RECOMMENDED EXEMPTION FROM FURTHER PALAEONTOLOGICAL STUDIES:

PROPOSED PV SOLAR FACILITY ON YORK A, FARM NO 279 (PORTION 0) NEAR HOTAZEL, JOE MOROLONG LOCAL MUNICIPALITY, NORTHERN CAPE

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

EXECUTIVE SUMMARY

Hotazel Solar Facility 2 (Pty) Ltd ("the Applicant") is proposing a 100 megawatt PV solar facility with a footprint of up to 230 hectares on land parcel York A (Farm No. 279, Portion 0) together with a 132kV overhead transmission line connection to the national grid. The solar facility project area, with two site options (1 and 2), is situated *c*. 5 km southeast of the town of Hotazel in the Joe Morolong Local Municipality, Northern Cape Province (Fig. 1).

The project area – including powerline corridor options - is entirely underlain by Quaternary to Recent aeolian (wind-blown) sands of the Gordonia Formation (Kalahari Group). Deep borrow pits and mining excavations in the broader Hotazel region show that the surface sands are underlain at depth by a series of thick calcrete hardpans (Mokolanen Formation) as well as locally by consolidated sandy and gravelly deposits of the Kalahari Group. The Gordonia sands are themselves only very sparsely fossiliferous, while the only fossil remains recorded from the calcretes beneath them are locally abundant, low-diversity invertebrate burrows as well as casts of plant rootlets and of reedy vegetation. Such trace fossils are of widespread occurrence within the Kalahari region. Impacts on them are likely to be of low conservation significance and special mitigation measures to protect them are not considered warranted.

The overall palaeontological sensitivity of the entire Hotazel 2 project area, *including* the various transmission line corridor options to Hotazel Substation, is assessed as LOW. Small pockets of locally HIGH sensitivity might occur around pans as well as along drainage lines but these are not apparent within the project footprint on satellite images. Plio-Pleistocene calcretised gravels and finer-grained alluvium in pan and river settings may contain mammalian remains such as bones, teeth and horn cores in addition to abundant, low-diversity trace fossil assemblages.

It is concluded that the overall impact significance of the proposed Hotazel 2 development is VERY LOW (-). This assessment applies equally to the PV solar footprint itself as well as to the proposed transmission lines to the national grid and other infrastructure (access and internal roads, on-site substation *etc*). There is no marked preference for any particular PV facility, substation or transmission line route option on palaeontological heritage grounds.

Given the very large outcrop area of the sparsely fossiliferous Kalahari Group sediments that are impacted by the numerous mining, railway and alternative energy projects in the vicinity of Hotazel,

the cumulative impact of these developments – including that of the Hotazel 2 - is assessed as LOW. The No-Go option (no PV facility) would have a neutral impact on local fossil heritage resources.

The following mitigation measures to safeguard fossils exposed on site during the construction phase of the development are proposed:

- The Environmental Officer (EO) responsible for the development must remain aware that all sedimentary deposits have the potential to contain fossils and he/she should thus monitor all deeper (> 1 m) excavations into sedimentary bedrock for fossil remains on an on-going basis. If any substantial fossil remains (*e.g.* vertebrate bones, teeth) are found during construction SAHRA should be notified immediately (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) so that appropriate mitigation (*i.e.* recording, sampling or collection) by a palaeontological specialist can be considered and implemented, at the developer's expense.

- A chance-find procedure should be implemented so that, in the event of fossils being uncovered, the EO/Site Engineer will take the appropriate action, which includes:

    - Stopping work in the immediate vicinity and fencing off the area with tape to prevent further access;
    - Reporting the discovery to the provincial heritage agency and/or SAHRA;
    - Appointing a palaeontological specialist to inspect, record and (if warranted) sample or collect the fossil remains;
    - Implementing further mitigation measures proposed by the palaeontologist; and
    - Allowing work to resume only once clearance is given in writing by the relevant authorities.

    (These recommendations are tabulated in Appendix 1).

- During maintenance and servicing of infrastructure, if excavation is required, it shall be limited to the disturbed footprint as far as practicable. Should bulk works exceed the existing disturbed footprint, SAHRA shall be notified.

