone of Visual Influence: The actual zone of visual influence of the project may be smaller because of screening by existing trees and buildings.

This also relates to the number of receptors:

- High visibility: visible from a large area (e.g. several square kilometers)
- Moderate visibility: visible from an intermediate area (e.g. several hectares)
- Low visibility: visible from a small area around the project site.

The actual zone of influence could be limited to several hectares – provided the proposed development is sufficiently screened by windbreaks similar to the existing one on the western boundary of the proposed site. (Appropriate vegetation should be chosen for this purpose)

5.2.2 Receptors

The level of visual impact considered acceptable is dependent on the type of receptors.

- *High sensitivity – e.g. residential areas, nature reserves and scenic routes or trails;*
- *Moderate sensitivity – e.g. sporting or recreational areas, or places of work;*
- *Low sensitivity – e.g. industrial, or degraded areas.*

Receptors within the view catchment are mainly workers within agricultural fields and hikers within nature reserves. Although uses associated with nature reserves generally listed as highly sensitive, this sensitivity is only applicable when viewpoints exist within the view catchment looking towards the site. As there are no roads or pathways within the nature reserve areas, the sensitivity is negligible (due to inaccessibility, and low volume usage).

5.2.3 Visual Exposure

Visual exposure – based on distance from the project to selected viewpoints. Exposure or visual impact tends to diminish exponentially with distance.

- *High exposure – dominant or clearly noticeable;*
- *Moderate exposure – recognisable to the viewer;*
- *Low exposure – not particularly noticeable to the viewer;*

Three primary viewpoints have been identified (refer 5.2.5).

From viewpoints A and C, the development would not be particularly noticeable to the viewer; whereas from viewpoint B the development would indeed be recognizable to the viewer. The impact of the latter can be further reduced however – through strategic migratory measures.

5.2.4 Visual Intrusion

Visual intrusion – the level of compatibility or congruence of the project with the particular qualities of the area, or its 'sense of place'. This is related to the idea of context and maintaining the integrity of the landscape or townscape.

<i>High visual intrusion –</i>	<i>results in a noticeable change or is discordant with the surroundings;</i>
<i>Moderate visual intrusion –</i>	<i>partially fits into the surroundings, but clearly noticeable;</i>
<i>Low visual intrusion –</i>	<i>minimal change or blends in well with the surroundings.</i>

Although the ASEF differs considerably from the existing visual aesthetic, the proposed solar infrastructure is low and fragmented and could be screened sufficiently with elements that are appropriate to the agricultural landscape. Solar facilities are themselves 'productive' landscapes (generating energy) and are thus congruent with agricultural use.

Solar energy facilities elsewhere are typically associated with (or located within) agricultural landscapes, and thus form a compatible land use typology. They are not alien to this kind of landscape in general, though the proposal is new to this environment specifically.

With the introduction of the ASEF, a certain visual amenity may be added through diversity of visual experience, adding a point of interest to otherwise ubiquitous farmland.

5.2.5 Spatial Context



Site view looking South-West – gravel roads and agricultural lands



Site view looking North-East – low hills and gentle undulations



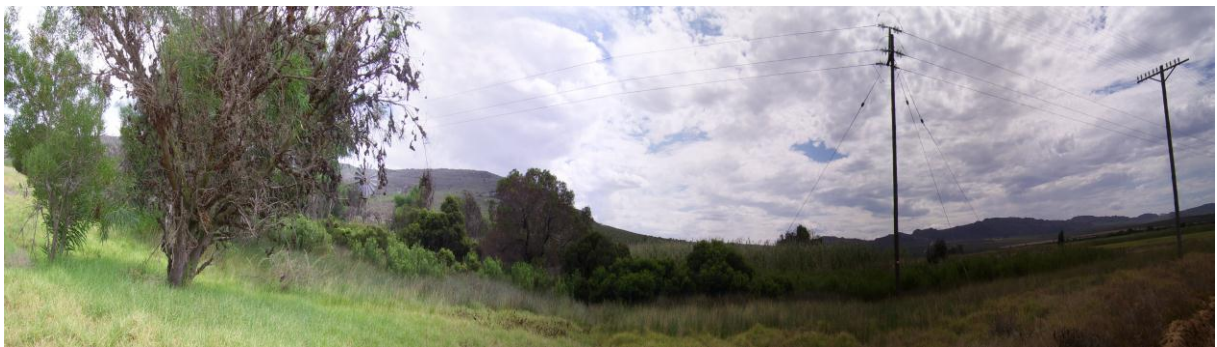
Site view looking South-West – towards the mountain slopes



