RECOMMENDED EXEMPTION FROM FURTHER PALAEONTOLOGICAL STUDIES:

PROPOSED CONSTRUCTION OF HUMANSRUS SOLAR PV FACILITY 1 ON THE REMAINDER OF FARM 147, HUMANSRUS NEAR COPPERTON, SIYATHEMBA MUNICIPALITY, NORTHERN CAPE

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1. OUTLINE OF THE PROPOSED DEVELOPMENTS

Humansrus Solar PV Facility 1 (Pty) Ltd is proposing to develop two separate PV solar energy facilities of 75 MW total generation capacity - Humansrus Solar PV Facility 1 – on the Remainder of Farm 147 Humansrus, situated about 10 km southeast of the small mining village of Copperton, Sitathemba Municipality, Northern Cape (Fig. 2). Electricity generated will be supplied to the national Eskom grid via the existing Kronos or Cuprum Substation, close to the solar development sites. Project infrastructure will cover an estimated 275 ha and will comprise the following main components:

- solar photovoltaic panels with a generation capacity of 75 MW;
- On-site switching-station / substation;
- Auxiliary buildings (gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Inverter-stations, transformers and internal electrical reticulation (underground cabling);
- Access and internal road network;
- Laydown area;
- Overhead electrical transmission line / grid connection to the existing Kronos or Cuprum Substation;
- Rainwater tanks; and
- Perimeter fencing.

Various alternatives, in terms of technology of the solar arrays, as well as layout for the solar arrays and associated infrastructure on the development site, will be considered and be informed by the environmental constraints identified and assessment by the various specialists as part of the on-going environmental assessment process.

Environmental Impact Assessments for the two solar energy projects are being conducted by Cape Environmental Assessment Practitioners (Pty) Ltd, George for Humansrus Solar PV Facility 1 (Pty) Ltd (Contact details: First Floor, Eagles View Building, 5 Progress Street, George. PO Box 2070, George, 6530. Telephone: (044) 874 0365 Facsimile: (044) 874 0432. Web: www.cape-eaprac.co.za).

The present combined palaeontological heritage comment for the two adjacent solar facility developments has been commissioned by Mr Stefan de Kock of PERCEPTION Planning, George (Contact details: PO Box 9995, George 6530, Western Cape, South Africa. Fax: +27(0)86 510 8357. Mobile: +27(0)82 568 4719).

2. GEOLOGICAL BACKGROUND

The study area for the proposed Humansrus Solar PV Facility 1 comprises flat-lying, semi-arid terrain at around 1100 – 1130 m amsl spanning the R357 road, roughly 10 km to the southeast of Copperton mining village (Fig. 2). Several recent palaeontological impact assessments in the Copperton area by the author have outlined the geology of the region (*e.g.* Almond 2012a, 2012b, 2013a, 2013b). As shown on the relevant 1: 250 000 geological map 2922 Prieska (Figure 1), the study area is underlain by Permo-Carboniferous glacial rocks of the **Dwyka Group** (**Karoo Supergroup**). These rocks crop out at near-surface in the southern part of the area but are mantled by Quaternary aeolian sands of the **Gordonia Formation** (**Kalahari Group**) over most of the northern portion of the study area. Several small inliers of much older basement rocks emerge through the cover of Kalahari sands and other superficial deposits in the Copperton area. On the farm Humansrus 147 these Precambrian basement rocks are assigned to the **Vogelstruisbult Formation** of the **Jacobsmyn Pan Group** (**Mv** in Fig. 1), mainly consisting of high grade metamorphic rocks such as banded pelitic gneiss and migmatites, as well as several small outcrops of intrusive igneous rocks (anorthosites, gabbros) assigned to the **Plat Sjambok Suite** (**Mp**) of ill-defined Mokolian age (*i.e.* Mid Proterozoic, between 1000 and 2050 Ma) (Slabbert *et al.* 1999, Cornell *et al.* 2006). These ancient basement rocks were last metamorphosed some one billion or so years ago (1 – 1.2 Ga) and since they are entirely unfossiliferous they will not be considered further here.

3. PALAEONTOLOGICAL HERITAGE

The fossil heritage associated with each of the rock units represented in the Copperton study region has been previously outlined by Almond (2013a, 2013b and earlier references).

The igneous and metamorphic **basement rocks** are entirely unfossiliferous.