If the mitigation measures outlined above are adhered to, the residual impact significance of any construction and operational phase impacts on local palaeontological resources is considered to be low.

The mitigation measures proposed here should be incorporated into the Environmental Management Plan (EMP) for the Hotazel 2 project.

The palaeontologist concerned with mitigation work will need a valid collection permit from SAHRA. All work would have to conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere to the minimum standards for Phase 2 palaeontological studies recently published by SAHRA (2013).

1. OUTLINE OF PROPOSED DEVELOPMENT

The Applicant is proposing to construct a 100 megawatt PV facility with a footprint of up to 275 hectares on the land parcel York A (Farm No. 279, Portion 0) together with a 132kV overhead transmission line connection to the national grid. The solar facility project area, with two site options (1 and 2), is situated on the northern side of the R31 tar road between Hotazel and Kuruman, *c*. 5 km southeast of the town of Hotazel in the Joe Morolong Local Municipality, Northern Cape Province (Fig. 1). Associated infrastructure will include an internal road network, access road from the R380, substation, perimeter fencing *etc*. Several short 132 kV overhead transmission line route options are under consideration to connect the on-site substation within the solar facility project area to the national grid *via* the existing Hotazel Substation located *c*. 3 km to the northwest.

The present palaeontological heritage desktop study assesses the project area as well as the various transmission line route options for the proposed Hotazel 2. The report has been commissioned as part of the Scoping and EIR process for this development by Cape EAPrac (Contact details: Mr Dale Holder. Cape EAPrac. 17 Progress Street, George. PO Box 2070 George 6530, RSA. Tel: 044 874 0365. Fax: 044 874 0432. E-mail: dale@cape-eaprac.co.za).

2. GEOLOGICAL BACKGROUND

The Hotazel 2 project area on the Remaining Extent of York A 279, as well as the associated 132 kV transmission line corridor options, are all situated in very flat-lying, sandy, semi-desert terrain at *c*. 1070 m amsl. They lie within the southern Kalahari Region lying between the Korannaberg in the west and the Kurumanheuwels in the East (Fig. 1). The sandy terrain here is fairly featureless Kalahari thorn veld. This region is drained by the Ga-Mogara River, a southern tributary of the Kuruman River that runs *c*. 5 km to the west of the project area, and by its tributaries. In general, bedrock exposure is extremely limited in the region due to the thick cover by Kalahari Group sediments. Existing manganese mines are situated to the northwest and south of the PV facility project area.

The geology of the area around and to the southeast of Hotazel is outlined on the 1: 250 000 scale geological map 2722 Kuruman (Fig. 2). A brief sheet explanation is printed on the map. The Hotazel 2 PV Facility project area (including the overhead transmission line corridor options) is entirely underlain by Pleistocene to Recent aeolian sands of the **Gordonia Formation** (**Kalahari Group**) (Qs in Fig. 2). The geological map as well as recent field studies in the region (Almond 2013a, 2013b) show that the Kalahari sands here are extensively underlain by hardpan calcretes (Tl in Fig. 2), some of which at least can be assigned to the **Mokalanen Formation** of the Kalahari Group. Subdued linear sand dunes trending NW-SE as well as pale calcrete exposures along the Ga-Mogara River and nearby pans are clearly visible outside the present project area on satellite images. No major drainage lines or pans are visible on satellite images within the present project area but calcretes are expected here at depth beneath the cover sands (Fig. 1).

The following account of the geology of the Hotazel region has largely been abstracted from previous PIA reports by Almond (2103a, 2013b, 2016). Ancient bedrocks of the Transvaal Supergroup and other Precambrian sediments in the Hotazel area are mantled by a thick succession of **superficial sediments** of probable Late Caenozoic (*i.e.* Late Tertiary or Neogene to Recent) age, most of which are assigned to the **Kalahari Group**. The geology of the Late Cretaceous to Recent Kalahari Group is reviewed by Thomas (1981), Dingle *et al.* (1983), Thomas

& Shaw 1991, Haddon (2000) and Partridge *et al.* (2006). Other superficial sediments whose outcrop areas are often not indicated on geological maps include colluvial or slope deposits (scree, hillwash, debris flows *etc*), sandy, gravelly and bouldery river alluvium, surface gravels of various origins, as well as spring and pan sediments. The colluvial and alluvial deposits may be extensively calcretised (*i.e.* cemented with pedogenic limestone), especially in the neighbourhood of dolerite intrusions or overlying Ghaap Group carbonate rocks.

