SITE SENSITIVITY VERIFICATION REPORT (IN TERMS OF PART A OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GN 320 ON 20 MARCH 2020)

PROPOSED DEVELOPMENT OF A 400 MW SOLAR PHOTOVOLTAIC FACILITY ON THE REMAINDER OF FARM GOEDE HOOP 26C AND PORTION 3 OF FARM GOEDE HOOP 26C, BETWEEN DE AAR & HANOVER, EMTHANJENI LOCAL MUNICIPALITY, PIXLEY KA SEME DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE, SOUTH AFRICA

John E. Almond PhD (Cantab.)
***Natura Viva* cc, PO Box 12410 Mill Street,**
Cape Town 8010, RSA
naturaviva@universe.co.za

May 2022

EXECUTIVE SUMMARY

Soventix South Africa (Pty) Ltd is proposing to construct a 400 MW Solar Photovoltaic (PV) facility (Soventix Phase 3) on the Remainder of Farm Goede Hoop 26C and Portion 3 of Farm Goede Hoop 26C, situated between De Aar & Hanover in the Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province, South Africa.

The Soventix Phase 3 solar facility and associated infrastructure (including grid connection) project area is underlain at depth by potentially fossiliferous continental sediments of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) of Middle Permian age. The palaeosensitivity of the project area has been provisionally rated as Very High by the DFFE Screening Tool. However, based on four successive palaeontological site visits to the broader Soventix solar project area - including, most recently, to the previously unassessed Phase 3 project areas – this sensitivity rating is *contested* in this report. No High Sensitivity fossil sites are recorded within any of the Soventix Phase 1 to Phase 3 solar project areas (including all associated infrastructure such as grid connections, substations, access roads *etc*). This is probably largely due to rarity of well-preserved fossil remains within the bedrocks concerned, the generally very poor levels of bedrock exposure (especially in flat-lying regions) as well as extensive baking of the sedimentary bedrocks by dolerite intrusions in the region. It is concluded that, in practice, all these sites – including the Soventix Phase 3 project area - are of LOW Palaeosensitivity.

The potential for rare, largely unpredictable fossil sites of High Palaeosensitivity within the Permian bedrocks or associated with older alluvial and pan deposits hidden in the subsurface cannot be entirely discounted. Many or most of the younger fossil sites would probably be protected during construction by environmental buffer zones along drainage lines. If any fossiliferous deposits are exposed by surface clearance or excavations during the construction phase of the development, the Chance Fossils Finds Protocol outlined in Appendix 1 to this report should be fully implemented. These recommendations should be included within the EMPrs for the Soventix Solar PV Facilities and associated infrastructure developments.

Provided that the Chance Fossil Finds Protocol tabulated in Appendix 1 is incorporated into the EMPrs and fully implemented during the construction phase of the Soventix solar PV facilities and associated infrastructure (*e.g.* grid connections, substations, access roads *etc*), there are no objections on palaeontological heritage grounds to authorisation of the proposed developments. Pending the discovery of significant new fossil finds before or during construction, no further specialist palaeontological studies, monitoring or mitigation are recommended for these renewable energy projects.

1. INTRODUCTION

The company Soventix South Africa (Pty) Ltd has commissioned the independent EAP ecoleges Environmental Consultants, Machadodorp, to undertake a Scoping and Environmental Impact Assessment (S&EIA) for the proposed development of a 400 MW Solar Photovoltaic (PV) facility (Soventix Phase 3) on the Remainder of Farm Goede Hoop 26C and Portion 3 of Farm Goede Hoop 26C, situated between De Aar & Hanover in the Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province, South Africa.

The following project background and description has been provided by ecoleges Environmental Consultants (Contact details: Mr Shaun MacGregor. ecoleges Environmental Consultants. No. 2 Generaal Street, Machadodorp (eNtokozweni), 1170, PO Box 516, Machadodorp, 1170. Cell: +27 (0)64 885 2240. E-mail: shaun@ecoleges.co.za) (See also Figs. 1 & 2):

1.1. Project background

In 2016 ecoleges undertook a Scoping & EIA process for the development of a 225 MW Solar PV facility between Hanover and De Aar in the Northern Cape. Three alternative footprints (PV01, PV02, PV03) were investigated during the assessment process. The central footprint (PV02) was identified as the preferred option because of its lower environmental impact and proximity to an existing 400kV Eskom powerline when compared with PV01 and PV03. The National Department of Environmental Affairs granted an environmental authorisation (DEA Reference: 14/12/16/3/3/2/998) on 16th April 2018. The activity must commence on the PV02 footprint within a period of five years from the date of issue. An amendment to increase the capacity (not the footprint) of the facility to 300 MW due to technological advancements in solar photovoltaic efficiency and electrical output was granted on 24th November 2020. A second amendment was granted in 2021 for the inclusion of containerised lithium-ion battery storage and dual-fuel backup generators with associated fuel storage. The competent authority was the National Department of Environmental Affairs because the application was part of the REIPPP or RMIPPP BID rounds, which formed part of a Strategic Infrastructure Project (SIP) as described in the National Development Plan, 2011. Soventix SA (Pty) Ltd was an unsuccessful bidder. However, the applicant has since partnered with another company, Solar Africa, with 1.5 GW in private renewable energy offtake agreements, making it economically feasible to develop two more 300 and 400 MW facilities (Phases 2 and 3, respectively). Soventix will therefore apply for an environmental authorisation to develop an additional 300MW on the PV03 footprint (Phase 2) that was considered during the initial S&EIA. It is proposed to connect this second phase to the substation that forms part of the authorised facility on PV02. Unlike footprints PV02 and PV03, Phase 3 was not assessed during the S&EIA for Phase 1. Phase 3 involves the development of a third 400 MW Solar Photovoltaic (PV) facility on the Remainder of Farm Goede Hoop 26C and Portion 3 of Farm Goede Hoop 26C. The two additional Solar PV facilities (Phase 2 and 3) will feed into the authorised sub-station on the PV02 footprint (Phase 1). Consequently, the expansion of the substation footprint will require a third (Part 2) amendment to the existing environmental authorisation (DEA Reference: 14/12/16/3/3/2/998). In addition to an environmental authorisation for Phase 3, General authorisations will also be required to undertake associated water uses during the construction and operation of the facility, specifically Section 21 (a), (b), (c), (i) & (g).

1.2. Project description: Soventix Phase 3 Solar Photovoltaic (PV) facility.

The size of the proposed development footprint for the Soventix Phase 3 400 MW solar PV facility on the Remainder of Farm Goede Hoop 26C and Portion 3 of Farm Goede Hoop 26C is approximately 600 ha. This area includes four interconnected 100 MW solar PV plants (150 ha each), with associated infrastructure. The PV system will be connected *via* distribution lines to the authorized substation on Phase 1. The substation ties into the existing ESKOM 400kV overhead powerlines. Existing roads will be used for main access, which may need to be enlarged to allow large equipment to access the site during construction. The main access to the site is off the N10 between De Aar & Hanover.

