

SITE SENSITIVITY VERIFICATION REPORT: PALAEOLOGICAL HERITAGE**PROPOSED SONNEBLUM PHOTOVOLTAIC SOLAR ENERGY FACILITY NEAR BLOEMFONTEIN, MANGAUNG METROPOLITAN MUNICIPALITY, FREE STATE PROVINCE**

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EXECUTIVE SUMMARY

Sonneblom Solar Power Plant (Pty) Ltd is proposing to develop the Sonneblom Photovoltaic Solar Energy Facility on Portion 1 of the farm Blydschap No. 504, c. 16 km southeast of Bloemfontein, Mangaung Metropolitan Municipality, Free State Province. The project has received Environmental Authorisation and is currently subject to a Part 2 Amendment Process. A pre-construction, field-based palaeontological assessment of the project has been requested by SAHRA.

While the Sonneblom SPP project area overlies potentially fossiliferous Late Permian continental sediments of the Adelaide Subgroup (Lower Beaufort Group) at depth, the bedrocks are nowhere exposed here due to pervasive, thick soil and grassy vegetation cover. No substantial Late Caenozoic alluvial deposits were identified during the site visit. The soils study for the project area indicates soil depths of 70 cm or more while the underlying Karoo Supergroup bedrocks are likely to be deeply-weathered near surface and hence largely unfossiliferous. Vertebrate fossil remains have rarely been recorded in this portion of the Main Karoo Basin, not least because of low bedrock exposure levels. The only fossil material recorded on site comprises occasional small, pebble-sized blocks of petrified wood reworked from the bedrocks into the overlying soils and sparse surface gravels. These derived fossils occur widely within the Karoo Basin in the Free State region, are of low scientific and conservation value (Proposed Field Rating IIC Local Resource) and do not require mitigation. No other fossils were recorded from the Late Caenozoic superficial sediments in the project area. It is concluded that the area is of LOW palaeosensitivity; the Very High sensitivity indicated by the DFFE Screening Tool is therefore *contested*.

It is concluded that potential impacts on palaeontological heritage resources due to the proposed renewable energy development are likely to be of LOW to VERY LOW significance. Pending the discovery of significant new fossil finds before or during construction, no further specialist palaeontological studies, monitoring or mitigation are recommended for this development. Provided that the Chance Fossil Finds Protocol tabulated in Appendix 1 is incorporated into the EMPr and fully implemented during the construction phase of the PV solar energy facility and grid connection developments, there are no objections on palaeontological heritage grounds to authorisation of the proposed Sonneblom SPP and associated grid connection.

1. INTRODUCTION

Sonneblom Solar Power Plant (Pty) Ltd is proposing to develop the Sonneblom Photovoltaic Solar Energy Facility (SPP) on Portion 1 of the farm Blydschap No. 504, located some 16 km southeast of Bloemfontein within the Mangaung Metropolitan Municipality, Free State Province (Figs. 1 & 2). The project entails the generation of up to 84MW electrical power through photovoltaic (PV) panels and its total footprint will be approximately 171 hectares (including supporting infrastructure on site). The proposed grid connection for the Sonneblom SPP would tie in with the existing Harvard Sannaspos Rural 86 Section 132.0 kV line traversing the site (Fig. 3). Environmental Authorisation (EA) for the Sonneblom Photovoltaic SPP was granted on 19 June 2015 (DEA Ref. No. 14/12/16/3/3/2/673). Sonneblom SPP is now applying for the amendment of the EA to correct the coordinates of corner points of study area, include a battery storage system (BESS), associated amendments and the access road.

The palaeosensitivity of the project area according to the DFFE Screening Tool is Very High (Fig. 4). An initial desktop palaeontological heritage (PIA) report by Dr J.S. Brink (undated) highlighted the potentially high palaeontological sensitivity of both the Palaeozoic bedrocks of the Lower Beaufort Group (Karoo Supergroup) as well as (especially) Late Caenozoic alluvial deposits in the project area. Based on this initial report, SAHRA's Final Comment (SAHRA CaselD: 5728, Letter of January 21, 2015) stated that:

A palaeontological field based assessment will be required and submitted to SAHRA before construction activities.

If any archaeological/palaeontological or any other heritage resources are identified, SAHRA and an archaeologist/palaeontologist must be alerted immediately dependent on the nature of the find. If this newly discovered heritage resource is considered significant, a rescue excavation may be needed and a permit from the responsible heritage authority required.

In accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a combined field-based and desktop site sensitivity verification has therefore been undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the DFFE National Web-Based Environmental Screening Tool.