Calcretes or **surface limestones** (**Ql** in Fig. 2) in the southern Kalahari Region are pedogenic limestone deposits that reflect seasonally arid climates in the region over the last five or so million years. They are briefly described by Truter *et al.* (1938) as well as Visser (1958) and Bosch (1993). The surface limestones may reach thicknesses of over 20 m, but are often much thinner, and are locally conglomeratic with clasts of reworked calcrete as well as exotic pebbles. The limestones may be secondarily silicified and incorporate blocks of the underlying Precambrian carbonate rocks. The older, Pliocene - Pleistocene calcretes in the broader Kalahari region, including sandy limestones and calcretised conglomerates, have been assigned to the **Mokalanen Formation** of the **Kalahari Group** and are possibly related to a globally arid time period between 2.8 and 2.6 million years ago, *i.e.* late Pliocene (Partridge *et al.* 2006).

Large areas of unconsolidated, reddish-brown to grey aeolian (*i.e.* wind-blown) sands of the Quaternary **Gordonia Formation** (**Kalahari Group**; **Qs** in Fig. 2) are mapped in the southern Kalahari study region. According to Bosch (1993) the Gordonia sands in the Kimberley area reach thicknesses of up to eight meters and consist of up to 85% quartz associated with minor feldspar, mica and a range of heavy minerals. The Gordonia dune sands are considered to range in age from the Late Pliocene / Early Pleistocene to Recent, dated in part from enclosed Middle to Later Stone Age stone tools (Dingle *et al*., 1983, p. 291). Note that the recent extension of the Pliocene - Pleistocene boundary from 1.8 Ma back to 2.588 Ma would place the Gordonia Formation almost entirely within the Pleistocene Epoch. Reworked and diagenetically altered sands of probable aeolian origin in the Kimberley area are often referred to as Hutton Sands.

3. PALAEONTOLOGICAL HERITAGE

The palaeontological record of the rock units represented in the Hotazel region has been reviewed by Almond (2013a, 2013b) as well as in the desktop study by Groenewald (2013). Fossil biotas recorded from each of the main rock units mapped here are briefly reviewed in Table 1 (based largely on Almond & Pether (2008) and references therein) where an indication of the inferred palaeontological sensitivity of each rock unit is also given. Pervasive calcretisation and chemical weathering of many near-surface bedrocks in the Northern Cape has compromised their original fossil heritage in many areas.

3.1. Fossils within the Kalahari Group

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 (Du Toit 1954, Dingle *et al*., 1983). 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 occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient, Plio-Pleistocene alluvial gravels.

Table 1. Fossil heritage of rock units represented in the Hotazel study region

GEOLOGICAL UNIT	ROCK TYPES & AGE	FOSSIL HERITAGE	PALAEONT-OLOGICAL SENSITIVITY	RECOMMENDED MITIGATION
OTHER LATE CAENOZOIC TERRESTRIAL DEPOSITS OF THE INTERIOR **(Most too small to be indicated on 1: 250 000 geological maps)**	**Fluvial, pan, lake and terrestrial sediments, including diatomite (diatom deposits), pedocretes, spring tufa / travertine, cave deposits, peats, colluvium, soils, surface gravels including downwasted rubble** **MOSTLY QUATERNARY TO HOLOCENE (Possible peak formation 2.6-2.5 Ma)**	**Bones and teeth of wide range of mammals (*e.g.* mastodont proboscideans, rhinos, bovids, horses, micromammals), reptiles (crocodiles, tortoises), ostrich egg shells, fish, freshwater and terrestrial molluscs (unionid bivalves, gastropods), crabs, trace fossils (*e.g.* termitaria, horizontal invertebrate burrows, stone artefacts), petrified wood, leaves, rhizoliths, diatom floras, peats and palynomorphs. calcareous tufas at edge of Ghaap Escarpment might be highly fossiliferous (*cf* Taung in NW Province – abundant Makapanian Mammal Age vertebrate remains, including australopithecines)**	**LOW** **Scattered records, many poorly studied and of uncertain age**	**Any substantial fossil finds to be reported by ECO to SAHRA**
Gordonia Formation (Qs) **KALAHARI GROUP** ***plus*** **SURFACE CALCRETES (Tl / Qc)**	**Mainly aeolian sands *plus* minor fluvial gravels, freshwater pan deposits, calcretes** **PLEISTOCENE to RECENT**	**Calcretised rhizoliths & termitaria, ostrich egg shells, land snail shells, rare mammalian and reptile (*e.g.* tortoise) bones, teeth** **Freshwater units associated with diatoms, molluscs, stromatolites *etc***	**LOW**	**Any substantial fossil finds to be reported by ECO to SAHRA**