Site view looking North-West – farm fences, wind break vegetation

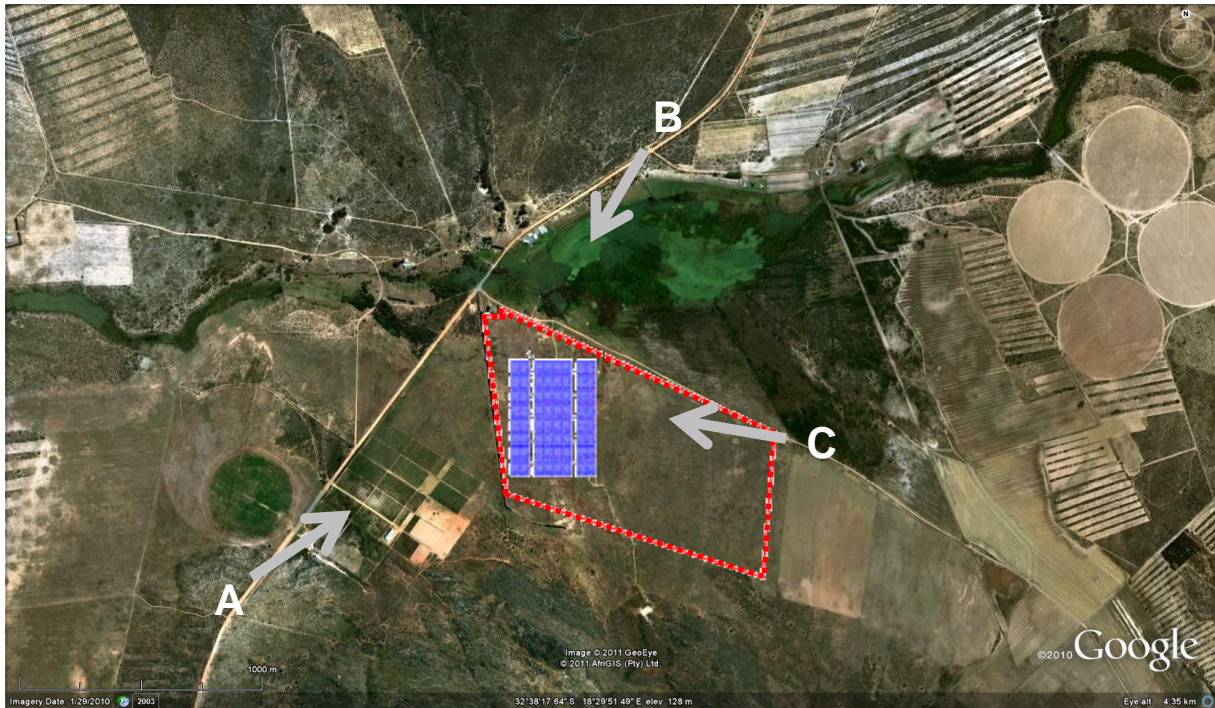


Windbreak along Western boundary, with existing farm building partially screened



Rietvlei marsh south of site, with existing communication lines

Primary Views Towards the proposed ASEF Site:



Site location with critical viewpoints A, B & C located.



View from Primary Viewpoint A

Viewpoint A is situated approximately 2km south of the proposed ASEF site along the public access gravel road between Aurora and Redelinghuys.

Towards the west (on the right of this image) lies Bakenskop. By progressing along this road towards Aurora the site would become obscured by this koppie.



View from Primary Viewpoint B

Viewpoint B is situated approximately 1.5km north of the proposed ASEF site - along the public access gravel road between Aurora and Redelinghuys.

In the foreground the Rietvlei marsh is visible and the hill towards the left of the image forms part of Bakenskop.



View from view point C

Viewpoint C is situated approximately 1.5km eastwards of the proposed ASEF site - along the private farm access-road (gravel surface).