The present PIA report has been commissioned by Mr Patrick Mabasa of Subsolar Energy (Pty) Ltd (Contact details: Subsolar Energy (Pty) Ltd. P.O. Box 785553, Sandton, 2146. Cell: +27 71 305 9183. E-mail: mabasa@subsolar.co.za). Environamics has been appointed as the independent environmental consultant to undertake the Part 2 Amendment Process on Sonneblom SPP's behalf (Contact details: Ms Carli Steenkamp. PO Box 6484, Baillie Park, 2526. Telephone: 082 220 8651. Cell: 086 762 8336. E-mail: carli@environamics.co.za).

2. DATA SOURCES FOR SITE SENSITIVITY VERIFICATION

The site sensitivity verification of the proposed Sonneblom SPP and the associated grid connection is based on:

- A short project outline, maps, kmz files, DFFE Screening Tool palaeosensitivity map and other relevant data provided by Subsolar Energy (Pty) Ltd, including the *Draft Motivational Report: Part 2 Amendment as part of the Sonneblom Photovoltaic Solar Energy Facility near Bloemfontein, Free State Province* compiled by Environamics (2021).
- A desktop review of (a) the relevant 1:50 000 and 1: 250 000 scale topographic maps, (b) Google Earth© satellite imagery, (c) published geological and palaeontological literature, including the relevant 1:250 000 geological map (2926 Bloemfontein) for which a sheet explanation has not yet been published, as well as (d) previous fossil heritage (PIA) assessments in the Bloemfontein – Free State region by the author and Dr J.S. Brink (undated) (See References).

- A half-day field assessment of representative sectors of the combined PV and grid connection project area by the author on 7 August 2021.

