PALAEONTOLOGICAL IMPACT ASSESSMENT: DESKTOP STUDY

PROPOSED SANNASPOS PHOTOVOLTAIC (PV) SOLAR ENERGY FACILITIES, Portion 0 of Farm 1808 Besemkop and Portion 0 of Farm 2962 Lejwe of Mangaung Metropolitan Municipality, Free State Province.

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July 2012

SUMMARY

The proposed Sannaspos Photovoltaic (PV) Solar Energy Facilities are situated in Mangaung Metropolitan Municipality, Free State Province. The region is underlain by the Beaufort Group geological strata, of the Karoo Supergroup. This geological unit consists essentially of sandstones and shales that were deposited in the Karoo Basin from the Middle Permian to the early part of the Middle Triassic periods. The predominantly terrestrial sediments of the Beaufort Group have yielded abundant vertebrate fossils notably early primitive reptiles (*Captorhinids*), mammal-like reptiles (*Therapsids*), amphibians, fish, molluscs and plant fossils. These finds have been instrumental in tracing the development of terrestrial life through the Permo-Triassic periods.

Excavations during the construction phase of the development may uncover previously unknown fossil deposits. To mitigate negative impacts on the fossil deposits, it is recommended that a qualified palaeontologist should undertake ground reconnaissance prior to groundbreaking and be consulted if any fossils are unearthed during excavations.

INTRODUCTION

SolaireDirect Southern Africa (Pty) Ltd is proposing to establish a commercial photovoltaic solar energy facility as well as associated infrastructure on a site located approximately 45 km east of Bloemfontein in Mangaung Metropolitan Municipality of Free State Province. The proposed development will be located on Portion 0 of Farm 1808 Besemkop and Portion 0 of Farm 2962 Lejwe, and will encompass area of approximately 600 hectares (Fig. 1).