The current land use is sheep farming, which will continue within the solar PV plants to ensure minimal reduction (if any) on agricultural potential of the land as well as a management tool to control vegetation growth. Given the size of the area required relative to the Site Area (both properties), only one (preferred) Alternative can be considered. The Site Area is bisected by a sensitive watercourse. Consequently, two parts (Part 1 ±333 ha and Part 2 ±543ha) have been identified that make up the preferred alternative (Figs. 1 & 2).

Phase 3 will be connected to Phase 2 and Phase 1 (EA Approved Development Area) *via* an overhead powerline. Depending on the width of the watercourse, pylons may need to be placed inside a watercourse, and some existing road crossings may need to be widened. It is also likely that the perimeter of the facility will fall within 100m from the edge a watercourse. A "larger-than-necessary" footprint is being assessed to allow for its refinement and possible reduction in surface area, based on specialist findings and recommendations.

The proposed PV projects are not located within any of the Renewable Energy Development Zones (REDZs) that were gazetted in Government Notice (GN) 114 in February 2018 and GN 144 in February 2021. Therefore, full Scoping and EIA Processes must be undertaken in their regard.

Combined desktop and field-based palaeontological assessment reports for the Soventix Solar PV project areas near Hanover have been previously submitted by Almond (2017) and Almond (2021).

According to the Department of Forestry, Fisheries and the Environment (DFFE) screening tool, the majority of the combined Soventix solar PV project areas and associated grid connection corridors are of Very High palaeosensitivity (Fig. 30). In accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) EIA Regulations of 2014, a combined field-based and desktop site sensitivity verification has therefore been undertaken in order to confirm or contest the environmental sensitivity of the proposed project area as identified by the DFFE National Web-Based Environmental Screening Tool. The palaeontological study will in turn determine how this development (and its separate elements, *e.g.,* solar PV panels, pylons, and road crossings) will impact on any palaeontological resources within the area and also contribute to the EMPr for the renewable energy developments.

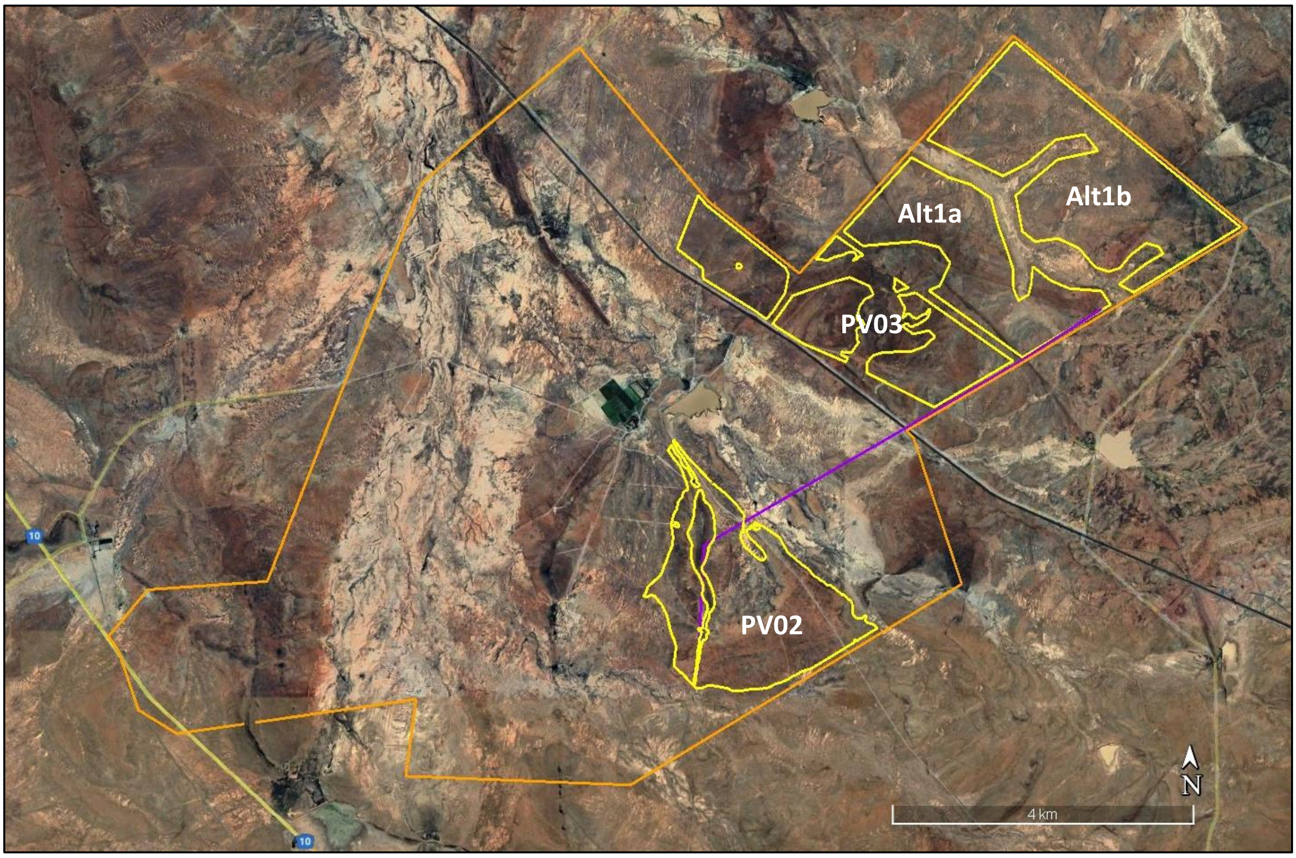

Figure 1: Google Earth© satellite image showing the project areas (yellow polygons) for the three phases of the proposed Soventix Solar Photovoltaic (PV) Facilities near Hanover, Northern Cape Province. The PV02 area has already received Environmental Authorization for Soventix Solar Phase 1 (300MW). Soventix Solar Phase 2 (300 MW) will be located on the previously assessed PV03 site The Soventix Phase 3 (400 MW) Solar Photovoltaic (PV) facility that is the principal subject of this SSV / compliance report will be partitioned between two project areas on the Remainder of Farm Goede Hoop 26C and Portion 3 of Farm Goede Hoop 26C (Alt1a & Alt 1b) which have not previously been assessed. The proposed route of the overhead powerline connecting Phase 3 with Phases 1 and 2 is shown in purple and is also covered by this report.