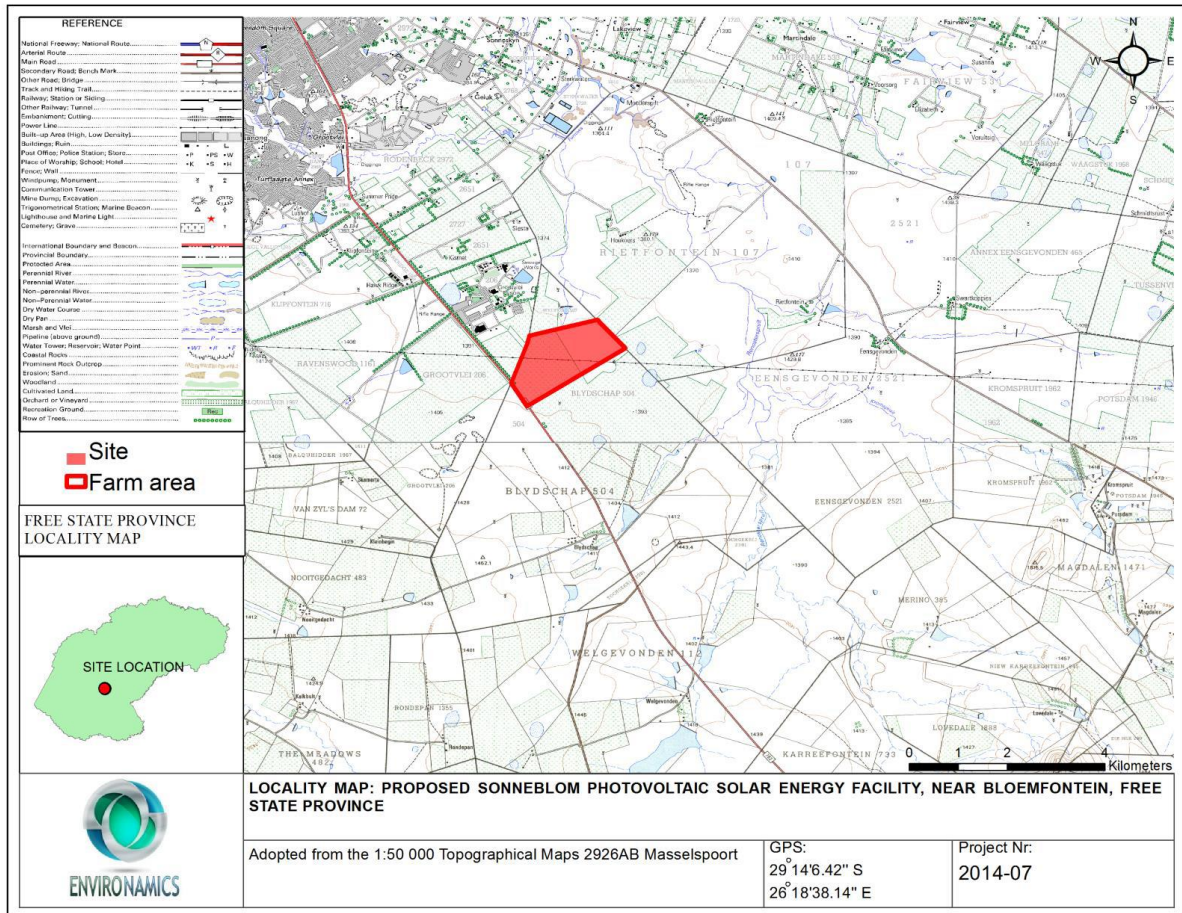


Figure 1: Map showing the location of the proposed Sonneblom Photovoltaic Solar Energy Facility (SPP) on Portion 1 of the farm Blydschap No. 504, situated c. 16 km southeast of Bloemfontein, Mangaung Metropolitan Municipality, Free State Province (Figure abstracted from the Draft Motivational Report prepared by Environamics, January 2021).

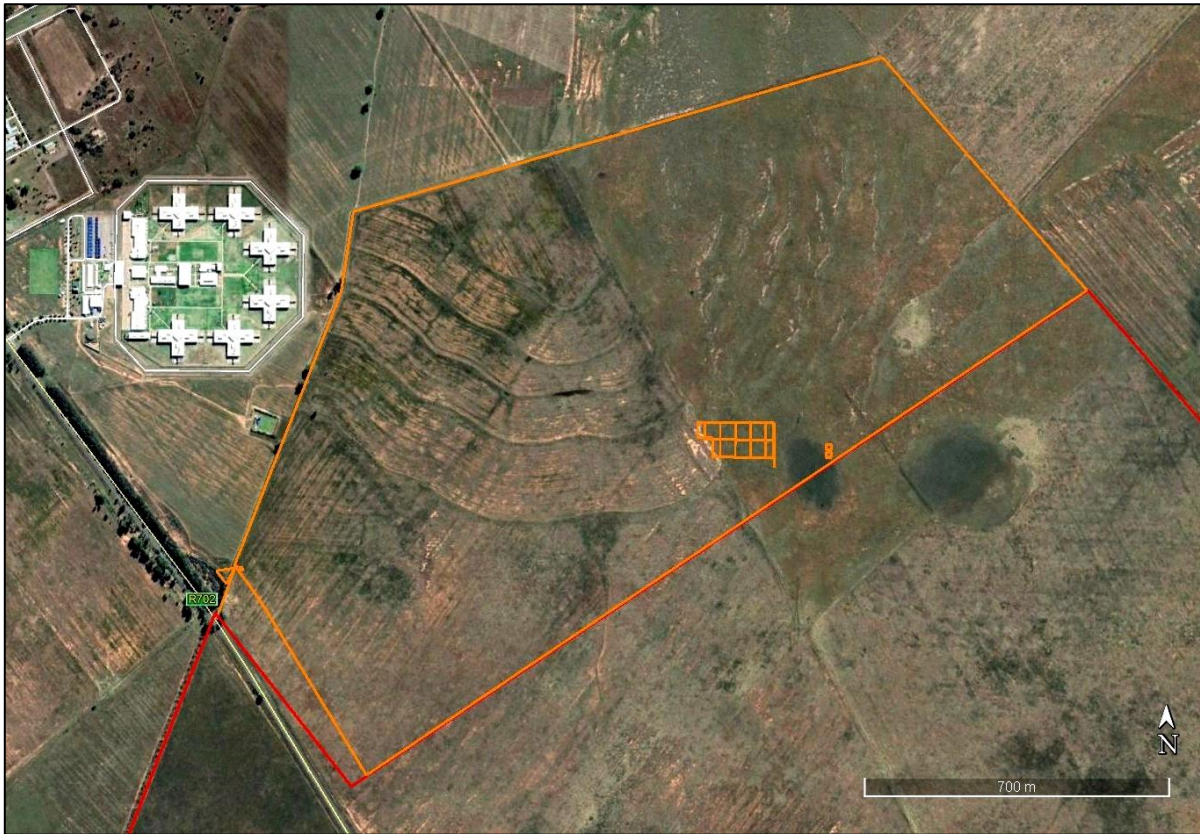


Figure 2: Google Earth© satellite image showing the project area (orange polygon) for the proposed Sonneblom Photovoltaic Solar Energy Facility (SPP) on Portion 1 of the farm Blydschap No. 504. The pale or dark rounded features seen here are probably shallow pans but these were obscured by grass during the site visit. The western sector of the project area has clearly been modified for agriculture. Sinuous SSW-NNE trending bare patches in the eastern sector might be related to shallow drainage courses but no identifiable alluvial deposits were encountered here during the site visit.

