PROPOSED PART 2 AMENDMENT FOR THE AUTHORISED MAIN TRANSMISSION SUBSTATION FOR THE SUTHERLAND 1 AND RIETRUG WIND ENERGY FACILITIES NEAR MERWEVILLE, CENTRAL KAROO DISTRICT, WESTERN CAPE PROVINCE

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

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EXECUTIVE SUMMARY

South Africa Mainstream Renewable Power Developments (Pty) Ltd is proposing the relocation of the authorised Main Transmission Substation (MTS) for the Sutherland 1 and Rietrug Wind Energy Facilities near Merweville, Central Karoo District, Western Cape Province. A Part 2 Amendment process is being undertaken to assess the relocation of the MTS on Portion 0 and Portion 7 of Farm Hamel Kraal 16 as it will be relocated within the already assessed and authorised 132 kV grid corridor.

The authorised and amended MTS sites are both underlain at depth by potentially fossiliferous sedimentary rocks of the Abrahamskraal Formation, Lower Beaufort Group (Karoo Supergroup) which are of Middle Permian Permian age. The majority of the amended site is occupied by low relief terrain mantled by alluvial and downwasted surface gravels as well as finer-grained deposits of low palaeosensitivity, with very little fresh bedrock exposure. Previous field surveys of the 400 kV grid corridor have recorded fragmentary cranial and post-cranial bones as well as teeth of large-bodied tetrapods (dinocephalians or pareiasaurs), locally abundant petrified wood, plant stem moulds and low-diversity invertebrate trace fossils on the farm Hamel Kraal 16 (Almond 2019). Sparse blocks of petrified wood have been recorded within the authorised MTS site. No new fossil sites were recorded within the amended site during the recent one-day site visit. To the east and shortly *outside* the amended substation project area new fossil sites comprising downwasted large tetrapod bones, moulds of plant stems within channel sandstones and locally abundant (but equivocal) trace fossils have been recorded. None of these new sites would require mitigation as a result of the MTS or the associated 400 kV grid connection developments.

The DFFE Screening Report for the proposed MTS development provisionally assigns a VERY HIGH palaeosensitivity to the project area (Appendix 3). Due to the scarcity of well-preserved, scientifically important fossils within the amended MTS project area, based on desktop studies as well as fieldwork, it is inferred that the area is in fact largely of LOW PALAEONTOLOGICALLY SENSITIVITY, although sparse, and largely unpredictable fossils might also occur here. The results of the DFFE screening tool sensitivity is therefore *contested* here.

The construction phase of the proposed MTS on the amended site will have a NEGATIVE LOW impact significance without mitigation, remaining NEGATIVE LOW with implementation of the proposed mitigation measures (See below). Negative residual impacts will be partially offset by an improved palaeontological data base and fossil collections (*positive* impacts). Confidence levels for this assessment are Medium, given the low bedrock exposure levels encountered in the project area. Once constructed, the Operational and De-commissioning Phases of the MTS will not involve further adverse impacts on palaeontological heritage so these are not assessed here.

The No-Go alternative - *i.e*. development of the authorized MTS site - would also have a NEGATIVE LOW impact on palaeontological heritage, with and without mitigation. However*, the amended site is preferred here on palaeontological heritage grounds* because of the higher probability of significant unrecorded fossil sites being present in the more dissected, hilly terrain of the authorised site.

Pending the outcome of outstanding palaeontological field-based studies for several WEF projects in the Sutherland – Merweville region (*e.g.* the authorised Suurplaats WEF), it is provisionally concluded that the cumulative impact significance of the proposed new MTS and associated electrical grid infrastructure developments in the context of other renewable energy and electrical infrastructure projects in the region is NEGATIVE MEDIUM without mitigation. This would fall to *NEGATIVE LOW provided that* the proposed monitoring and mitigation recommendations made for *all* these various renewable energy projects are fully implemented. These anticipated cumulative impacts following mitigation lie within acceptable limits.

The MTS project is not fatally flawed and there are no objections on palaeontological heritage grounds to authorisation of the proposed site amendment, *provided that* the recommended mitigation measures for the construction phase outlined below and in Appendix 2 are included in the EMPr for the development and are fully implemented.