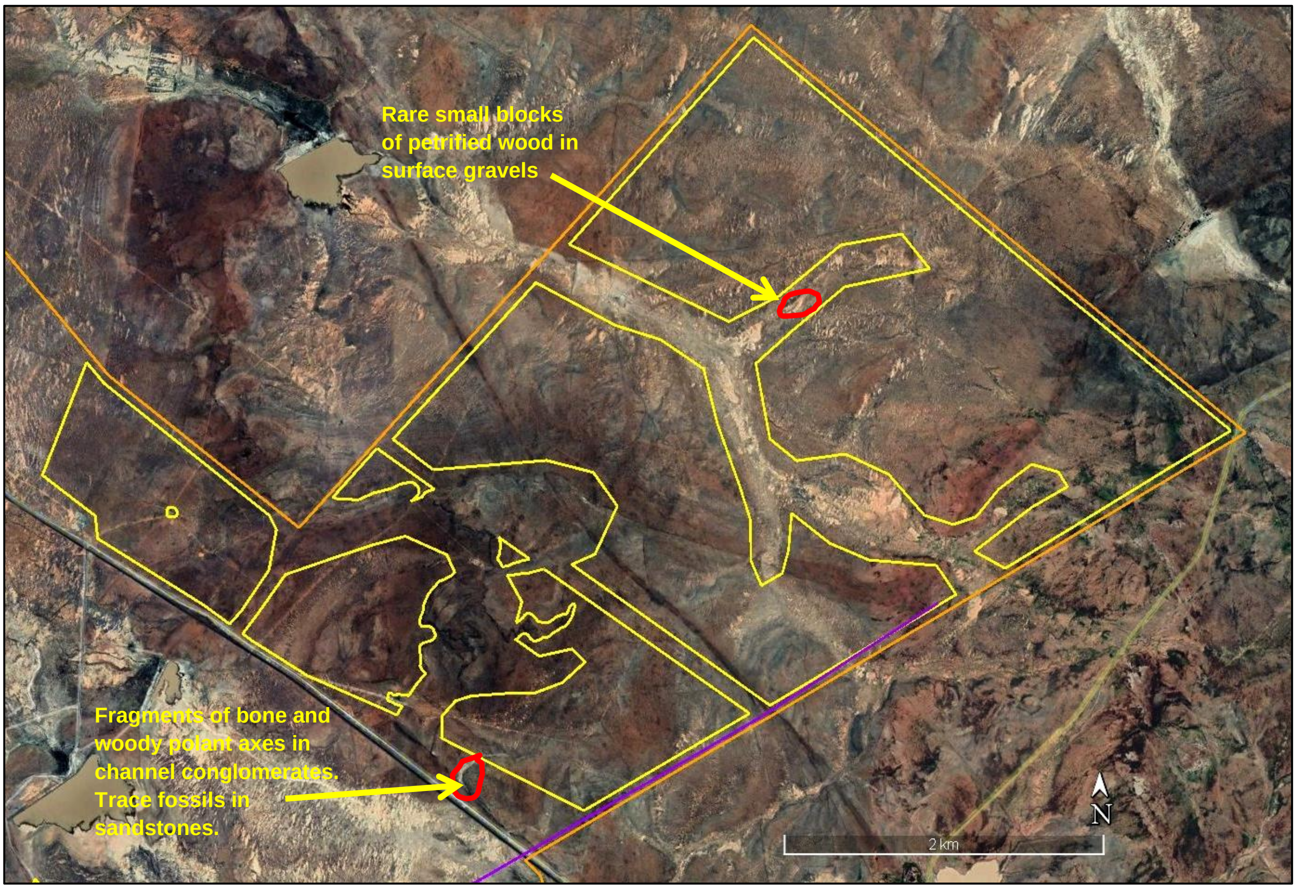

Figure 2: Google Earth© satellite image showing the Soventix Phase 2 and Phase 3 project areas in more detail. Reddish-brown areas are dolerite intrusions (unfossiliferous) while darker grey areas may reflect surface exposure of sedimentary bedrocks. However, field observations indicate that these areas often comprise weathered surface gravels of sandstone, palaeocalcrete and mudrock of low palaeosensitivity. Two areas where sparse fossil remains of low scientific and conservation value have been recorded are outlined in red. *N.B.* Both fossil sites lie *outside* the solar project areas.

2. DATA SOURCES

The palaeontological heritage site sensitivity verification report for the Soventix Phase 3 Solar Photovoltaic (PV) facility and associated infrastructure project area is based on:

- Detailed project descriptions, maps, kmz files, DFFE screening reports and other relevant background documentation provided by ecoleges Environmental Consultants.

- A desktop review of (a) 1:50 000 scale topographic map 3024CD Burgervilleweg and the 1:250 000 scale topographic map sheet 3024 Colesberg, (b) Google Earth© satellite imagery, (c) published geological and palaeontological literature, including 1:250 000 geological maps (sheet 3024 Colesberg) and relevant sheet explanation (Le Roux 1993), as well as (d) previous desktop and field-based fossil heritage (PIA) data for the wider Soventix project area near Hanover region by the author (Almond 2017, 2021), including an additional site visit by Professor Bruce Rubidge of Wits University, Johannesburg and the author in March 2021.

- A two day field survey of representative rock exposures within the Soventix Phase 2 and Phase 3 project areas by the author on 24 and 25 April 2022.

Although access to portions of the project area during the site visit were constrained by very muddy conditions following recent heavy rains as well as dense grassy vegetation, confidence levels for the conclusions reached in this report are Medium and supported by previous palaeontological fieldwork in the vicinity (Almond 2017, 2021).

3. GEOLOGICAL CONTEXT

The Soventix Phase 3 project area on the Remainder of Farm Goede Hoop 26C and Portion 3 of Farm Goede Hoop 26C comprises for the most part flat to very gently sloping terrain between 1330 to 1350 m amsl lying to the northeast of a low sandstone and dolerite ridge that reaches elevations of *c*. 1360 m amsl. Although the area looks geologically complex on satellite images (Figs. 1 & 2), in practice it is mostly covered by monotonous low *bossieveld* and grassy vegetation with surface gravels and thick soils (Figs. 5 & 5). Levels of bedrock exposure are generally very low indeed, apart from low rocky ridges on the periphery of the area, especially to the south and northeast, as well as occasional small farms dams and borrow pits in the wider region (*cf* Figs. 6 & 12).