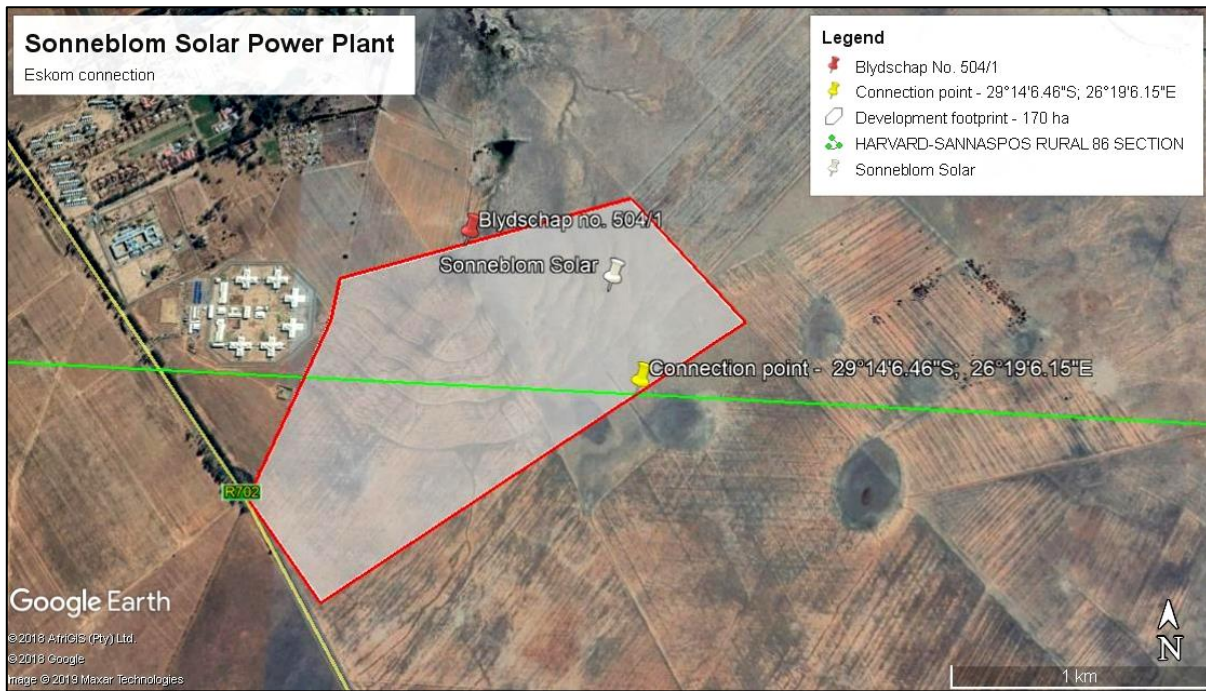


Figure 3: Proposed grid connection for the Sonneblom SPP to tie in with the existing Harvard Sannaspos Rural 86 Section 132.0 kV line traversing the site.