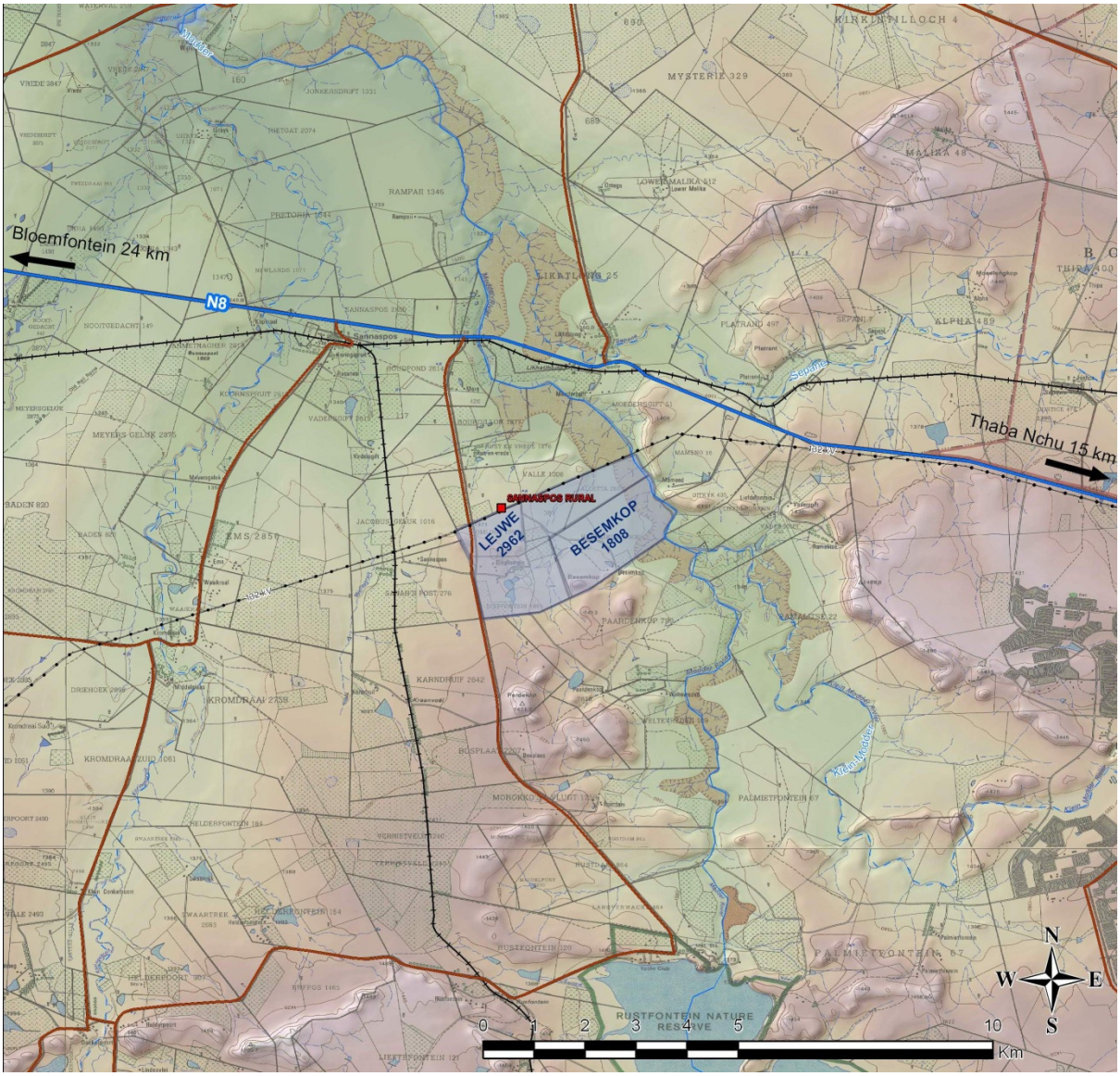


Figure 1. Extract showing the location of proposed Sannaspos Photovoltaic (PV) Solar Energy Facilities in Mangaung Metropolitan Municipality, Free State Province.

COMPONENTS OF THE PROPOSED DEVELOPMENT

The key components of the Sannaspos Photovoltaic (PV) Solar Energy Facilities will accommodate the following:

- Photovoltaic (PV) panels with an installed capacity of up to 75MW (Sannaspos PV Phase 1) and up to 10MW (Sannaspos PV Phase 2).
- Arrays of photovoltaic (PV) panels;
- Inverter/Transformer enclosures;
- Grid connection substation and 132kV overhead power lines;
- Auxiliary Electrical equipment
- Cabling between the project components, to be lain underground where practical;
- Internal access roads; fencing and