The undulating nature of the landscape provides for visual screening by virtue of topography rather than vegetation cover.

5.3 Visual Impacts

5.3.1 Change in Landscape Character

The combination of uniform vegetation, gently undulating topography and the relative lack of indigenous and diverse vegetation (as well as the scattered nature of existing buildings) results in a relatively low visual diversity. This landscape will have difficulty in absorbing visual change, resulting in the development having a higher degree of visual contrast. This is not necessarily negative, however, as it could introduce a point of interest.

5.3.2 Height and scale of solar panels and ancillary structures

Any structure of large bulk or height will contrast starkly with the surrounding landform and will be highly visible due to the lack of screening. However, the solar panel frames are relatively low (less than 3m) and although regularly spaced, they remain fairly fragmented and faceted in appearance. The 3m fencing is potentially more significant in visual terms – and should be as transparent as possible (palisade, not solid) and dark in colour as possible (charcoal or black preferably).

5.3.3 Visibility from Sensitive Receptors

The landscape character of the proposed site is more sensitive to visual change due to the open and expansive sense of place, and monochromatic land use typology. However, the general visibility of the site would be moderate. Should screen planting occur on all sides of the development, the site would only be visible to a minimal number of people - due to its isolated location.

5.3.4 Glare and Reflection

The applicant has indicated that the solar panels would be manufactured of material that do not generate significant glare. Glare would only be noticeable to views at higher elevations - from the koppies on either side of the site, but only where there are existing viewpoints or access routes.

5.3.5 Light Pollution

At this stage no information is available regarding security lighting. However, any external lights to be installed should be shielded in such a way as to cast light only upon the area required to be illuminated. No naked light sources are to be visible from beyond the site (only reflected light should be visible away from the site), and no light should be emitted into the sky (reflectors should cast light downwards only).

5.3.6 Visual Scarring

Limited visual scarring will occur should the development be screened on all sides, and once the vegetation has been allowed to recover. A landscape rehabilitation plan with appropriate plant species list could be developed to assist in this regard.

5.3.7 Visibility of Construction Site Camp & Construction Vehicles

The site camp would be located within the site boundary – on the southern portion of the site. This element will have limited influence due to its temporary nature and isolated geographic location of the proposed site.

5.3.8 Cumulative Impacts

The development of the ASEF is the first of its kind in the region and the geographic location limits its visibility. However, should similar facilities be established in the area beyond the saddle, these would become visible to surrounding towns. Further development of this kind should be considered within context.

Table 1: Summary of impacts during construction phase:

ACTIVITY	IMPACT
Site clearing & grading	Although this has a high visual impact it would be similar to agricultural fields that have been ploughed and will thus fit into the farmland landscape
Construction of electrical fence	The electrical fence should be fairly transparent and not hamper views from and towards the proposed site. It should be palisade rather than solid, and dark in colour
Construction of screw pile foundations	The screw foundations onto which the solar panel frames will be fixed are largely underground and will have a limited visual impact.
Construction of solar panel frames	The solar panels, although rigidly organised, are fairly low and fragmented and with screening should have little impact on the surrounding environment.
Transmission lines and new substation	An entire new transmission line will be constructed adjacent to the existing power lines – connecting to a new substation. This
Vehicular traffic	Increased traffic will be experienced during construction; however, due to the isolated nature of the site this will have little impact on the surrounding environment.

Table 2: Summary of impacts during operational phase:

ACTIVITY	IMPACT
Vehicular traffic	During the operational phase intermittent vehicular traffic will occur - mainly for maintenance purposes. Thus a limited visual impact on the receiving environment is expected.
Solar panel infrastructure	The solar panels, although rigidly organised, are fairly low and fragmented. With sufficient screening there should be little impact on the surrounding environment.
Transmission lines and substation	These follow an existing route, running parallel to extant power lines. Thus the new transmission lines will not significantly alter the visual condition.
Security lighting	any external lights should be shielded to cast light only upon the area required to be illuminated. No naked light sources are to be visible from beyond the site, and no light should be emitted into the sky

5.4 Mitigation Measures

Should the proposal be approved, several mitigation measures will reduce negative visual impacts and augment positive visual impacts, to ensure that the ASEF sits comfortably within its visual environment. These are as follow:

Screen Planting:

Additional screen planting, using appropriate species, congruent with the rural agricultural landscape will reduce the visibility of the proposed ASEF, and could be introduced as 'windbreaks' along the site boundaries. Indigenous vegetation should be allowed to colonize the site. A landscape rehabilitation plan should be included.