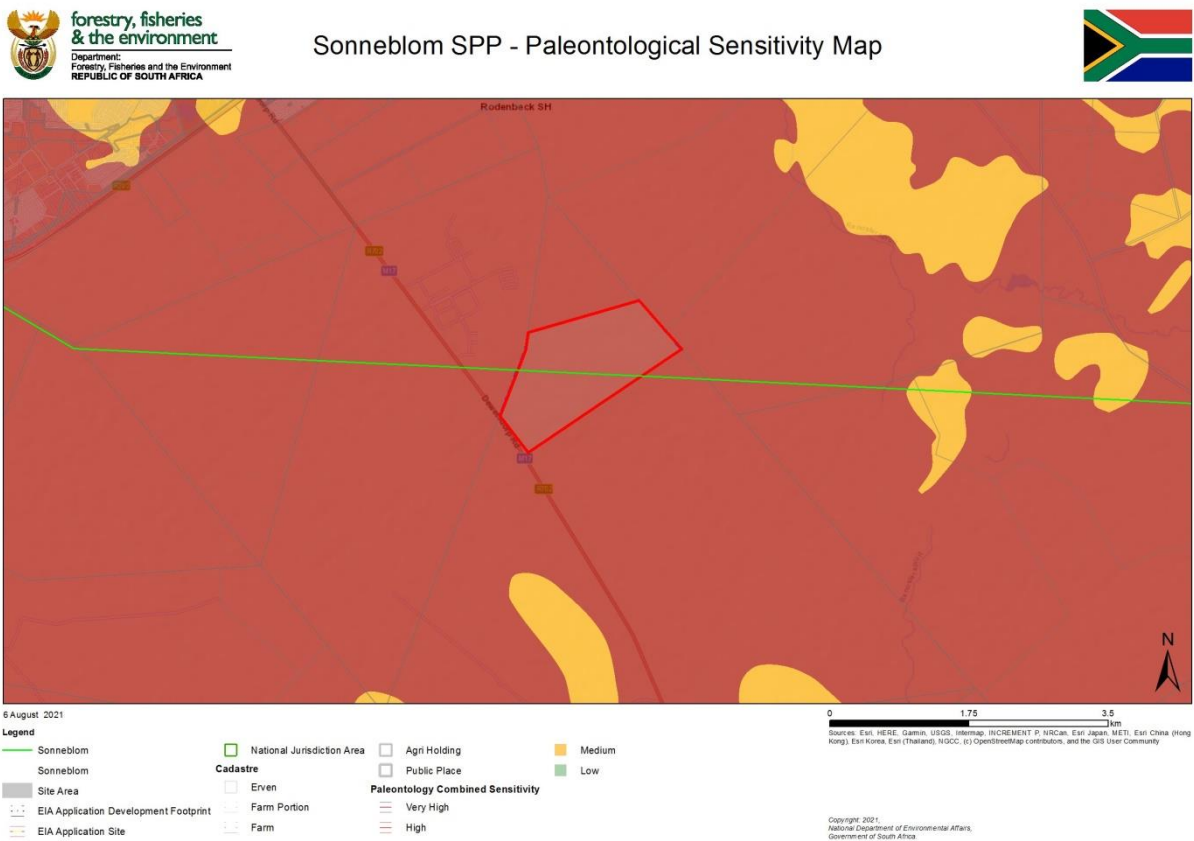


Figure 4: Paleontological sensitivity map for the Sonneblom SPP project area near Bloemfontein. The entire area is provisionally assigned a Very High palaeosensitivity here due to the underlying sedimentary bedrocks of the Lower Beaufort Group (Karoo Supergroup). The palaeosensitivity mapping is *contested* in this report.

3. GEOLOGICAL & PALAEOLOGICAL CONTEXT

The geology of the Sonneblom SPP project area is shown on 1: 250 000 geological map 2926 Bloemfontein (Fig. 5, Council for Geoscience, Pretoria) for which a sheet explanation has not yet been published. The project area is underlain at depth by continental (fluvial / lacustrine) sediments of the **Adelaide Subgroup** (Lower Beaufort Group, Karoo Supergroup) that are probably Late Permian in age (Johnson *et al.* 2006). Due to generally poor bedrock exposure, the Adelaide Subgroup has not been differentiated into formations on the Bloemfontein 1: 250 000 geology sheet. A short account of the sedimentology of the Adelaide Subgroup tabular, pale buff to whitish arkosic channel sandstones and grey-green overbank mudrocks with horizons of ferruginous carbonate diagenetic concretions in the Winburg 1: 250 000 sheet project to the north of Bloemfontein is given by Nolte (1995) who infers a braided river depositional setting.

While the Lower Beaufort Group (Adelaide Subgroup) beds near Bloemfontein are not assigned to a specific formation on the published 1: 250 000 geological map, in terms of current mapping of the Main Karoo Basin fossil assemblage zones (AZs) the fossil biotas in this sector of the basin are assigned to the **Daptocephalus Assemblage Zone**, previously known as the *Dicynodon* Assemblage Zone (Smith *et al.* 2020, Viglietti 2020). Mapping of Karoo Basin fossil sites by Nicolas (2007) (Fig. 6) emphasizes the dearth of recorded fossil vertebrate remains in this portion of the Main Karoo Basin. This is probably in large part due to the generally low levels of bedrock exposure in this region.

Recent authoritative reviews of fossil biotas within the *Daptocephalus* AZ (previously known as the *Dicynodon* AZ) have been provided by Smith *et al.* (2012) and Viglietti (2020). In the absence of good, fresh bedrock exposure, as in the present study area near Bloemfontein, the main category of fossils found regionally comprises resistant-weathering blocks of petrified (silicified) wood that have been reworked by weathering and erosion into the overlying superficial sediments, *viz.* alluvium and downwasted surface gravels. Fossil wood (gymnosperm) taxa recorded from the *Daptocephalus* AZ include *Australoxylon* and *Prototaxoxylon* (Bamford 1999, 2004, 2016).