The geology of the wider Soventix Solar project area is outlined on the 1: 250 000 geology sheet 3024 Colesberg (Le Roux 1993) (Fig. 3) and has been reviewed in some detail in the earlier illustrated PIA reports by Almond (2017, 2021). The area is underlain by Middle to Late Permian sedimentary rocks of the Karoo Supergroup that are intruded by Early Jurassic dolerites. According to the 1: 250 000 geological map the area is largely underlain at depth by Permian continental (fluvial / lacustrine) sediments of the **Adelaide Subgroup** (**Lower Beaufort Group**) (Pa) which include erosive-based yellowish-weathering channel sandstone packages, grey-green overbank mudrocks with horizons of calcrete palaeosol horizons and occasional thin crevasse splay sandstones. Based on rare dinocephalian cranial fossil remains recorded by Almond (2021), it is likely that the Adelaide Subgroup succession represented in the present project area belongs to the upper part of the Abrahamskraal Formation of late Middle Permian age (*cf* Day & Rubidge 2014, 2020).In the project area near Hanover the Adelaide Subgroup bedrocks are extensively intruded, baked and secondarily minerised as a consequence of intrusion by a network of sills and dykes of the **Karoo Dolerite Suite** (Jd). Thin **kimberlite dykes** of Jurassic to Cretaceous age are mapped in the broader study region, including just north of the present study area (blue lines in Fig. 3).

The great majority of the Beaufort Group and Karoo dolerite outcrop area is obscured by thick, pervasive **Late Caenozoic superficial sediments** of probable Pleistocene to Holocene age, as well as by karroid shrub and grassy vegetation (Figs. 4 & 5). These superficial sediments include silty to sandy soils and alluvium related to the broader Brakrivier drainage system and its tributaries, doleritic and sandstone colluvium (scree, hillwash slope deposits), and downwasted / eluvial surface gravels dominated by resistant clasts of dark hornfels, sandstone, orange-patinated quartzite and dolerite that are modified by sheet wash processes (Figs. 21 to 23). The dolerite intrusions weather out at surface as low rocky ridges and *koppies* that show up in rusty-brown colours in satellite images (Fig. 1, 2, 15 & 16). They have baked (thermally metamorphosed) the adjacent Karoo Supergroup mudrocks to hornfels, and sandstones to quartzites (Figs. 17 to 19). Dolerite colluvial rubble extends well beyond the intrusions themselves to blanket adjacent slopes and *vlaktes*.

Representative exposures of the various sedimentary and igneous rock units seen within or on the margins of the Soventix Solar Phase 2 and 3 project areas are illustrated below in Figures 6 to 24 with explanatory figure legends. It is noted that the geologically and palaeontologically more interesting areas – *viz*. those showing higher relief, rocky terrain – will generally be excluded from solar project footprints.

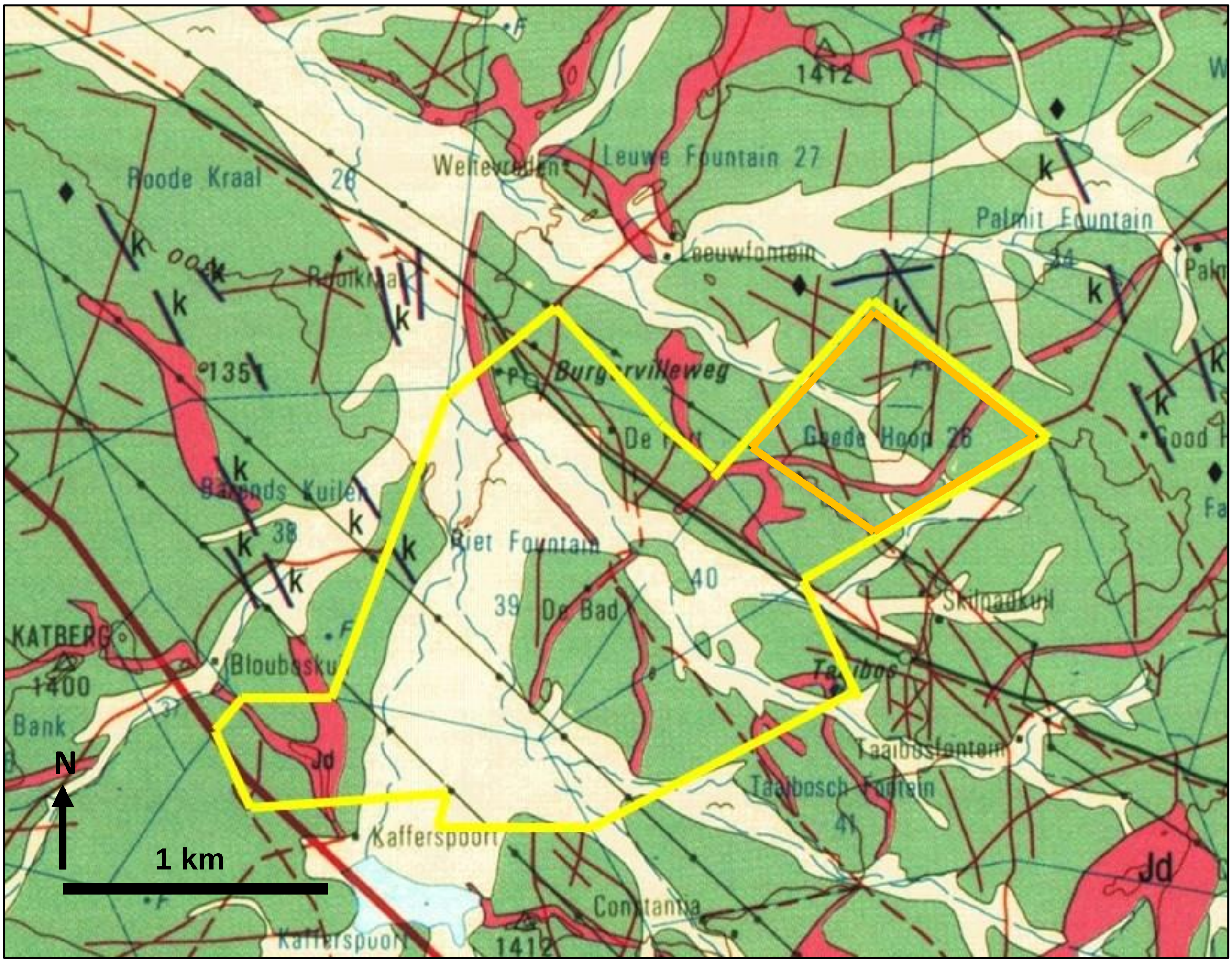

Figure 3: Geological map of the wider Soventix solar PV plant project area between De Aar and Hanover, Northern Cape (yellow polygon) showing the *approximate* location of the Soventix Phase 3 project area on the Remainder of Farm Goede Hoop 26C and Portion 3 of Farm Goede Hoop 26C (orange polygon) (Map abstracted from 1: 250 000 geology sheet 3024 Colesberg, Council for Geoscience, Pretoria). A large proportion of the remaining terrain within the yellow polygon has been previously palaeontologically surveyed by Almond (2017, 2021). The following main rock units are mapped within the study areas: green (Pa) = Adelaide Subgroup (Lower Beaufort Group – probably Middle Permian Abrahamskraal Formation); pink (Jd) = intrusive dykes and sills of the Early Jurassic Karoo Dolerite Suite; white = Pleistocene to Recent alluvial deposits; small black diamond symbols = Kimberlite pipe; blue lines – kimberlite dykes (k). Unmapped Late Caenozoic superficial sediments include doleritic and sandstone colluvium, eluvial surface gravels and soils (including possible relict aeolian sands of the Gordonia Formation, Kalahari Group).