Palaeontological fieldwork at several sites some 10 to 15 km south of Hotazel (Almond 2013a, 2013b) indicated that the Gordonia sands and underlying calcretes here are very sparsely fossiliferous. The only fossil remains recorded from these sediments in the wider study region are locally abundant, low-diversity invertebrate burrows as well as casts of plant rootlets and of reedy

vegetation preserved in subsurface calcrete hardpans. These trace fossils were probably associated with damp *vlei* settings within largely abandoned river channels. Such trace fossils are of widespread occurrence within the Kalahari region so impacts on fossil heritage here are likely to be of low conservation significance and special mitigation measures to protect them are not considered warranted.

The overall palaeontological sensitivity of the entire Hotazel 2 PV Facility project area is assessed as LOW. Pockets of locally HIGH sensitivity along drainage lines and around pans are not expected here, although their presence cannot be entirely discounted. Plio-Pleistocene calcretised gravels and finer-grained alluvium in such settings might contain mammalian remains such as bones, teeth and horn cores in addition to abundant, low-diversity trace fossil assemblages.

4. CONCLUSIONS & RECOMMENDATIONS

The overall palaeontological sensitivity of the entire Hotazel 2 PV Facility project area, including both site options as well as the various 132 overhead transmission line corridor options to Hotazel Substation, is assessed as LOW. Small pockets of locally HIGH sensitivity might occur along drainage lines and around any pans but these are not anticipated on the basis of satellite imagery. Plio-Pleistocene calcretised gravels and finer-grained alluvium in these last settings may contain mammalian remains such as bones, teeth and horn cores in addition to abundant, low-diversity trace fossil assemblages.

It is concluded that the overall impact significance (pre-mitigation) of the proposed Hotazel 2 PV Facility is VERY LOW (-). This assessment applies equally to the core PV Facility project area on the Remaining Extent of Farm York A 297 itself, as well as the proposed transmission lines and other infrastructure (internal road network, access road from the R380, IPP substation, perimeter fencing *etc*). There is no preference on palaeontological heritage grounds for either one of the two solar facility site or substation options or any particular transmission line route options among those under consideration.

As shown on the SAHRIS webite, there are numerous ongoing and proposed mining, railway and other developments located in the immediate vicinity of Hotazel and the present solar park project. To the author's knowledge, the only palaeontological impact assessments submitted for these projects are those by Almond (2013a, 2013b, 2016) as well as Groenewald (2013). In all four cases, the impact significance of the proposed developments were assessed as low. Given the very large outcrop area of the sparsely fossiliferous Kalahari Group sediments involved here, the cumulative impact of the proposed alternative energy developments around Hotazel is assessed as LOW. The No-Go option (no PV facility) would have a neutral impact on local fossil heritage resources.

The following mitigation measures to safeguard fossils exposed on site during the construction phase of the development are proposed (See also tabulated Fossil Finds Procedure in Appendix 1):

- The ECO responsible for the development must remain aware that all sedimentary deposits have the potential to contain fossils and he/she should thus monitor all deeper (> 1 m) excavations into sedimentary bedrock for fossil remains on an on-going basis. If any substantial fossil remains (*e.g.* vertebrate bones, teeth) are found during construction SAHRA should be notified immediately (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). This is in order that that appropriate mitigation (*i.e.* recording, sampling or collection) by a palaeontological specialist can be considered and implemented, at the developer's expense.