- **Recommended mitigation measures**

In view of the low palaeosensitivity of the amended MTS project area and the inferred low impact significance of the proposed development on palaeontological heritage resources, it is concluded that no further palaeontological heritage studies or specialist palaeontological mitigation are required for this project, pending the exposure of any substantial fossil remains (*e.g.* vertebrate bones and teeth, large blocks of petrified wood) before or during the construction phase. None of fossil sites recorded in the vicinity lies within the proposed MTS project area itself (or within the authorised 400 kV grid corridor) and so they do not require mitigation in this regard.

The ECO / ESO responsible for the development should be alerted to the possibility of fossil remains being found on the surface or exposed by fresh excavations during construction. Should substantial fossil remains be discovered during construction, these should be safeguarded (preferably *in situ*) and the ECO / ESO should alert Heritage Western Cape, HWC at the earliest opportunity (Contact details: Heritage Western Cape. 3rd Floor Protea Assurance Building, 142 Longmarket Street, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 5959 Email: ceoheritage@westerncape.gov.za)). This is so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a qualified palaeontologist.

The palaeontological specialist involved would require a collection permit from HWC. Fossil material must be curated in an approved repository (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA (2013) and HWC (2021).

These recommendations are summarized in Appendix 2 and must be incorporated into the EMPr for the MTS development as a condition accompanying environmental authorisation of the project.

Summary of palaeontological impact significance ratings for the amended MTS development

Impact: Disturbance, damage or destruction of fossil heritage resources preserved at or beneath the ground surface within the project footprint		
Cause: Surface clearance or excavations		
	Without mitigation	***With mitigation***
Construction Phase	NEGATIVE LOW	NEGATIVE LOW
No-Go Option*	NEGATIVE LOW	NEGATIVE LOW
Cumulative impacts	NEGATIVE MEDIUM	NEGATIVE LOW

- ***i.e.*** **development of the authorised MTS site**

1. INTRODUCTION & BRIEF

South Africa Mainstream Renewable Power Developments (Pty) Ltd is proposing the relocation of the authorised Main Transmission Substation for the Sutherland 1 and Rietrug Wind Energy Facilities which is to be located near Merweville, Central Karoo District, Western Cape Province. The proposed relocation of the authorised MTS will be to a more accessible site on Portion 0 and Portion 7 of Farm Hamel Kraal 16, situated *c*. 25 km WSW of the small town of Merweville in the Moordenaars Karoo region, Central Karoo District of the Western Cape Province (Figs. 1 & A1.1 in Appendix 1). This will enable construction activities and facilitate accessibility for connection to other renewable energy projects in the area. A Part 2 Amendment process will be undertaken to assess the relocation of the MTS as it will be relocated within the already assessed and authorised grid corridor.

The authorised and amended MTS project areas overlie Middle Permian bedrocks of the Beaufort Group (Karoo Supergroup) that are potentially fossiliferous and rated as of High to Very High palaeosensitivity (SAHRIS palaeosensitivity map, DFFE Screening Tool) (Fig. A3.1 in Appendix 3). A desktop and field-based palaeontological heritage assessment of the authorised MTS site was previously undertaken by the present author in the context of electrical grid infrastructure to support the authorised Rietrug, Sutherland and Sutherland 2 Wind Energy Facilities (Almond 2019).The present combined desktop and field-based PIA report contributes to the Part 2 Amendment process that is being undertaken to assess the revised location of the MTS within the already assessed and authorised grid corridor. It forms part of an umbrella Heritage Impact Assessment for the MTS project that is being compiled by Dr Jason Orton of ASHA Consulting (Pty) Ltd. (Address: 23 Dover Road Muizenberg, 7945. Tel: 021 788 1025. Cell: 083 272 3225. E-mail: jayson@asha-consulting.co.za) and will also have input into the Environmental Management Programme (EMPr) for the development. The independent EAP for the project is Ms Arlene Singh of Nala Environmental Consultants (Address: Corner of Old Pretoria Main Road & Maxwell Drive, Waterfall, Johannesburg, 2090.Tel: +27 84 277 7074. E-mail: Arlene@veersgroup.com).