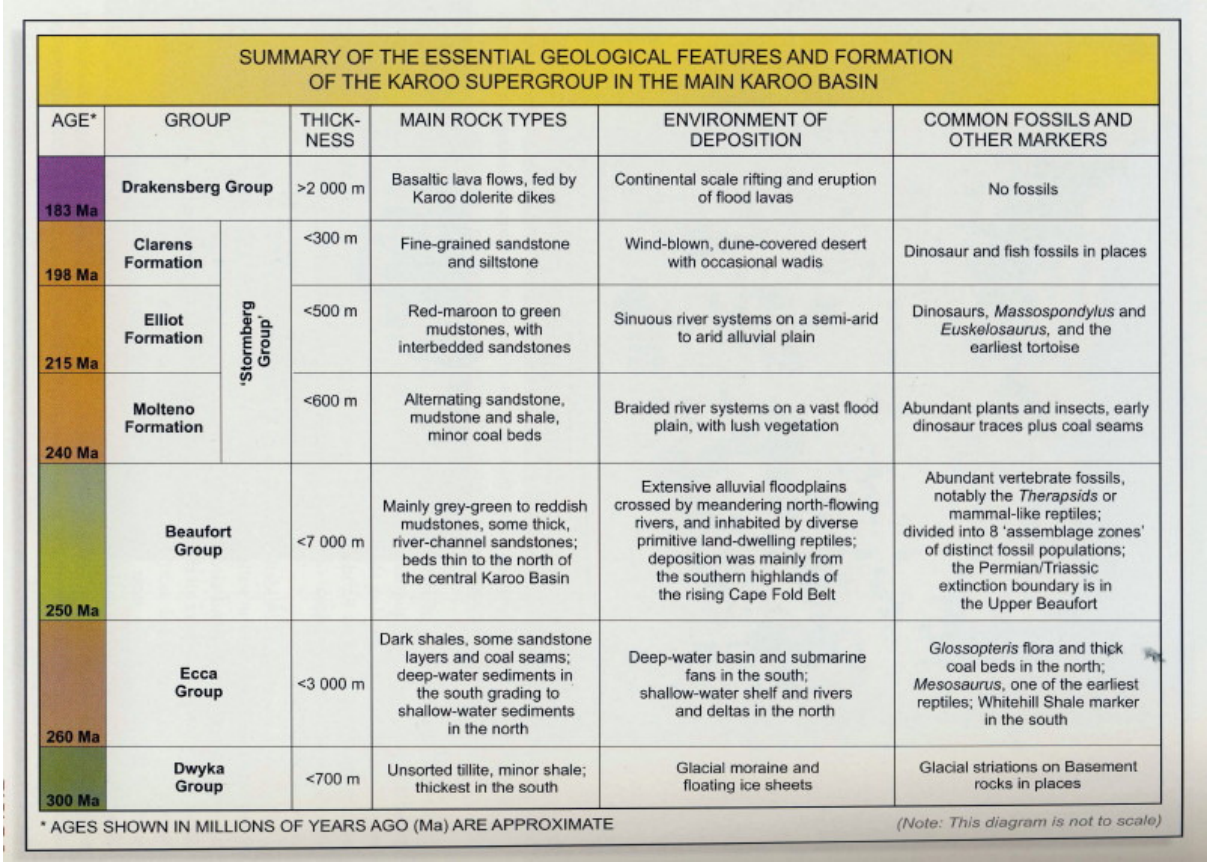
- Workshop area for maintenance storage, office, toilets and small water treatment unit.

GEOLOGICAL BACKGROUND

The bedrock geology of the study area is outlined on the 1: 250 000 Topo-Cadastral series of South Africa, 2926 Bloemfontein (Council for Geoscience, Pretoria; Theron, J.C. 1963). The site of the proposed Sannaspos Solar Power Development Facilities is underlain by sandstone and shale sediments that form the Beaufort Group, part of the Karoo Supergroup (Groenewald 1989).

PALAEONTOLOGICAL SIGNIFICANCE OF THE STUDY AREA

The Beaufort Group (Karoo Supergroup) of formations are rich in Triassic and Permian fossils (Johnson et al., 2006) (Fig. 2). Vertebrate fossils including retiles, mammal-like reptiles (*Therapsids*) (Fig. 3), amphibians and fish remains occur in the Beaufort Group (Rubidge et al., 1995). Invertebrate fossils, invertebrate burrows and trails, well-preserved leaf impressions, silicified wood and stem impressions have also been recorded from a number of localities in the Beaufort Group (Anderson et al., 1998; McLachlan & Anderson 1973; 1977; Riek, 1973, 1976, Rubidge et al., 1995).