- A chance-find procedure should be implemented so that, in the event of fossils being uncovered, the ECO/Site Engineer will take the appropriate action, which includes:
    - Stopping work in the immediate vicinity and fencing off the area with tape to prevent further access;
    - Reporting the discovery to the provincial heritage agency and/or SAHRA;
    - Appointing a palaeontological specialist to inspect, record and (if warranted) sample or collect the fossil remains;
    - Implementing further mitigation measures proposed by the palaeontologist; and
    - Allowing work to resume only once clearance is given in writing by the relevant authorities.

- During maintenance and servicing of infrastructure, if excavation is required, it shall be limited to the disturbed footprint as far as practicable. Should bulk works exceed the existing disturbed footprint, SAHRA shall be notified.

If the mitigation measures outlined above are adhered to, the residual impact significance of any construction and operational phase impacts on local palaeontological resources is considered to be very low.

The mitigation measures proposed here should be incorporated into the Environmental Management Plan (EMP) for Hotazel 2 PV Facility project.

The palaeontologist concerned with mitigation work will need a valid collection permit from SAHRA. All work would have to conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere to the minimum standards for Phase 2 palaeontological studies recently published by SAHRA (2013).

5. KEY REFERENCES

ALMOND, J.E. 2010. Prospecting application for iron ore and manganese between Sishen and Postmasburg, Northern Cape Province: farms Jenkins 562, Marokwa 672, Thaakwaneng 675, Driehoekspan 435, Doringpan 445 and Macarthy 559: desktop palaeontological assessment, 20 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2012a. Proposed westerly extension of Sishen Iron Ore Mine near Kathu, Kalagadi District Municipality, Northern Cape. Palaeontological specialist study" desktop study, 18 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2012b. Proposed 16 Mtpa expansion of Transnet's existing manganese ore export railway line & associated infrastructure between Hotazel and the port of Ngqura, Northern & Eastern Cape. Part 1: Hotazel to Kimberley, Northern Cape. Palaeontological assessment: desktop study, 28 pp.

ALMOND, J.E. 2013a. Proposed 16 Mtpa expansion of Transnet's existing manganese ore export railway line & associated infrastructure between Hotazel and the Port of Ngqura, Northern & Eastern Cape. Part 1: Hotazel to Kimberley, Northern Cape. Palaeontological specialist assessment: combined desktop and field-based study, 85 pp. Natura Viva cc, Cape Town.

ALMOND, 2013b. Proposed new railway compilation yard at Mamathwane near Hotazel, John Taolo Gaetsewe District Municipality, Northern Cape. Palaeontological specialist assessment: combined desktop and field-based study, 29 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2016. Proposed Hotazel Solar Park on the Farm Hotazel Annex Langdon (f278/0), Joe Morolong Local Municipality, Northern Cape. Recommended exemption from further palaeontological studies, 12 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. & PETHER, J. 2008. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

BOSCH, P.J.A. 1993. Die geologie van die gebied Kimberley. Explanation to 1: 250 000 geology Sheet 2824 Kimberley, 60 pp. Council for Geoscience, Pretoria.

DINGLE, R.V., SIESSER, W.G. & NEWTON, A.R. 1983. Mesozoic and Tertiary geology of southern Africa. viii + 375 pp. Balkema, Rotterdam.

DU TOIT, A. 1954. The geology of South Africa. xii + 611pp, 41 pls. Oliver & Boyd, Edinburgh.

GROENEWALD, G. 2013. Palaeontological desktop assessment of the Farm Gloria 266, near Hotazel town in the John Toalo Gaetsewe District Municipality in the Northern Cape Province, 9 pp. PGS Heritage & Grave Relocation Consultants.

HADDON, I.G. 2000. Kalahari Group sediments. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of southern Africa, pp. 173-181. Oxford University Press, Oxford.

HADDON, I.G. 2005. The sub-Kalahari geology and tectonic evolution of the Kalahari Basin, Southern Africa. Unpublished PhD thesis, University of Johannesburg, 343 pp.

HENDEY, Q.B. 1984. Southern African late Tertiary vertebrates. In: Klein, R.G. (Ed.) Southern African prehistory and paleoenvironments, pp 81-106. Balkema, Rotterdam.