A wide range of fossil groups is recorded from the **Dwyka Group** of the Northern Cape but recent field studies suggest that the glacially-related sediments are generally highly weathered and calcretised near-surface in the Copperton region while well-preserved, potentially fossiliferous interglacial beds are not well-represented at surface in the area. The only fossils recorded from the Dwyka rocks in the general region are small domical to columnar stromatolites preserved within bouldery erratics of grey carbonate (probably dolomite) have been reported from the farm Klipgats Pan by Almond (2012a). These erratics have probably been transported by ice movement from the Campbell Rand Subgroup (Ghaap Group) that crops out in the Ghaap Plateau to the north of Prieska.

The fossil record of the **Kalahari Group** is generally sparse and low in diversity. The **Gordonia Formation** dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying bedrocks

(including, for example, dolerite) may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (*e.g. Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*) and shells of land snails (*e.g. Trigonephrus*) (Almond 2008, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g. Corbula, Unio*) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands. These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes of the **Mokolanen Formation** might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways.

Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings such as pans) may be expected occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient, Plio-Pleistocene alluvial gravels. Important fossil mammalian remains assigned to the Florisian Mammal Age (*c.* 300 000 – 12 000 BP; MacRae 1999) have recently been documented from stratigraphic units designated Group 4 to Group 6 (*i.e.* calcrete hardpan and below) at Bundu Pan, some 22 km northwest of Copperton (Kiberd 2006 and refs. therein). Orton (2012) recently recorded a single fossil equid tooth associated with a rich MSA artefact assemblage exposed in an erosion donga leading into the southern edge of a small quarry on the farm Hoekplaas (originally a pan area), just to the west of the present study area. The tooth may have originally eroded out of a thin, MSA artefact-rich gravel horizon (palaoesurface) within soils exposed in section at the southern end of the gully. This horizon is probably equivalent to Group 2 of Kiberd's stratigraphy at Bundu Pan, and therefore somewhat younger than the Florisian mammal fauna reported there. However, since the erosion gully where the tooth was collected also incises older, coarser fluvial gravels that directly overlie the calcrete hardpan here, the source may in fact be equivalent to the slightly older Group 3 of Kiberd's scheme (Almond 2013a). It is quite likely that fossil bones and teeth of mammals are preserved within buried Pleistocene fluvial and pan sediments within the Humansrus Farm study area, as seen at Bundu Pan in the same region. However, such fossil sites are likely to be sparsely distributed and their locations difficult to predict, given the extensive younger sedimentary cover.

4. CONCLUSIONS & RECOMMENDATIONS

The igneous and metamorphic Precambrian basement rocks underlying the Humansrus study area at depth are entirely unfossiliferous. The overlying Permo-Carboniferous glacially-related sediments of the Dwyka Group (Karoo Supergroup) are, at most, sparsely fossiliferous, with occasional transported stromatolitic carbonate erratics. Kalahari Group sediments (calcretes and aeolian sands) mantling the older bedrocks, especially in the northern portion of the study area, are generally of low palaeontological sensitivity. Mammalian bones and teeth have been recorded from similar rocks elsewhere in Bushmanland but are very scarce.

It is concluded that the both the proposed Humansrus Solar PV Facility 1 near Copperton, including the associated short transmission lines, are unlikely to have significant impacts on local palaeontological heritage resources.

It is therefore recommended that, pending the discovery of significant new fossils remains before or during construction, exemption from further specialist palaeontological studies and mitigation be granted for the proposed Humansrus Solar PV Facility 1 on Farm Humansrus 147 near Copperton.

Should any substantial fossil remains (*e.g.* well-preserved stromatolites, mammalian bones and teeth) be encountered during excavation, however, these should be safeguarded, preferably *in situ*, and reported by the ECO to SAHRA, *i.e.* The South African Heritage Resources Authority, as soon as possible (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502. Email: cscheermeyer@sahra.org.za) so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (*e.g.* stratigraphy, sedimentology, taphonomy) by a professional palaeontologist.

5. KEY REFERENCES

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6. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

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 in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. 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 palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape under the aegis of his Cape Town-based company *Natura Viva* cc. He is a long-standing 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.