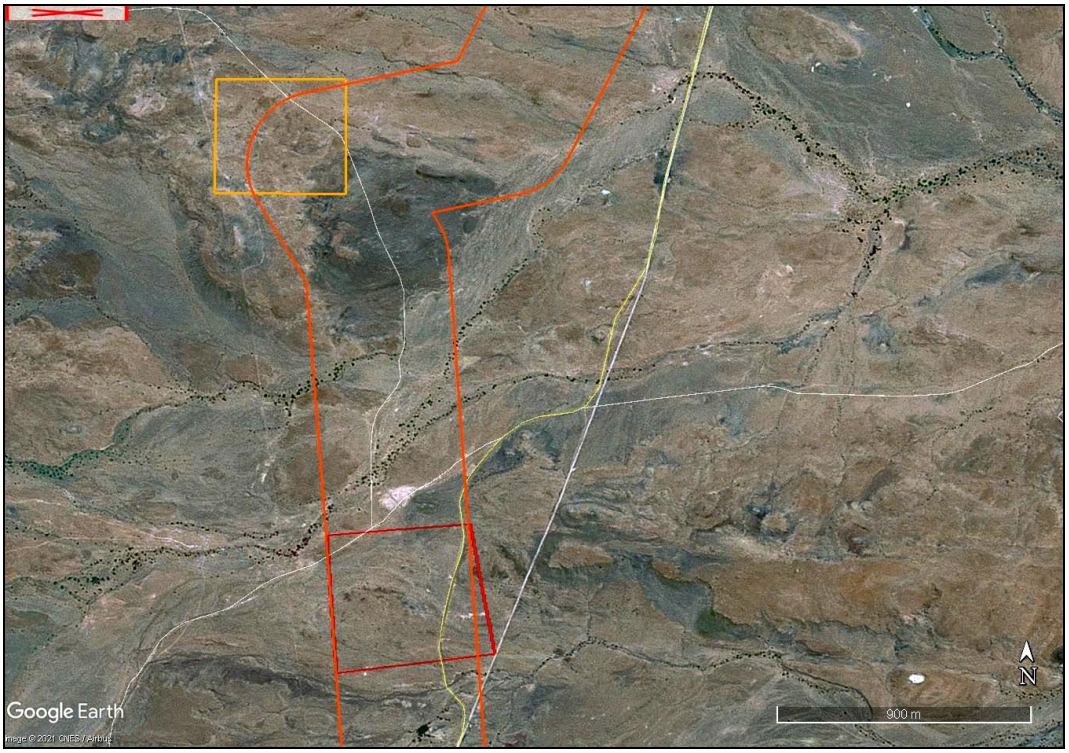

Figure 1: Google Earth© satellite image showing the location of the authorised MTS (orange rectangle), the authorised grid connection corridor for the Sutherland 1 and Rietrug Wind Energy Facilities (red) as well as the proposed amended location of the MTS (red polygon) on Portion 0 and Portion 7 of Farm Hamel Kraal 16, *c*. 25 km WSW of Merweville in

the Moordenaars Karoo region of the Western Cape Province. See Figure A1.1 in Appendix 1 for a more detailed satellite image of the amended MTS project area.

2. LEGISLATIVE CONTEXT

The present combined desktop and field-based palaeontological heritage report falls under Sections 35 and 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999), and it will also inform the EMPr for this project.

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:
(1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
(2) All archaeological objects, palaeontological material and meteorites are the property of the State.
(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
(4) No person may, without a permit issued by the responsible heritage resources authority—

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

(5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—

(a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
(b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
(c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph *(a)* to apply for a permit as required in subsection (4); and
(d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Minimum standards for the palaeontological component of heritage impact assessment reports (PIAs) have been published by SAHRA (2013) and by Heritage Western Cape (2021).

2.1. Legislative and Permit Requirements for potential specialist mitigation

Should professional palaeontological mitigation be necessary during the construction phase of the development (1) the palaeontologist concerned will need to apply for a Fossil Collection Permit from Heritage Western Cape, HWC (Contact details: Heritage Western Cape. 3rd Floor Protea Assurance Building, 142 Longmarket Street, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 5959 Email: ceoheritage@westerncape.gov.za. (2) Palaeontological collection should comply with international best practice. (3) All fossil material collected must be deposited, together with key collection data, in an approved depository (museum / university), such as the Iziko Museums, Cape Town. (4) Palaeontological mitigation work including the ensuing Fossil Collection Reports should comply with the minimum standards specified by SAHRA (2013) and HWC (2021).