Easrth-Shaping

Flattening and grading of the site is to be kept to a minimum – and as far as possible the natural profile and slope of the site is to be maintained. Natural drainage should be allowed to continue.

Solar Panels

The applicant has also indicated that the solar panels would be manufactured of material that do not generate significant glare. This must be ensured, however the actual installation itself can become a point of visual interest within an otherwise ubiquitous farmscape.

Security lighting

Security lighting must be kept to an absolute minimum – and only the portions of the that are necessary to illuminated may be lit. Only reflected light is permissible - no naked light may be visible from the surrounding context. All light must be shielded from view. No light may be cast into the sky – reflectors must ensure that light is cast downwards. Light masts should be kept as low as possible.

Security fencing

The fencing should be as transparent as possible (palisade, not solid). It should be dark in colour (black or charcoal) – to recede from view and disappear into the background. The fence should not be visually dominant over the solar panels.

Transmission lines

These should follow the path of the existing power lines as far as possible – to minimise impact. 'Windbreak planting could be installed parallel to these lines – to provide a background for visual absorption.

New substation

Should a new housing building be required, this should take the form of a simple farm building – as per the existing rural structures within the surrounds. A simple barn or shed-type building with screen planting where possible would be most appropriate.

6. CONCLUSIONS AND RECOMMENDATIONS

The ASEF site is of lesser concern than the new transmission lines, however as these following an existing line in an already transformed environment, their actual significance in visual impact terms is somewhat reduced.

As no significant visual or aesthetic issues are present, the visual specialists recommend that approval for the proposal be granted; with the condition that sufficient mitigation measures (as described above) are put in place.

These should be guided by the inclusion of a landscape rehabilitation (or landscape development) plan; environmental management plan covering both construction and operational phases, (prepared by a professional landscape architect or suitably qualified consultant).

Further, this presents the opportunity to set the standard for local Solar Energy Facilities, which should always be sited and constructed with visual considerations in mind. This could be an educational opportunity as well – creating heightened awareness of green energy potential – and promoting the aesthetics of sustainability in a tangible way.

7. REFERENCES

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SOLAIREDIRECT Photovoltaic modules

- The assurance of optimum performance for a minimum area.
- Highly transparent glass that allows high electricity yields .
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- Made in South Africa.
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SOLAIREDIRECT is one of the largest manufacturers of solar modules in Europe and offers its customers high quality modules. The use of crystalline solar cells of high quality guarantee better returns.

Solar glass

For the construction of our photovoltaic modules, we use solar glass specially produced by renowned German producers. The surface of the glass with its special structure and its translucency enables increased solar installations. SOLAIREDIRECT modules yield high energy throughout the life of the modules.

Frames

Executive SOLAIREDIRECT modules are made of anodized extruded aluminum. They have a high resistance to twisting, are equipped with holes for drainage and suitable for all standard editing systems. With their profile, the modules can withstand very high loads (tested up to 540 kg/m²). Our modules are also available without a frame.

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SOLAIREDIRECT modules are certified to IEC 61215 Edition II and the standard 61,730
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- Qualified, IEC 61215
- Safety tested, IEC 61730
- Heavy Snow Load tested
- Periodic Inspection



SOLAIREDIRECT SD1-0610 modules

Mechanical Characteristics

Length:	1660 mm
Width:	990 mm
Arrivals :	45 mm
Weight:	Approx . 19,5 kg
Connection Box :	1 IP65 box avec 3 bypass diodes
Cable :	Solar cable, length 1000 mm, 4 mm ² Pre-assembled with Tyco or Multicontact plug
Front glass :	Antireflection glass 3,2 mm
Cellules :	60 polycrystalline cells (156 x 156 mm)
Encapsulation of cells :	EVA (Ethylène Vinyle Acétate)
Back :	Tedlar or APA composite sheet
Frame :	Black or raw anodized aluminium profile
Laminate size :	1652 x 982 x 5 mm (L x l x h)