Figure 4: View northwards across the Soventix Phase 3 project area showing low relief terrain carpeted by grasses and bossieveld vegetation with almost no bedrock exposure.

Figure 5: Grey areas on satellite images, such as here on the SE corner of the Phase 3 Alt1a project area, do not necessarily indicate areas of Adelaide Subgroup bedrock exposure. Often the grey hues are due to unconsolidated eluvial surface gravels of sandstone or mudrock that are generally of low palaeosensitivity.

Figure 6: Low escarpments of prominent-weathering Adelaide Subgroup channel sandstones mark a major sandstone-rich package cropping out in the eastern corner of the Phase 3 Alt1b project area. This package of closely-spaced sandstones *might* be equated with the Moordenaars Member within the upper Abrahamskraal Formation (or even the overlying Poortjie Member of the Teekloof Formation) but this is equivocal. Higher relief areas such as this are unlikely to be included within the final solar project footprint but are more likely to yield fossil material that the *vlaktes* below.

Figure 7: Tabular bedded, medium-grained channel sandstone body of the Adelaide Subgroup, eastern corner of the Phase 3 Alt1b project area. Mudrock packages between the channel sandstones are much less well exposed, in part due to rubbly sandstone colluvial cover.

Figure 8: Flaggy-bedded unit of friable, medium-grained, yellowish-brown channel sandstone showing a sharp, erosional basal contact with underlying grey-green overbank mudrocks, SE edge of Phase 3 Alt1b project area.

Figure 9: Rusty-brown, secondarily ferruginised horizon of breccio-conglomerate towards the base of a channel sandstone (hammer = 30 cm), eastern corner of Phase 3 Alt1b project area. Such coarse-grained units are a target for prospecting for reworked tetrapod bone and tooth fossils.

Figure 10: The Adelaide Subgroup channel sandstones are frequently associated with well-developed diagenetic concretions of coffee-brown ferruginous carbonate (*koffieklip*), seen here on the SE edge of the Phase 3 Alt1b project area (hammer = 30 cm). *Koffieklip* bodies in the vicinity reach thicknesses of *c*. 3 m and occasionally contain this mudflake conglomerates. *Koffieklip* is sometimes associated with fossil transported plant assemblages as well as uranium mineralisation.

Figure 11: Thick, superficially massive sandstones in the same area as the previous image show evidence of possible karstic (solution) weathering as well as superficial etching by lichens. These processes may compromise preservation and recording of fossil material within sandstone facies.

Figure 12: Unusually good (by local standards) section through thin-bedded, grey-green overbank siltstones capped by a channel sandstone, here exposed in the cut face of a small borrow pit close to the railway line and just outside the Phase 2 project area (hammer = 30 cm).

Figure 13: Prominent-weathering, thin horizon of pedogenic calcrete (possibly secondarily silicified), marked by hammer (30 cm long) within a baked overbank mudrock succession, eastern corner of Phase 3 Alt1b project area.

Figure 14: Horizon of small (< 5cm diameter), sphaeroidal, pale grey pedogenic calcrete concretions within hackly-weathering overbank mudrocks, eastern corner of Phase 3 Alt1b project area. Such concretions mark ancient soils which are a primary target for fossil tetrapod recording.

Figure 15: Subtle surface expression of a major WNW-ESE trending dolerite dyke as a low ridge (width indicated by arrow), here crossing the SE sector of the Phase 3 Alt1a project area.

Figure 16: Major, well-jointed dolerite intrusion building part of the elongate ridge along the SW edge of the Phase 3 project area. This intrusion extends into lower-lying terrain within the solar project area itself and has baked a considerable volume of the adjacent sedimentary rocks, compromising their palaeosensitivity (see following two figures).

Figure 17: Extensive exposure of well-jointed, baked quartzitic sandstone situated within the thermal aureole of the dolerite intrusion illustrated above. Occasional wave-rippled palaeosurfaces developed in ancient ponds are a target for finding fossil vertebrate trackways and other trace fossils.

Figure 18: Ridge slope exposure of baked overbank mudrocks situated within the thermal aureole of the dolerite intrusion illustrated in Figure 18 (hammer = 30 cm). Any fossils originally preserbed within these metasediments are likely to be of limited scientific value due to solution and secondary mineralisation by hot circulating fluids during dolerite intrusion.

Figure 19: Close-up of thermally-metamorphosed overbank siltstones in the exposure illustrated above showing characteristic vuggy appearance with irregular, rounded hollows and pale secondary siliceous rims (scale in cm).

Figure 20: Narrow dyke of blueish-green igneous rock containing small, pale, rounded infilled vesicles or amygdales (hammer – 30 cm), southern edge of Phase 3 Alt1b project area. This *might* be a kimberlite-related rather than a dolerite dyke.