MACRAE , C. 1999. Life etched in stone. Fossils of South Africa. 305 pp. The Geological Society of South Africa, Johannesburg.

MCCARTHY, T. & RUBIDGE, B. 2005. The story of Earth and life: a southern African perspective on a 4.6-billion-year journey. 334pp. Struik, Cape Town.

NASH, D.J. & SHAW, P.A. 1998. Silica and carbonate relationships in silcrete-calcrete intergrade duricrusts from the Kalahari of Botswana and Namibia. Journal of African Earth Sciences 27, 11-25.

NASH, D.J. & MCLAREN, S.J. 2003. Kalahari valley calcretes: their nature, origins, and environmental significance. Quaternary International III, 3-22.

PARTRIDGE, T.C., BOTHA, G.A. & HADDON, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 585-604. Geological Society of South Africa, Marshalltown.

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

THOMAS, M.J. 1981. The geology of the Kalahari in the Northern Cape Province (Areas 2620 and 2720). Unpublished MSc thesis, University of the Orange Free State, Bloemfontein, 138 pp.

THOMAS, R.J., THOMAS, M.A. & MALHERBE, S.J. 1988. The geology of the Nossob and Twee Rivieren areas. Explanation for 1: 250 000 geology sheets 2520-2620. 17pp. Council for Geoscience, Pretoria.

THOMAS, D.S.G. & SHAW, P.A. 1991. The Kalahari environment, 284 pp. Cambridge University Press.

TANKARD, A.J., JACKSON, M.P.A., ERIKSSON, K.A., HOBDAY, D.K., HUNTER, D.R. & MINTER, W.E.L. 1982. Crustal evolution of southern Africa – 3.8 billion years of earth history, xv + 523pp. Springer Verlag, New York.

TRUTER, F.C., WASSERSTEIN, B., BOTHA, P.R., VISSER, D.L.J., BOARDMAN, L.G. & PAVER, G.L. 1938. The geology and mineral deposits of the Olifants Hoek area, Cape Province. Explanation of 1: 125 000 geology sheet 173 Olifants Hoek, 144 pp. Council for Geoscience, Pretoria.

VISSER, D.L.J. 1958. The geology and mineral deposits of the Griquatown area, Cape Province. Explanation to 1: 125 000 geology sheet 175 Griquatown, 72 pp. Council for Geoscience, Pretoria.

VISSER, D.J.L. *et al.* 1989. The geology of the Republics of South Africa, Transkei, Bophuthatswana, Venda and Ciskei and the Kingdoms of Lesotho and Swaziland. Explanation of the 1: 1 000 000 geological map, fourth edition, 491 pp. Council for Geoscience, Pretoria.

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, Limpopo, Northwest, Kwa-Zulu Natal, Mpumalanga and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has previously served as 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.