3. STUDY APPROACH

This combined desktop and field-based palaeontological heritage report provides an assessment of the observed or inferred palaeontological heritage within the amended MTS study area, with recommendations for any specialist palaeontological mitigation where this is considered necessary. GPS data for key localities mentioned by number in the text are given in Appendix 1 where they are mapped in the context of the amended project area (Fig. A1.1).

The report is based on: (1) a review of the relevant scientific literature; (2) published geological maps (1: 250 000 geology sheet 320 Sutherland) and relevant sheet explanations (Theron 1983); (3) a one-day site visit carried out on 3 June 2021, and (4) The author's field experience with the formations concerned and their palaeontological heritage (*cf* Almond 2019) and (5) a review of palaeontological impact assessment (PIA) reports for other electrical infrastructure / renewable energy projects in the region (especially Almond 2010b, 2016h, 2015i).

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc*) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience. Consultation with professional colleagues, as well as examination of institutional fossil collections, may play a role here, or later following scoping during the compilation of the final report. This data is then used to assess the palaeontological sensitivity of each rock unit to development (Provisional tabulations of palaeontological sensitivity of all formations in the Western Cape have been compiled by Almond & Pether 2008). The likely impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field-based assessment by a professional palaeontologist is usually warranted.

On the basis of the desktop study, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are then determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Mitigation by a professional palaeontologist – normally involving the recording and sampling of fossil material and associated geological information (*e.g.* sedimentological data) – is usually most effective during the construction phase when fresh fossiliferous bedrock has been exposed by excavations, although pre-construction recording of surface-exposed material may sometimes be more appropriate. To carry out mitigation, the palaeontologist involved will need to apply for a palaeontological collection permit from the relevant heritage management authority (*i.e.* HWC). It should be emphasized that, *providing appropriate mitigation is carried out*, the majority of developments involving bedrock excavation can make a *positive* contribution to our understanding of local palaeontological heritage.

4. ASSUMPTIONS & LIMITATIONS

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.

2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.

3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.

4. The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (*e.g*. of commercial mining companies) - that is not readily available for desktop studies.

5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:
(a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
(b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium *etc*).
Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

The only limitation on this study was the very low level of bedrock exposure over most of the amended MTS project area. In order to assess the palaeosensitivity of the latter, it was therefore necessary to examine hillslope and stream gulley exposures in the vicinity of, but outside, the project area itself. Confidence levels for this assessment are rated as Medium / Moderate.

5. GEOLOGICAL BACKGROUND

The amended MTS project area is situated in alluvial plains or *vlaktes* close to the foot of the east-facing Great Escarpment (Klipfontein se Berg – Vanwyksberg – Besemgoedberg ranges) of the semi-arid Moordenaarskaroo subregion of the Great Karoo *sensu stricto*. Topographic relief here is low (*c*. 790- 800 m amsl) and the area is drained by several intermittently flowing tributary streams of the Dwyka River drainage network (*e.g.* Jukrivier, Oubergsrivier). Bedrock exposure levels within the project area itself are very low (Figs. 3, 4 & 14), while reasonably good exposures occur in a dissected range of low hills just to the east (Figs. 5 to 7).

The geology of the Merweville region is outlined on the 1: 250 000 scale geology sheet 3220 Sutherland (Theron 1983) (Fig. 2) as well as the updated 1: 250 000 Sutherland metallogenic map that includes important new stratigraphic detail for the Lower Beaufort Group succession (Cole & Vorster 1999). The study area is entirely underlain by Middle Permian continental sediments of the **Lower Beaufort Group** (Adelaide Subgroup, Karoo Supergroup), and in particular the **Abrahamskraal Formation** (Pa) at the base of the Lower Beaufort Group succession (Johnson *et al.* 2006 and references cited below). The bedrocks in the project area probably belong to the sandstone-rich middle part of the Abrahamskraal Formation, known as the **Koornplaats Member**. According to Loock *et al.* (1994) the Koornplaats Member of the Abrahamskraal Formation. is characterized by:

- Yellow-weathering sheet-like channel sandstone packages with heavy mineral laminations (up to 2 cm thick) towards the top and basal lag breccio-conglomerates. A prominent, laterally-persistent package of five yellowish fine-grained sandstone units marks the upper part of the member in the Roggeveld – Nuweveld Escarpment area. The sandstones are associated with fossil tetrapod material and reworked plant material, including silicified wood (rarely with exotic extra-basinal pebbles) and *Vertebraria* glossopterid roots. Uranium mineralization may be associated with transported plant material.
- Grey and maroon overbank mudrocks with calcrete horizons, tetrapod fossils.

The Beaufort Group sediments in the study region west of Merweville are folded along numerous west-east trending fold axes (narrow black lines on geological map, Fig. 2). Bedding dips are largely low to subhorizontal while local quartz veining with mineral lineation as well as fault breccias indicate small-scale, N-S directed thrust faulting here. No Karoo dolerite or younger (Cretaceous) intrusions are mapped within the present study region. The Beaufort Group bedrocks in the project area are largely mantled by Late Caenozoic **superficial deposits** such as scree and other slope deposits (colluvium and hillwash), stream alluvium, down-wasted surface gravels, calcretes and various sandy to gravelly soils (Figs. 15 & 16). The geology of the grid line corridor associated with the MTS has been outlined by Almond (2019). Representative exposures of the Beaufort Group bedrocks and Late Caenozoic superficial sediments within and outside but close to the project area with explanatory figure legends are shown below in Figures 5 to 16.

Overbank mudrock facies of the Koornplaats Member are exposed on the steeper slopes of a low ridge just east of the MTS project area (Figs. 5 to 7). They are grey-green to purple-brown, hackly-weathering with occasional interbedded thin crevasse-splay sandstones as well as horizons of cobble-sized, sphaeroidal to lenticular pedogenic calcretes marking Permian palaeosols.

The pale yellow-brown weathering, friable, medium- to coarse-grained, massive or tabular to cross-bedded channel sandstones of the Koornplaats Member in the study region are characterized here by the extensive development of lenses and sheets of dark coffee-brown *koffieklip* (pale grey on unweathered, freshly broken surfaces) (Figs. 18 to 13). These distinctive, more resistant-weathering rocks are the result of secondary precipitation of diagenetic ferruginous carbonate, perhaps related to persistent high water tables within these sandstone bodies. They are typically well-jointed and weather to form rubbly to platy cappings on low sandstone scarps. The ferruginised *koffieklip* sandstone displays occasional wave-rippled bed tops as well as – in this area – abundant puzzling trace fossils (Section 6). Locally thin (few dm) lenses and horizons of

basal channel breccio-conglomerate rich in reworked greyish calcrete glaebules are developed (Fig. 9). These units may be fossiliferous (Section 6).

Most of the project area lies within low-relief alluvial *vlaktes* of the Jukrivier drainage network featuring occasional subdued sandstone ridges with *koffieklip* exposures along their crests and a few low exposures of crumbly, weathered mudrocks with a few palaeocalcrete nodules. Most of the area is mantled by downwasted eluvial gravels of sandstone, *koffieklip*, calcrete and vein quartz as well as unconsolidated sandy to gravelly alluvial soils (Figs. 3, 4, 15 & 16).