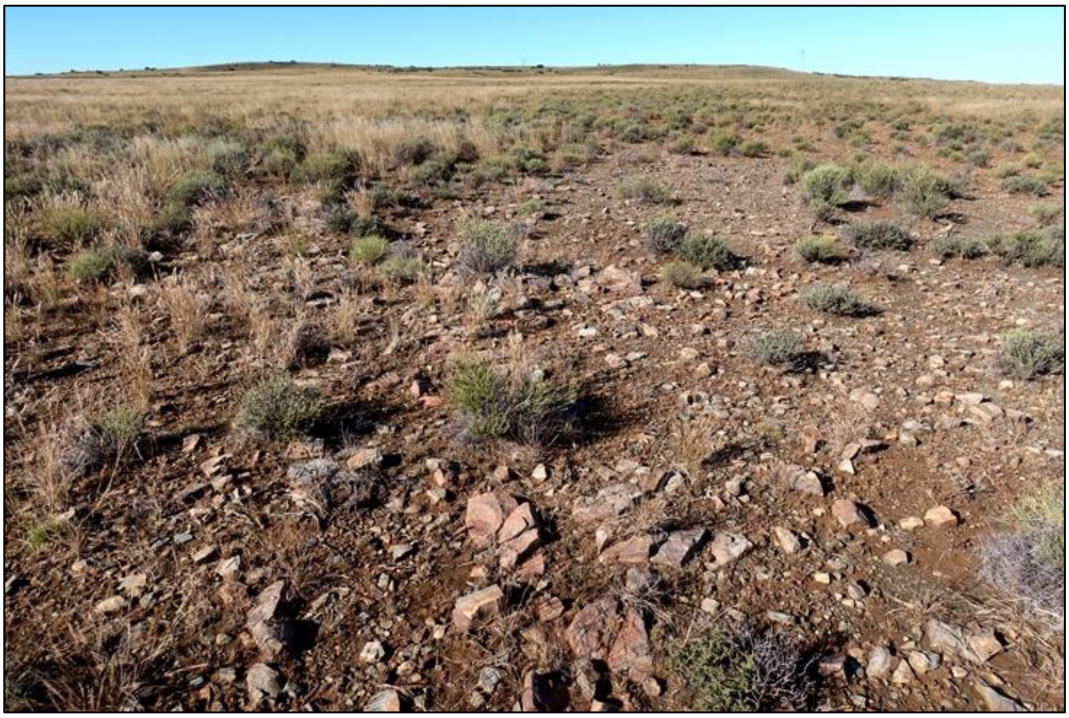

Figure 21: Where vegetation cover is sparse, the land surface is generally seen to be carpeted with eluvial surface gravels, variously dominated by clasts of sandstone (as here), quartzite, orange-patinated hornfels, platy mudflakes or ferruginised calcrete concretions.

Figure 22: Open, shallow pan-like areas within the grassy *vlaktes* usually have a sparse veneer of resistant-weathering, sheet-washed gravels. This is a good context to look for reworked blocks of petrified wood (*cf* Figs 28 and 29).

Figure 23: Thick, muddy, orange-brown soils with sparse gravels that blanket most of the flat-lying portions of the Phase 3 project areas are well seen in farm tracks following heavy rains as well as around farm dams and in aardvark burrows.

4. PALAEONTOLOGICAL HERITAGE

The palaeontological heritage associated with the Palaeozoic and Caenozoic sedimentary rock units represented within the broader Soventix solar project area has been outlined in previous PIA reports by Almond (2017, 2021). Fossil tetrapod remains appear to be generally very rare in this portion of the Permian Adelaide Subgroup outcrop area. This may due, at least in part, to the generally poor bedrock exposure levels – especially in flatter-lying regions – as well intense dolerite intrusion regionally. Exceptional finds of cranial material of titanosuchid dinocephalians – a group of large herbivorous or omnivorous therapsids which has not been recorded previously to the northeast of Victoria West (*cf* Day & Rubidge 2014, 2019) - was first reported by Almond (2021) close to but *outside* the authorized Soventix Phase 1 project area. These finds established a late Middle Permian age for the beds which are accordingly equivalent to the upper part of the Abrahamskraal Formation, falling within the upper portion of the *Tapinocephalus* Assemblage Zone (*i.e. Diictodon – Styracocephalus* Subzone) (Day & Rubidge 2020). The only other fossils previously recorded here comprise locally common, generally small blocks of reworked petrified wood within older alluvial deposits and surface gravels as well as possible low-diversity invertebrate trace fossil assemblages (Almond 2017, 2021).

No further High Palaeosensitivity fossil sites of scientific or conservation value have been identified within the wider Soventix solar project area during the recent palaeontological two-day site visit. The only new fossil material recorded from bedrock exposures here - all from *outside* the Phase 3 project areas (Fig. 2) – comprises: (1) small, unidentifiable fragments of fossil bone and (2) poorly-preserved moulds of woody plant axes within mudrock intraclast basal breccias (Figs. 24 to 26), (3) ill-defined horizontal invertebrate burrows on a crevasse splay sandstone bed top (Fig. 27) and (4) very occasional small reworked blocks of well-preserved silicified wood among surface gravels (Figs. 28 & 29). None of this fossil material is of significant scientific or conservation value. Of course, the potential occurrence of High Sensitivity fossil sites in the subsurface within the solar project areas cannot be entirely discounted. Recently recorded fossil sites on the margins of the Soventix Phase 2 and Phase 3 solar project areas are illustrated below and mapped on the satellite image in Figure 2.

Figure 24: Thin, vaguely cross-bedded unit of grey-green, gritty basal channel breccia exposed on the margins of a borrow pit close to the railway line and just outside the Phase 2 project area (hammer = 30 cm). This bed has yielded poorly preserved, transported bone and wood material (see following photos) (30.855205° S, 24.339003°).

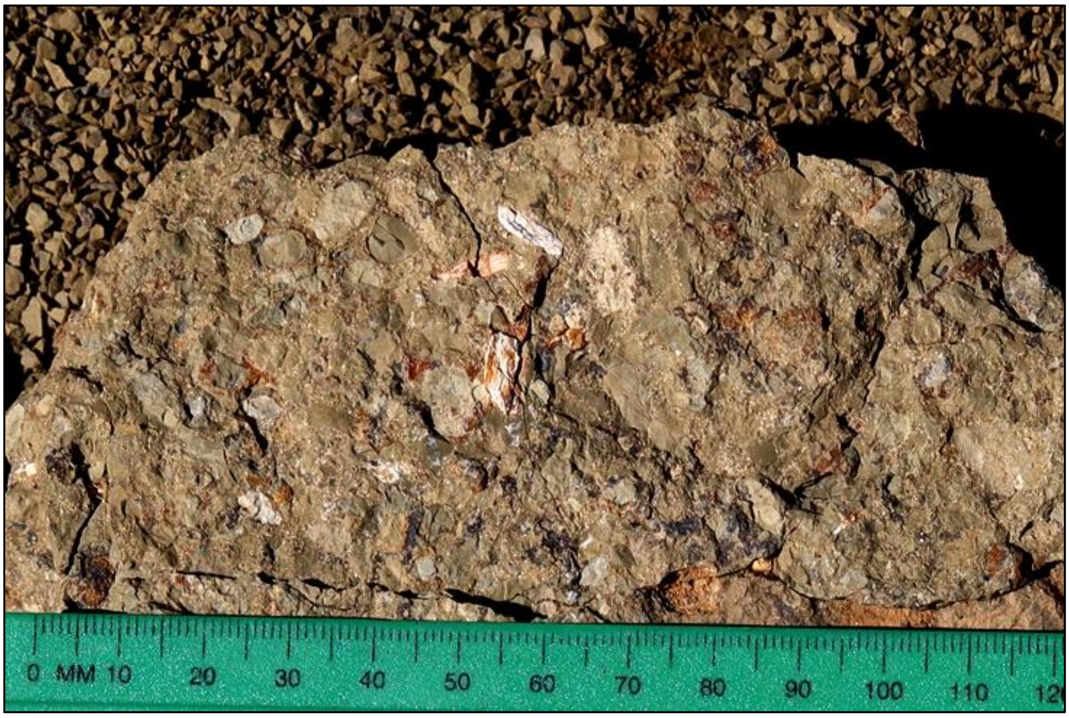

Figure 25: Slab of fine mudflake breccia from the bed illustrated above showing pale fragments of bone (scale in cm and mm). This fossil material is unidentifiable and of little scientific interest (30.855205° S, 24.339003°).