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

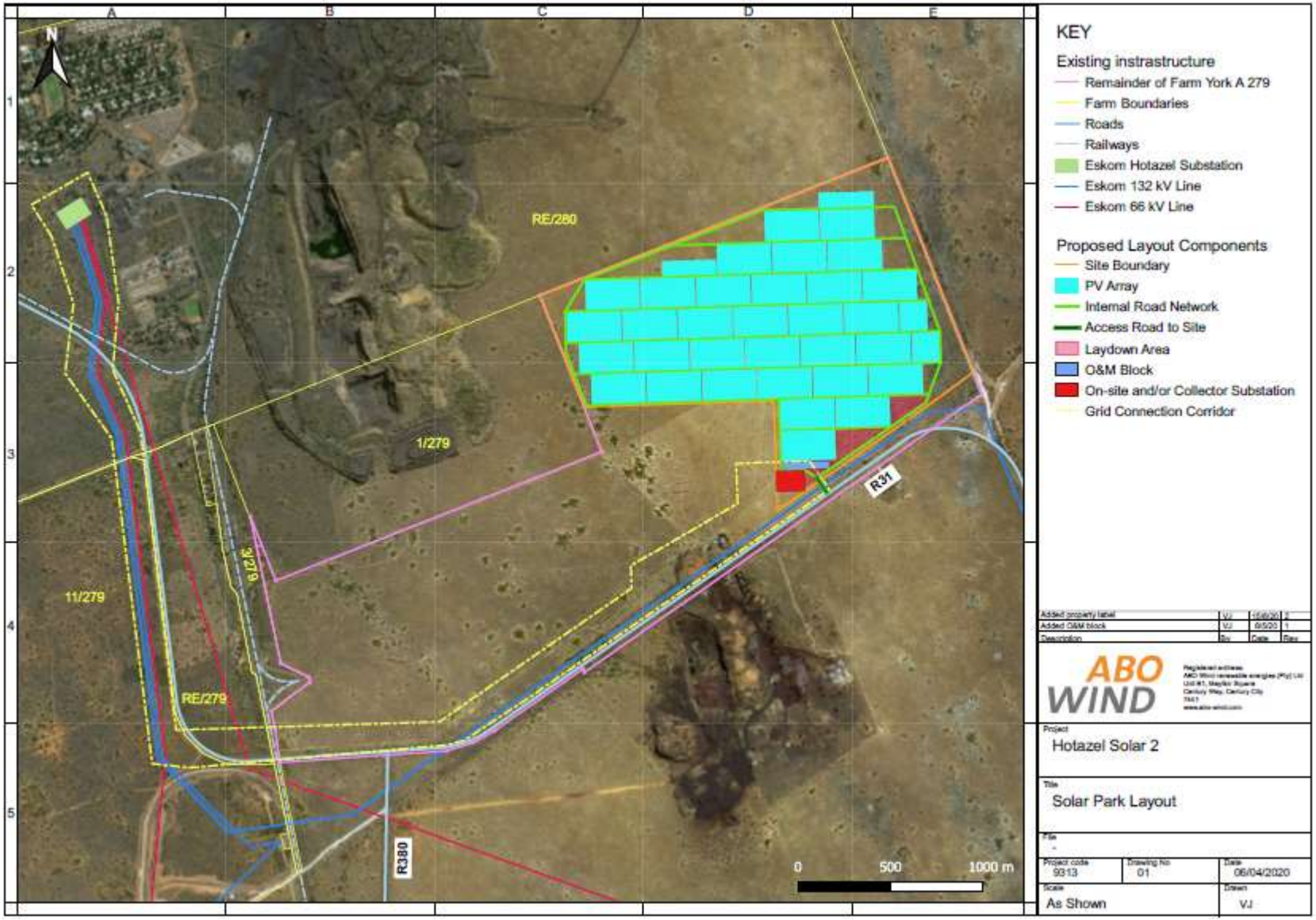

Figure 1: Google Earth© satellite image of the Hotazel 2 PV facility project area on York A, Farm No. 279 Portion 0 near Hotazel, Northern Cape.