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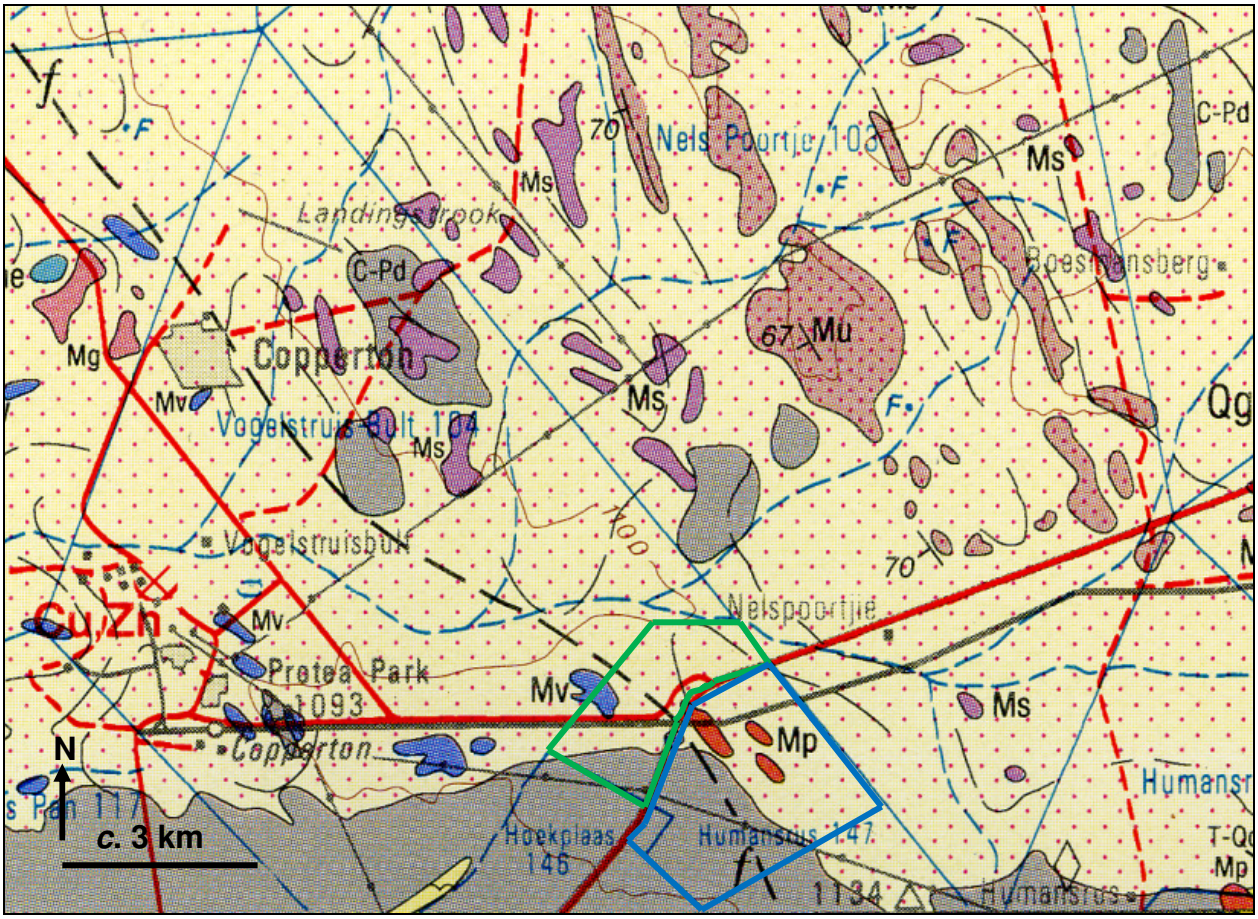

Figure 1: Extracts from 1: 250 000 geology map 2922 Prieska (Council for Geoscience, Pretoria) showing the approximate outline of the proposed RE Capital 13 and RE Capital 14 solar energy facility study areas on the farm Humansrus 147 near Copperton (green and blue polygons respectively). The main geological units mapped within the study region are:
1. Precambrian (Mid Proterozoic / Mokolian) basement rocks (igneous / metamorphic):
Dark blue (Mv) = Vogelstruisbult Formation schists and gneisses (Jacobsmyn Pan Group)
Red (Mp) = Plat Sjambok Suite intrusive igneous rocks (anorthosite, gabbro)
2. Late Carboniferous / Early Permian Karoo Supergroup sediments:
Grey (C-Pd) = Mbizane Formation (Dwyka Group)
3. Late Caenozoic (Quaternary to Recent) superficial deposits:
Pale yellow with dots (Qg) = reddish aeolian sands of Gordonia Formation (Kalahari Group)