The mainly Pleistocene to Recent superficial deposits in the project area - *viz.* sandy soils, downwasted surface gravels, pedocretes (such as ferricretes) and alluvium – are poorly known in palaeontological terms. They are likely to be of Low to Very Low palaeosensitivity for the most part. However, these younger sediments may occasionally contain important fossil biotas, notably the bones, teeth and horn cores of mammals (*e.g.* Cooke 1974, Skead 1980, Klein 1984, MacRae 1999, Partridge & Scott 2000, Churchill *et al.* 2000, Boshoff & Kerley 2013). These may include ancient human remains of considerable palaeoanthropological significance (*e.g.* Grine *et al.*, 2007). Other potential late Caenozoic fossil biotas from these superficial deposits include non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (*e.g.* calcretised termitaria and other insect burrows or nests, coprolites, rhizoliths), and plant remains such as peats or palynomorphs (pollens) in fine-grained, organic-rich alluvial horizons. Quaternary alluvial sediments may contain reworked Stone Age artifacts that are useful for constraining their maximum age.

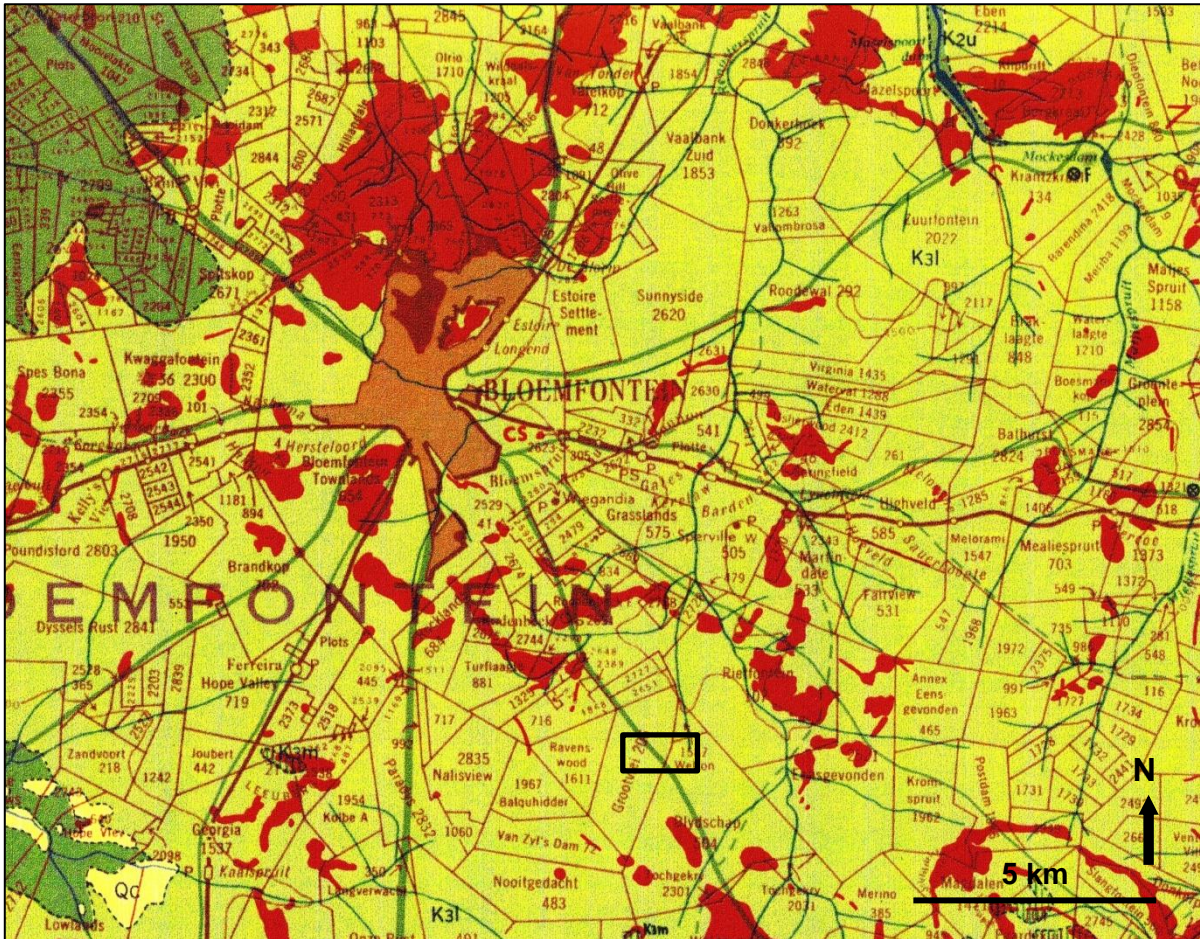


Figure 5: Extract from 1: 250 000 geological map 2926 Bloemfontein (Council for Geoscience, Pretoria) showing the *approximate* location of the Sonneblom Photovoltaic Solar Energy Facility (SPP) project area on Portion 1 of the farm Blydschap No. 504 (small black rectangle). The area is underlain at depth by Late Permian continental sediments of the Lower Beaufort Group / Adelaide Subgroup (dark green) that are not differentiated at formational level on the map due to generally poor bedrock exposure levels. Most of the Beaufort Group outcrop area around Bloemfontein is mantled by Late Caenozoic superficial sediments such as alluvium (pale green). Dolerite intrusions (dark red) building low Karoo *koppies* occur in the wider region but are not mapped within the study area.

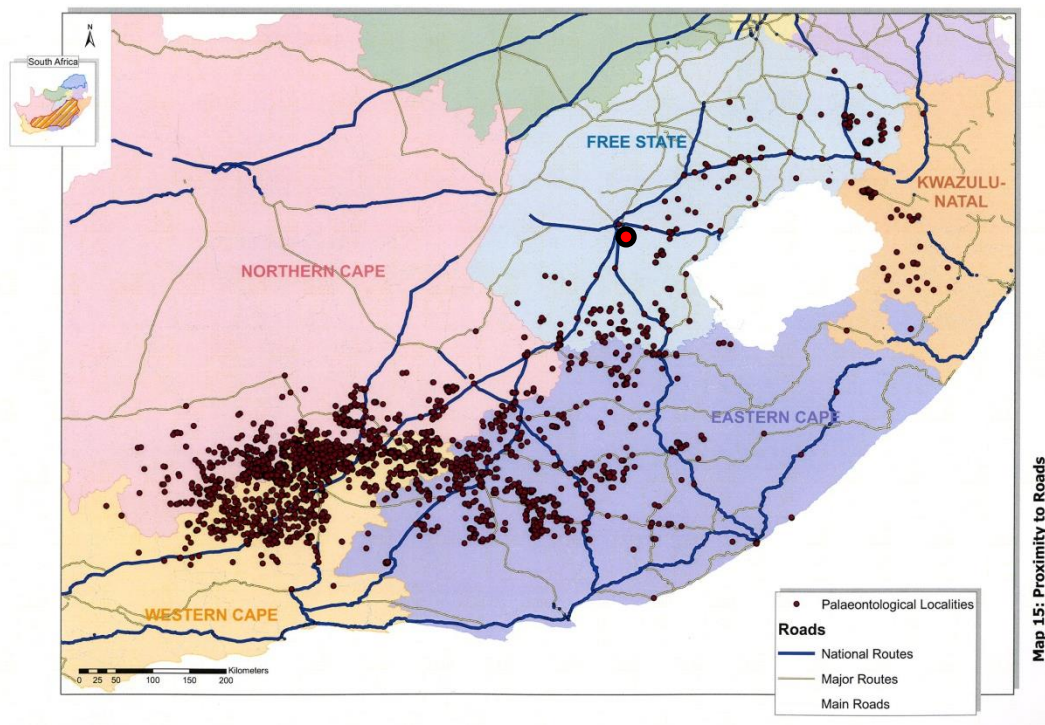