Figure 26: Moulds of poorly preserved wood plant axes within a loose block of basal breccia from the bed illustrated in Figure 24 (scale in cm and mm) (30.855205° S, 24.339003°).

Figure 27: Bedding plane assemblage of ill-defined horizontal invertebrate burrows on the upper surface of a crevasse splay sandstone (scale in cm) (30.855224° S, 24.338730° E).

Figure 28: Isolated small block of dark, cherty silicified wood found among surface gravels (scale in cm and mm) (30.854486° S, 24.339279° E). Similar blocks of reworked wood are likely to occur widely within the project area but are of very limited scientific value.

Figure 29: Isolated small block of pale silicified wood reworked into surface gravels (scale in cm and mm). The preservation of the woody fabric here is good (30.828441° S, 24.361058° E).

5. SITE SENSITIVITY VERIFICATION

Site sensitivity mapping for palaeontological heritage prepared by ecoleges Environmental Consultants using the DFFE National Web-Based Environmental Screening Tool suggests that the Soventix Phase 3 project area as well as the associated grid connection corridor are largely of Very High palaeosensitivity, with smaller areas of Medium palaeosensitivity associated with alluvial deposits and areas of zero or negligible sensitivity reflecting intrusions of Karoo dolerite (Fig. 30).

Based on previous combined desktop and field-based PIA studies by the author in the broader Soventix solar study region (Almond 2017, 2021) as well as the recent 2-day palaeontological site, it is concluded that the entire solar facility and grid connection project areas are in fact of **Low palaeosensitivity overall**. This is based on (1) the apparent rarity of scientifically important fossil material, even where bedrock exposure is comparatively good, (2) the pervasive thick cover of palaeontologically insensitive Late Caenozoic deposits (surface gravels, soils, colluvium) in low-lying areas which are the primary locus of solar plant development, and (3) compromising of fossil preservation due to intensive dolerite intrusion in the region. The potential for rare, largely unpredictable fossil sites of High palaeosensitivity associated with Permian sedimentary bedrocks as well as consolidated older alluvial and pan deposits in the subsurface cannot be entirely discounted, however.

The provisional DFFE-based palaeosensitivity mapping is accordingly *contested* in this report.

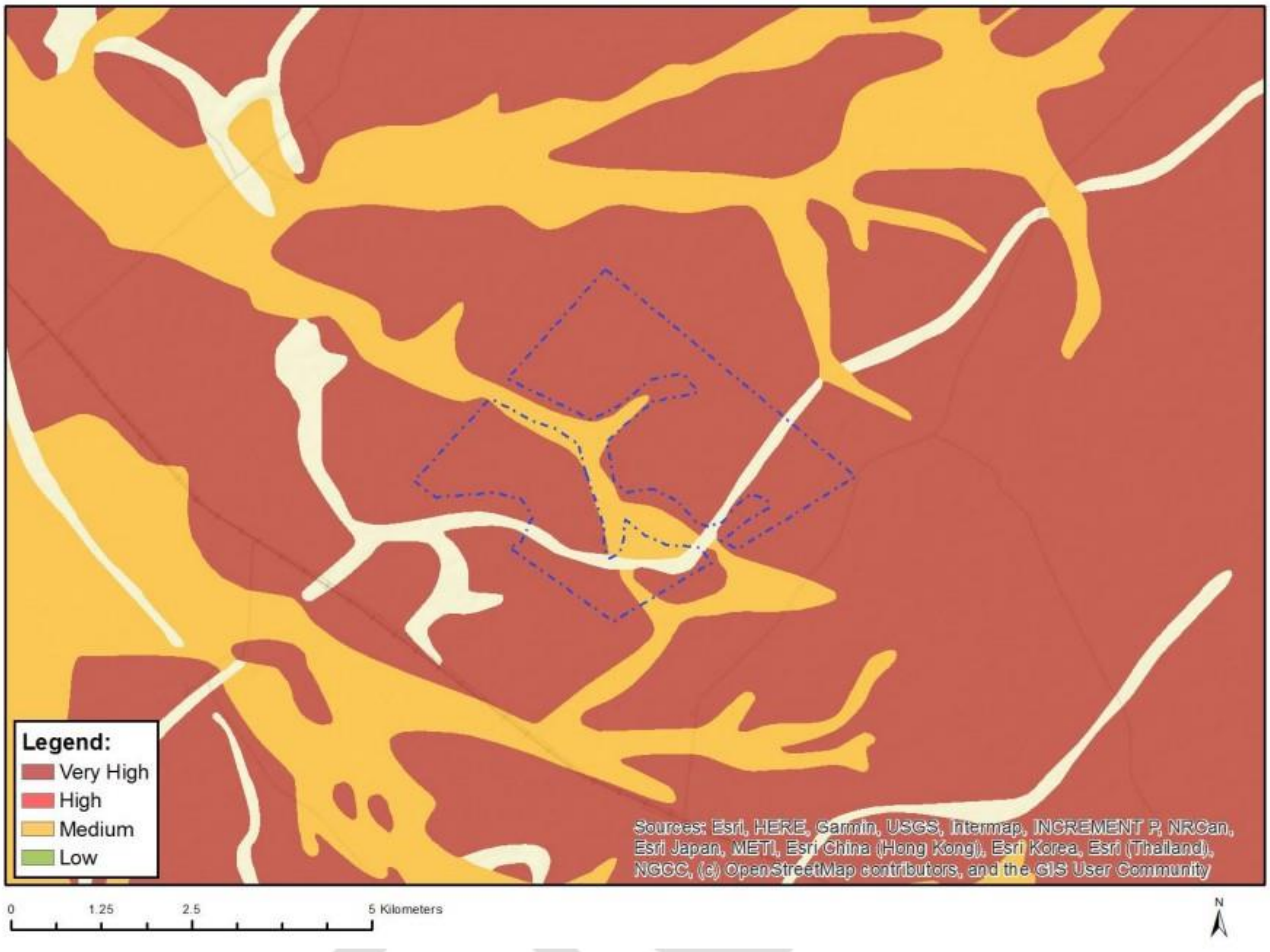

Figure 30: Palaeontological sensitivity map for the Soventix Phase 3 project area near Hanover, abstracted from the DFFE Screening Report prepared by the ecoleges Environmental Consultants (January 2022). The outcrop area of the Lower Beaufort Group is provisionally assigned a Very High palaeosensitivity here, Late Caenozoic alluvium a Medium sensitivity while Karoo dolerite intrusions are designated as insensitive. This sensitivity mapping is *contested* in this report which concludes the is of LOW palaeosensitivity overall due to thick cover by Late Caenozoic unfossiliferous superficial sediments (soils, gravels *etc*) and extensive baking of sedimentary bedrocks by intensive dolerite intrusion.