SUMMARY OF THE ESSENTIAL GEOLOGICAL FEATURES AND FORMATION OF THE KAROO SUPERGROUP IN THE MAIN KAROO BASIN

AGE*	GROUP		THICK-NESS	MAIN ROCK TYPES	ENVIRONMENT OF DEPOSITION	COMMON FOSSILS AND OTHER MARKERS
183 Ma	Drakensberg Group		>2 000 m	Basaltic lava flows, fed by Karoo dolerite dikes	Continental scale rifting and eruption of flood lavas	No fossils
198 Ma	Clarens Formation	'Stormberg Group'	<300 m	Fine-grained sandstone and siltstone	Wind-blown, dune-covered desert with occasional wadis	Dinosaur and fish fossils in places
215 Ma	Elliot Formation	'Stormberg Group'	<500 m	Red-maroon to green mudstones, with interbedded sandstones	Sinuous river systems on a semi-arid to arid alluvial plain	Dinosaurs, *Massospondylus* and *Euskelosaurus*, and the earliest tortoise
240 Ma	Molteno Formation	'Stormberg Group'	<600 m	Alternating sandstone, mudstone and shale, minor coal beds	Braided river systems on a vast flood plain, with lush vegetation	Abundant plants and insects, early dinosaur traces plus coal seams
250 Ma	Beaufort Group		<7 000 m	Mainly grey-green to reddish mudstones, some thick, river-channel sandstones; beds thin to the north of the central Karoo Basin	Extensive alluvial floodplains crossed by meandering north-flowing rivers, and inhabited by diverse primitive land-dwelling reptiles; deposition was mainly from the southern highlands of the rising Cape Fold Belt	Abundant vertebrate fossils, notably the *Therapsids* or mammal-like reptiles; divided into 8 'assemblage zones' of distinct fossil populations; the Permian/Triassic extinction boundary is in the Upper Beaufort
260 Ma	Ecca Group		<3 000 m	Dark shales, some sandstone layers and coal seams; deep-water sediments in the south grading to shallow-water sediments in the north	Deep-water basin and submarine fans in the south; shallow-water shelf and rivers and deltas in the north	*Glossopteris* flora and thick coal beds in the north; *Mesosaurus*, one of the earliest reptiles; Whitehill Shale marker in the south
300 Ma	Dwyka Group		<700 m	Unsorted tillite, minor shale; thickest in the south	Glacial moraine and floating ice sheets	Glacial striations on Basement rocks in places

* AGES SHOWN IN MILLIONS OF YEARS AGO (Ma) ARE APPROXIMATE

(Note: This diagram is not to scale)

Figure 2. Summary of the essential geological features and formation of the Karoo Supergroup in the main Karoo Basin (Courtesy of http://www.saforums.co.za).

Figure 3. Example of *Cynognathus* skull typical of the Beaufort Group (Rubidge et al., 1995)

ASSESSMENT OF POTENTIAL IMPACT OF PROPOSED DEVELOPMENT

Excavations during the construction phase may uncover previously unknown fossil deposits. This in itself is a positive aspect of the development. However, it is possible that fossils may be lost, damaged of destroyed in the course of the excavations, which is the negative aspect of the project.

The negative impacts can be lessened or prevented altogether through engagement of qualified palaeontologist prior to the onset of the project, to sample, record and salvage fossil remains as well as assessing long-term impacts on fossil heritage.

CONCLUSIONS & RECOMMENDATIONS

The greater region including where the development of the proposed Sannaspos Photovoltaic (PV) Solar Energy Facilities will be located is well known for abundant vertebrate, invertebrate and plant fossils spanning the Triassic and Permian epochs. Though not every single locality is bound to contain fossils, there is likelihood that excavations during construction may unearth fossil remains. These fossils can be lost, damaged or destroyed, and as such, the following is recommended:

1. That a qualified palaeontologist be commissioned to undertake ground reconnaissance of the designated area prior to groundbreaking.
2. That construction manager(s) report any fossil finds encountered during construction to a qualified palaeontologist who will undertake necessary mitigation procedures in accordance with protocols of the South African Heritage Resources Agency (SAHRA).

References

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Declaration of Independence

I, Job Kibii, author of the Palaeontological Impact Assessment: Desktop Study, hereby declare that I am an independent consultant appointed by Zone Land Solutions to provide specialist input on the proposed Sannaspos Photovoltaic (PV) Solar Energy Facilities in Mangaung Metropolitan Municipality, Free State Province. I hereby confirm that I have no business, financial, personal or other interest in the activity, application or appeal in respect of which I have been appointed other than fair remuneration for work performed in connection with the activity and application. All opinions expressed in my specialist report are my own.

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