Electrical Characteristics (typical)

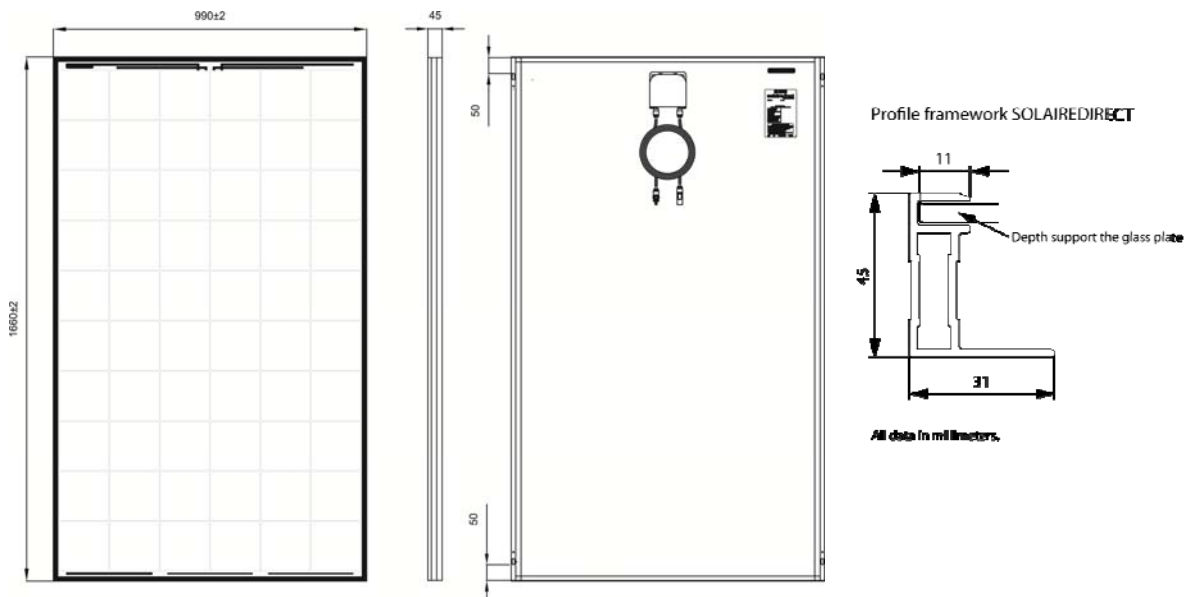
Module class :	250 Wc	245 Wc	240 Wc	235 Wc	230 Wc
Minimum Power :	247,5 Wc	242,5 Wc	237,5 Wc	232,5 Wc	227,5 Wc
Maximum Power :	252,5 Wc	247,5 Wc	242,5 Wc	237,5 Wc	232,5 Wc
Rated voltage U _{mpp} :	29,8 V	29,5 V	29,3 V	29,0V	28,8 V
Mpp Current I _{mpp} :	8,40 A	8,30 A	8,20 A	8,10 A	8,00 A
Open circuit voltage U _{oc} :	37,1 V	36,9 V	36,7 V	36,6 V	36,5 V
Short circuit I _{sc} :	8,90 A	8,80 A	8,70 A	8,60 A	8,50 A
Max system voltage. :	1000 V	1000V	1000 V	1000 V	1000 V
Yield module :	15,2 %	14,9 %	14,6 %	14,3 %	14,0 %

Temperature coefficient of the open circuit voltage : - 0,35%/K
 Temperature coefficient of short circuit current: 0,05%/K
 Temperature coefficient of power : - 0,44 %/K