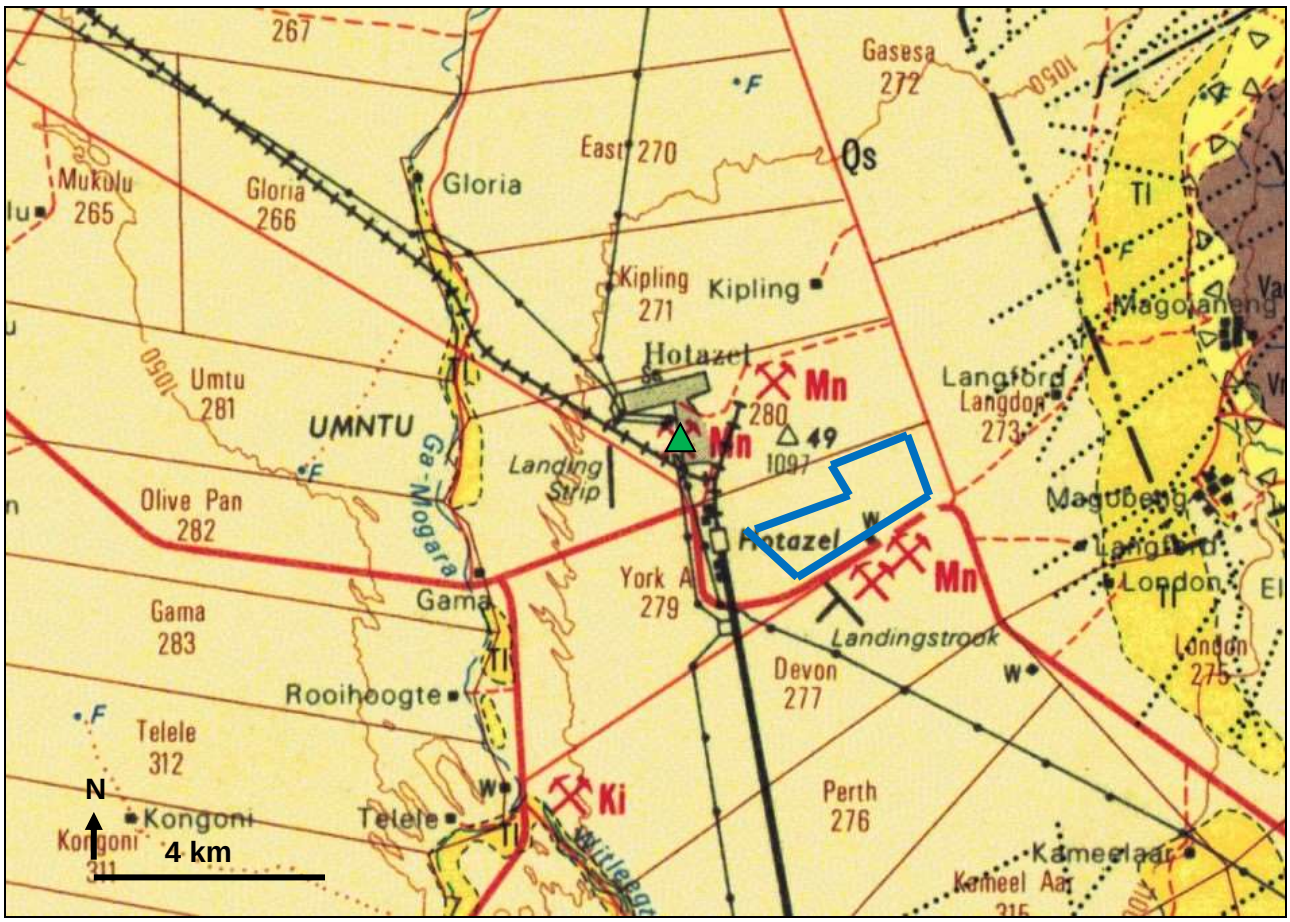

Figure 2: Extract from 1: 250 000 geology map 2722 Kuruman (Council for Geoscience, Pretoria) showing location of the York A, Farm No. 279 Portion 0 project area for the proposed Hotazel 2 PV Facility (blue polygon) to the SE of Hotazel, Northern Cape. The green triangle is the existing Hotazel Substation. The entire project area, including the proposed 132 kV overhead transmission line route options to Hotazel Substation, is underlain by aeolian sands of the Gordonia Formation (Kalahari Group) (Qs, pale yellow areas on the map). These are extensively underlain by thick near-surface calcrete that crop out at surface along the Ga-Mogara River to the west and around pans (Tl, darker yellow).

<table>
<tr><td colspan="3">CHANCE FOSSIL FINDS PROCEDURE: HOTAZEL PV SOLAR FACILITY ON YORK A, FARM NO 279 (PORTION 0) NEAR HOTAZEL,</td></tr>
<tr><td>Province & region:</td><td colspan="2">JOE MOROLONG LOCAL MUNICIPALITY, NORTHERN CAPE</td></tr>
<tr><td>Responsible Heritage Management Authority</td><td colspan="2">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">Gordonia and Mokolanen Formations (Kalahari Group)</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Calcretised rhizoliths & termitaria, ostrich egg shells, land snail shells, rare mammalian and reptile (e.g. tortoise) bones, teeth</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 Management Authority and project palaeontologist (if any) who will advise on any necessary mitigation
Ensure fossil site remains safeguarded until clearance is given by the Heritage Management Authority 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 Management Authority and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Management Authority, 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 Management Authority</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 Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Management Authority minimum standards.</td></tr>
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