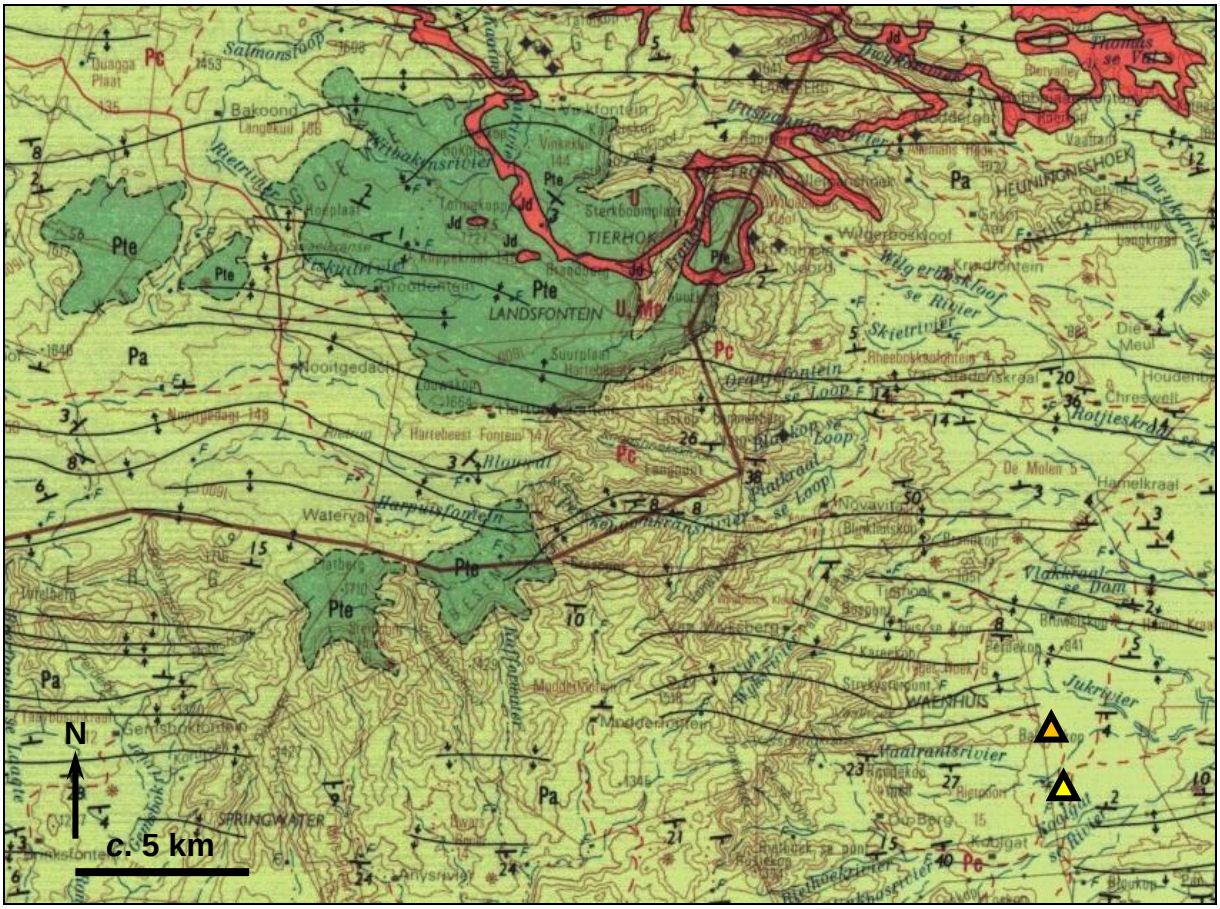

Figure 2: Extract from 1: 250 000 geological sheet 3220 Sutherland (Council for Geoscience, Pretoria) showing the *approximate* authorised (orange) and amended (yellow) locations of the proposed MTS on Farm Hamel Kraal 16, *c*. 25 km WSW of Merweville, Western Cape Province.

The main bedrock units represented in the Moordenaars Karoo study region include:
Pa (pale green) = Abrahamskraal Formation (Lower Beaufort Group)
Pte (dark green) = Teekloof Formation (Lower Beaufort Group)
Jd (red) = Karoo Dolerite Suite
***N.B.* Late Caenozoic superficial deposits that are not mapped at 1: 250 000 scale also occur here, including alluvium, colluvium, surface gravels, soils and calcrete.**

Figure 3: Low relief, dissected hilly terrain and alluvial *vlaktes* at the foot of the east-facing Great Escarpment – view towards the SW across part of the MTS project area in the Moordenaarskaroo subregion of the Great Karoo.

Figure 4: Low ridges and scarps of weathered Beaufort Group channel sandstone and gravelly to sandy alluvial *vlaktes* within the MTS project area, viewed towards the WNW.