Figure 6: Map of Beaufort Group fossil tetrapod localities in the Main Karoo Basin (from Nicolas 2007) showing the paucity of fossil records in the central Free State region (red circle) near Bloemfontein. This may be largely due to poor bedrock exposure levels in this sector of the Main Karoo Basin.

4. SITE SENSITIVITY VERIFICATION – FIELD OBSERVATIONS

The Sonneblom Photovoltaic Solar Energy Facility (SPP) project area on Portion 1 of the farm Blydschap No. 504 is situated in flat-lying to gently undulating agricultural lands between 1380 and 1400 m amsl on the south-eastern outskirts of Bloemfontein, just east of the R702 tar road. Satellite imagery (Fig. 2) shows that the western sector of the project area in particular has been modified for agriculture. At the time of the palaeontological site visit (August 2021) the site was almost entirely covered with dense grassy to fine shrubby vegetation, with very occasional emergent woody shrubs and numerous scattered domical termitaria. Bedrock exposure is effectively zero due to the pervasive cover by sandy soils with sparse downwasted / eluvial surface gravels (Figs. 7 & 8). The surface soils and gravels are only visible in occasional bare patches among the grassy vegetation, including along farm tracks, as well as in aardvark burrows (Figs. 9 & 10). A set of SSW-NNE trending, sinuous bare patches, clearly visible on satellite images of the eastern project area, might be related to the bedrock stratigraphy and / or shallow drainage lines. In his desktop study, Brink (undated) remarks on potential drainage lines or alluvial deposits related to tributary streams of the Modderivier (one such tributary runs c. 2.2 km to the NE of the project area) but notes that surface drainage lines are not obvious here. Any drainage lines or pans (darker round features seen in satellite images within and outside the project area) are clearly very shallow and masked by grassy vegetation here. No identifiable alluvial or pan deposits were encountered during the site visit.