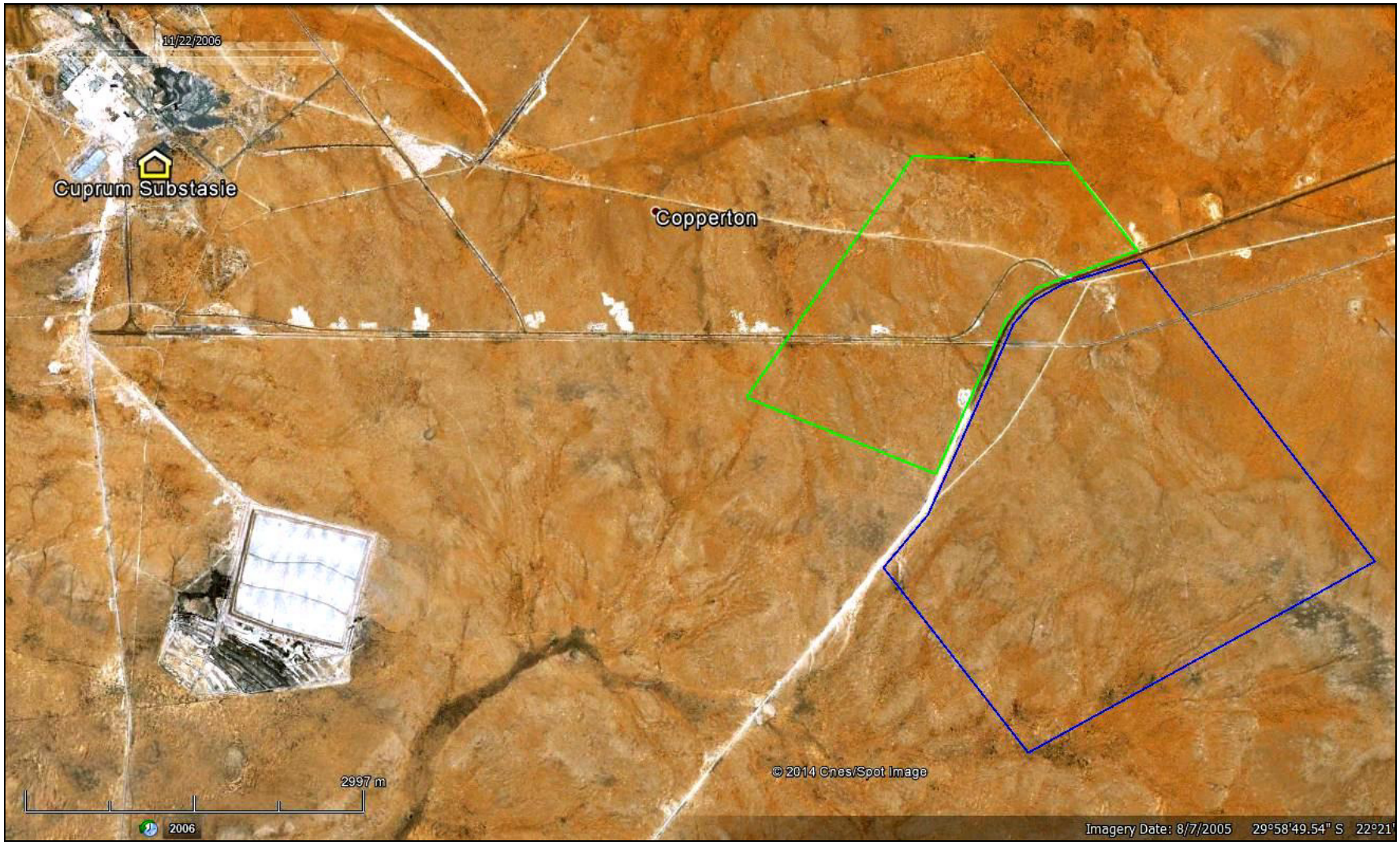

Figure 2: Google earth© satellite image showing the location of the study areas for the Humansrus Solar PV Facility 1 (green polygon) and Humansrus Solar PV Energy Facility 2 (blue polygon) PV solar facilities on the Remainder of Farm 147, Humansrus near Copperton, Siyathemba Municipality, Northern Cape. The existing Cuprum Substation is indicated; the existing Kronos Substation is located just to the south of the southern edge of the image