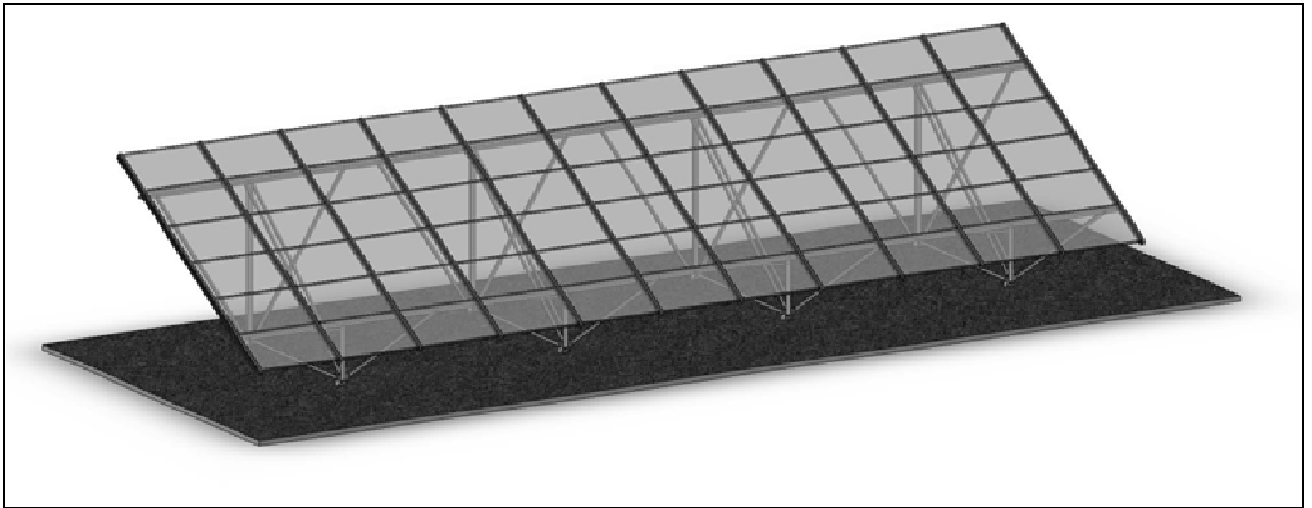
The above values refer to a Standard Test Conditions : 1000 W/m², AM 1,5 and a cell temperature of 25 °C,
 Power measurements made with an accuracy of +/- 1%.

Eligible Operating Conditions

Operating Temperature Range :	- 40 °C à + 85 °C
Hail :	Up to a hailstone diameter of 28 mm and an impact speed of 86 km/h
Test Load :	Certified up to 5 400 Pa according to IEC 61215 Ed.2 (advanced test)

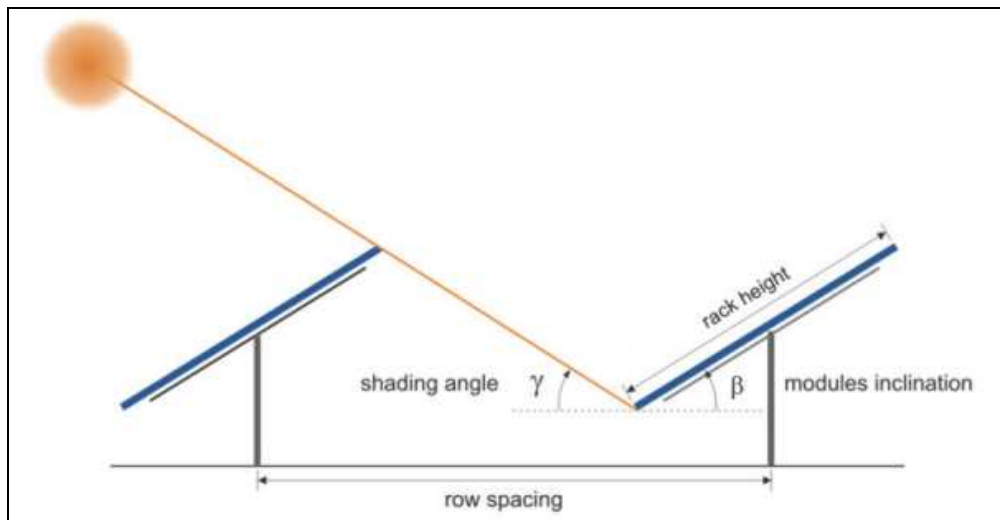


The site consists of 40 392 modules set up in an array of 11 x 6 rows of modules in separate strings. This results in a total number of arrays (or frames) of 612. Each array delivers approximately 15,8 kWp. A typical layout of the structure is as follows:



Typical Layout of Panel Structure

Each structure is inclined at an angle of 30° with a shading angle of 21° used to calculate the spacing between rows. Spacing varies according to the natural slope of the site



Shading & Inclination Angles