6. CONCLUSIONS

The Soventix Phase 3 solar facility and associated infrastructure (including grid connection) project area near Hanover is underlain at depth by potentially fossiliferous continental sediments of the Adelaide Subgroup (Karoo Supergroup) of Middle Permian age. The palaeosensitivity of the project area has been provisionally rated as Very High by the DFFE Screening Tool. However, based on three successive palaeontological site visits to the broader Soventix solar project area - including, most recently, to the previously unassessed Phase 3 areas – this sensitivity rating is *contested* in this report.

With the exception of limited higher-lying, rocky areas on the periphery of or (mostly) outside the likely solar PV project footprint, the Permian bedrocks here are very poorly exposed due to pervasive, thick, unfossiliferous superficial sediments (surface gravels, soils). Vertebrate fossil remains are very scarce within the available bedrock surface exposures while the only fossil sites recorded – *viz*. poorly-preserved bone and moulds of woody plant fragments, small reworked blocks of petrified wood, ill-defined invertebrate burrows – are of low scientific or conservation interest. The sedimentary bedrocks are extensively thermally metamorphosed by dolerite, and perhaps also kimberlite, intrusions which has probably compromised most fossils originally preserved within the adjoining country rocks. Karstic and lichen weathering of the better exposed sandstone units may also have destroyed fossil material within them. No High Sensitivity fossil sites are recorded within any of the Soventix Phase 1 to Phase 3 solar project areas (including all associated infrastructure such as grid connections, substations, access roads *etc*) and it is concluded that, in practice, all these sites – including the Soventix Phase 3 project area - are of LOW Palaeosensitivity.

The potential for rare, largely unpredictable fossil sites of High Palaeosensitivity within the Permian bedrocks (*e.g.* tetrapod bones and teeth) or associated with older alluvial and pan deposits hidden in the subsurface (*e.g.* mammalian bones, teeth, horncores, non-marine molluscs, calcretised termitaria) cannot be entirely discounted. Many or most of the younger fossil sites would probably be protected during construction by environmental buffer zones along drainage lines.

If any fossiliferous deposits are exposed by surface clearance or excavations during the construction phase of the development, the Chance Fossils Finds Protocol outlined in Appendix 1 to this report should be fully implemented. These recommendations should be included within the EMPrs for the Soventix Solar PV Facilities and associated infrastructure developments.

Provided that the Chance Fossil Finds Protocol tabulated in Appendix 1 is incorporated into the EMPrs and fully implemented during the construction phase of the Soventix solar PV facilities and associated infrastructure (*e.g.* grid connections), there are no objections on palaeontological heritage grounds to authorisation of the proposed developments. Pending the discovery of significant new fossil finds before or during construction, no further specialist palaeontological studies, monitoring or mitigation are recommended for these renewable energy projects.

7. REFERENCES

ALMOND, J.E. 2017. Proposed Soventix Solar PV Project on various farms near Hanover, Enthanjeni Municipality, Pixley ka Seme District, Northern Cape. Palaeontological heritage report: combined desktop & field-based assessment, 43 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2021. Proposed Soventix Solar PV project on various farms near Hanover, Enthanjeni Municipality, Pixley Ka Seme District, Northern Cape. Palaeontological heritage report: combined desktop & field-based assessment, 54 pp. Natura Viva cc, Cape Town.

DAY, M.O. & RUBIDGE, B.S. 2010. Biostratigraphy of the Tapinocephalus Assemblage Zone (Beaufort Group, Karoo Supergroup), South Africa. South African Journal of Geology 123, 149-164.

DAY, M.O. AND RUBIDGE, B.S., 2014. A brief lithostratigraphic review of the Abrahamskraal and Koonap Formations of the Beaufort Group, South Africa: Towards a basin-wide stratigraphic scheme for the Middle Permian Karoo. Journal of African Earth Sciences 100, 227-242.

DAY, M.O. & RUBIDGE, B.S.. 2020. Biostratigraphy of the Tapinocephalus Assemblage Zone (Beaufort Group, Karoo Supergroup), South Africa. South African Journal of Geology 123, 149 - 164.

JOHNSON, M.R., VAN VUUREN, C.J., VISSER, J.N.J., COLE, D.I., De V. WICKENS, H., CHRISTIE, A.D.M., ROBERTS, D.L. & BRANDL, G. 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 461-499. Geological Society of South Africa, Marshalltown.

LE ROUX, F.G. 1993. Die geologie van die gebied Colesberg. Explanation to 1: 250 000 geology Sheet 3024, 12 pp. Council for Geoscience, Pretoria.

SAHRA 2013. Minimum standards: palaeontological component of heritage impact assessment reports, 15 pp. South African Heritage Resources Agency, Cape Town.

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.

John E. Almond

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

<table>
<tr><th colspan="3">APPENDIX 1: SOVENTIX SOLAR PV PROJECTS (PHASES 1 TO 3) ON VARIOUS FARMS NEAR HANOVER</th></tr>
<tr><td>Province & region:</td><td colspan="2">Northern Cape: Pixley Ka Seme District</td></tr>
<tr><td>Responsible Heritage Resources Agency</td><td colspan="2">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).</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Middle Permian Adelaide Subgroup (Lower Beaufort Group, Karoo Supergroup), Late Caenozoic alluvium, pan sediments, surface gravels, soils</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Rare vertebrate bones and teeth, petrified wood and other plant material, trace fossils within Beaufort Group sediments.
Fossil mammal bones, teeth, horn cores, freshwater molluscs, plant material in Late Caenozoic alluvium and pan deposits.
Blocks of reworked silicified wood within surface gravels and older alluvium.</td></tr>
<tr><td rowspan="5">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
• 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) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
• 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</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
• Carefully 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</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">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.</td></tr>
</table>