No fossiliferous or other exposures of the Adelaide Subgroup bedrocks mapped within the Sonneblom SPP project area were encountered during the field survey. It is likely that any near-surface mudrocks here are highly weathered. The only fossil material recorded during the site visit comprises very sparse, small (up to few cm max. diam.), angular to subrounded blocks of petrified wood observed among downwasted surface gravels exposed in occasional bare patches within the Sonneblom Solar Power Plant project area (Fig. 11). It is noted that these fossils, reworked by erosion and downwasting from the Adelaide Subgroup bedrocks, are of widespread occurrence within the Late Caenozoic superficial deposits in the Free State. Apart from reworked petrified wood, no further fossil remains were recorded within the superficial sediments within the

project area. Because the scientific and conservation value of the fossil wood material is considered to be low, since it is out of context and of very widespread occurrence regionally, the palaeosensitivity of the solar power plant and grid connection project areas is assessed as LOW. The Very High sensitivity shown on the DFFE Screening Tool Map is therefore contested here.

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Figure 7: Typical flat, grassy terrain with scattered domical termitaria seen in the Sonneblom SPP project area. Bedrock exposure here is effectively zero in all seasons due to pervasive thick soil cover.



Figure 8: Even along farm tracks within the SPP project area bedrock and soil exposure is very limited (View eastwards along the Harvard Sannaspos Rural 86 Section 132.0 kV line that traverses the site).



Figure 9: Occasional bare patches among the grassy vegetation expose soils and sparse surface gravels but no Adelaide Group bedrocks or alluvial sediments.



Figure 10: Sample of pebble-sized, angular to subrounded surface gravels (sandstone, dolerite, vein quartz, granite / pegmatite, hornfels, ferricrete glaebules etc) collected from a bare area (Scale in cm).



Figure 11: Small reworked block of silicified fossil wood exposed among surface gravels (Scale in cm and mm) (29 14 05.7 S, 26 19 03.1 E). Such material is of low scientific or conservation significance (Proposed Field Rating IIIC Local Resource) and does not require mitigation.

APPENDIX 1: JOHN ALMOND SHORT CV

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and the University of Tübingen in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa and Madagascar. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out numerous palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Northwest Province, Mpumalanga, Gauteng, KwaZulu-Natal and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has served as a member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



Dr John E. Almond
Palaeontologist
***Natura Viva* cc**

APPENDIX 2: CHANCE FOSSIL FINDS PROTOCOL

SONNEBLOM PHOTOVOLTAIC SOLAR ENERGY FACILITY NEAR BLOEMFONTEIN	
Province & region:	Free State Province: Mangaung Metropolitan Municipality
Responsible Heritage Resources Agency	SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za).
Rock unit(s)	Adelaide Subgroup (Lower Beaufort Group) bedrocks Late Caenozoic alluvium, soils
Potential fossils	Rare vertebrate remains (reptiles, therapsids), petrified wood within Beaufort Group bedrocks Fossil mammal bones, teeth, horn cores, freshwater molluscs, plant material and reworked petrified wood blocks in Late Caenozoic alluvium.
ECO protocol	1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (<i>N.B.</i> safety first!), safeguard site with security tape / fence / sand bags if necessary.
	2. Record key data while fossil remains are still <i>in situ</i> : <ul style="list-style-type: none"> • Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo • Context – describe position of fossils within stratigraphy (rock layering), depth below surface • Photograph fossil(s) <i>in situ</i> with scale, from different angles, including images showing context (e.g. rock layering)
	3. If feasible to leave fossils <i>in situ</i> : <ul style="list-style-type: none"> • Alert Heritage Resources Agency and project palaeontologist (if any who will advise on any necessary mitigation • Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume
	3. If <i>not</i> feasible to leave fossils <i>in situ</i> (emergency procedure only): <ul style="list-style-type: none"> • <i>Carefully</i> remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock) • Photograph fossils against a plain, level background, with scale • Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags • Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist • Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation
	4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.
5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency	
Specialist palaeontologist	Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.