Figure 5: Low *koppie* of Koornplaats Member mudrocks capped by channel sandstones, situated just to the east of the project area. Bedrock exposures (and the chance of finding fossils) are far better here than within the project area itself.

Figure 6: Good exposures of grey-green and purple-brown overbank mudrocks of the Koornplaats Member on gentle to steep hillslopes just east of the project area.

Figure 7: Uppermost section of the Koornplaats Member mudrock succession illustrated above, here showing a laterally-persistent horizon of pedogenic calcrete concretions (Permian palaeosol, adjacent to hammer) and the base of a cross-bedded channel sandstone above (Hammer = 30 cm).

Figure 8: Large-scale. tabular cross-bedding within fluvial channel sandstones of the Koornplaats Member.

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Figure 9: Purplish-brown horizon or lens of basal channel breccio-conglomerate, largely composed of reworked mudstone intraclasts and calcrete glaebules (Hammer = 30 cm). Such coarse-grained channel deposits occasionally contain dispersed fossil wood and vertebrate skeletal remains (*cf* Almond 2019).

Figure 10: Low plateau of Koornplaats Member channel sandstone capped by well-developed horizon or lens of dark brown weathering *koffieklip* (ferruginous secondary carbonate of diagenetic origin).

Figure 11: Pale yellowish-brown, crumbly, thin-bedded or cross-bedded Koornplaats Member channel sandstone capped by dark brown *koffieklip* on the eastern margin of the project area.

Figure 12: Local preservation of wave-rippled sandstone bed tops within a *koffieklip* lens (Hammer = 30 cm).

Figure 13: North-dipping, cross-bedded Koornplaats Member channel sandstone exposed on the margins of a stream tributary of the Jukrivier, just north of the project area.

Figure 14: Rare, low, isolated exposure of Koornplaats Member mudrocks within the amended MTS project area. The mudrocks here are weathered with sparse, small pedogenic calcrete concretions.

Figure 15: Gravelly *vlaktes* within the project area mantled with downwasted, angular blocks of weathered Beaufort Group sandstone.

Figure 16: Finer-grained, sparsely vegetated, sandy to silty modern alluvium covering lower-lying areas in the north-western sector of the project area.

6. PALAEONTOLOGICAL HERITAGE

The overall palaeontological sensitivity of the Beaufort Group sediments is High to Very High (Almond & Pether 2008, SAHRIS website, DFFE Screening Tool). These continental sediments have yielded one of the richest fossil records of land-dwelling plants and animals of Permo-Triassic age anywhere in the world (MacRae 1999, Rubidge 2005, McCarthy & Rubidge 2005, Smith *et al.* 2012, 2020). Bones and teeth of Late Permian tetrapods have been collected in the western Great Karoo region since at least the 1820s and this area remains a major focus of palaeontological research in South Africa.

A chronological series of mappable fossil biozones or assemblage zones (AZ), defined mainly on their characteristic tetrapod faunas, has been established for the Main Karoo Basin of South Africa (Rubidge 1995, 2005, Van der Walt *et al.* 2010, Smith *et al.* 2020). Maps showing the distribution of the Beaufort Group assemblage zones within the Main Karoo Basin have been provided by Keyser and Smith (1979), Rubidge (1995, 2005), Nicolas (2007), Van der Walt *et al.* (2010) and, most recently, by Smith *et al.* (2020). The assemblage zone represented within the present study area is the late Middle Permian (Capitanian) ***Tapinocephalus*** **Assemblage Zone** (Theron 1983, Rubidge 1995, Day & Rubidge 2020).

The main categories of fossils recorded within the *Tapinocephalus* fossil biozone (Keyser & Smith 1977-78, Anderson & Anderson 1985, Smith & Keyser 1995a, MacRae 1999, Rubidge 2005, Nicolas 2007, Almond 2010a, Smith *et al.* 2012, Day 2013a, Day 2013b, Day *et al.* 2015b, Day & Rubidge 2020) include:

- isolated petrified bones as well as rare articulated skeletons of tetrapods (*i.e.* air-breathing terrestrial vertebrates) such as true **reptiles** (notably large herbivorous pareiasaurs like *Bradysaurus*, small insectivorous millerettids), rare pelycosaurs, and diverse **therapsids** or "mammal-like reptiles" (*e.g.* numerous genera of large-bodied dinocephalians, herbivorous dicynodonts, flesh-eating biarmosuchians, gorgonopsians and therocephalians);

- aquatic vertebrates such as large **temnospondyl amphibians** (*Rhinesuchus*, usually disarticulated), and **palaeoniscoid bony fish** (*Atherstonia*, *Namaichthys*, often represented by scattered scales rather than intact fish);

- freshwater **bivalves** (*Palaeomutela*);

- **trace fossils** such as worm, arthropod and tetrapod burrows and trackways, coprolites (fossil droppings) and plant stem or root casts;

- **vascular plant remains** (usually sparse and fragmentary), including leaves, twigs, roots and petrified woods ("*Dadoxylon*") of the *Glossopteris* Flora, especially glossopterid trees and arthrophytes (horsetail ferns).

An illustrated account of previous palaeontological records in the vicinity of the authorised MTS site and the associated 132 kV grid corridor has been provided by Almond (2019). Fossils recorded from the Koornplaats Member on Farm 16 Hamel Kraal include extensive scatters of petrified wood, fragmentary postcranial remains of large-bodied tetrapods (pareiasaur reptiles and / or dinocephalian therapsids), isolated tusks, cylindrical sandstone casts of reedy plant stems (probably horsetails) and a limited range of invertebrate trace fossils associated with wave-rippled sandstone palaeosurfaces and *koffieklip* horizons. Much of this material appears to have weathered out of channel basal breccias but some may have been associated with calcretised palaeosol horizons.

No new fossil sites were recorded within the amended MTS project area during the recent site visit; this is probably due, to a large extent, to very poor levels of bedrock exposure here. The Late Caenozoic superficial sediments overlying the bedrocks are unfossiliferous, while sparse reworked, transported fossil wood and bone fragments might be expected here.

New fossil sites recorded in the vicinity of the amended MTS site during the latest site visit are tabulated and mapped in Appendix 1. A scatter of fragmentary, downwasted postcranial bones of a large tetrapod was recorded on lower hillslopes some 240 m east of the MTS project area (Fig. 17). Ferruginised moulds of plant axes (stems or roots) within channel sandstone float blocks are associated with cross-bedded Koornplaats Member sandstones with well-developed basal breccio-conglomerates about 200 m east of the project area (Fig. 18).

The well-developed *koffieklip* (secondary ferruginous calcareous sandstone) lenses cropping out on the eastern margins of the MTS project area feature numerous, scattered examples of curious purported trace fossils assemblages comprising horizontal to oblique, linear to sinuous, cross-cutting “”burrows” (*c*. 1 cm wide) associated with rounded plug-like “burrows” (Figs. 19 to 21). Some of the linear burrows appear bilobate or faintly segmented locally. The relationship of the burrows with the rounded surfaces of the *koffieklip* host boulders suggests that they may be sheet-like in geometry, rather than cylindrical. Occasionally the linear burrows seem to radiate from a central plug, suggesting a more complex burrow system. It is also possible that these trace-like features are *abiogenic* artefacts (*i.e.* pseudofossils) related, for example, to dewatering or secondary mineralisation of the channel sandstone host rocks; they therefore require further study.

Figure 17: Scatter of fragmentary postcranial bones of a large-bodied tetrapod (pareiasaur or dinocephalian) among surface float c. 240 m east of the project area (Loc. 511) (Scale = *c.* 15 cm).

Figure 18: Float blocks of channel sandstone containing ferruginized moulds of plant axes *c*. 2 cm wide (Loc. 548) (Scale in cm and mm).

Figure 19: Blocks of *koffieklip* mantling the low plateau just east of the MTS project area showing prominent-wearing assemblages of possible trace fossils (See yellow dotted area in Fig. A1.1 for trace fossil localities).

Figure 20: Close-up of koffieklip boulder with laminated internal structure (perhaps Liesegang rings) showing *possible* linear and plug-like trace fossils (Scale = *c*. 15 cm). The linear features follow the rounded surfaces along the boulder edge, suggesting that they are not cylindrical in geometry.

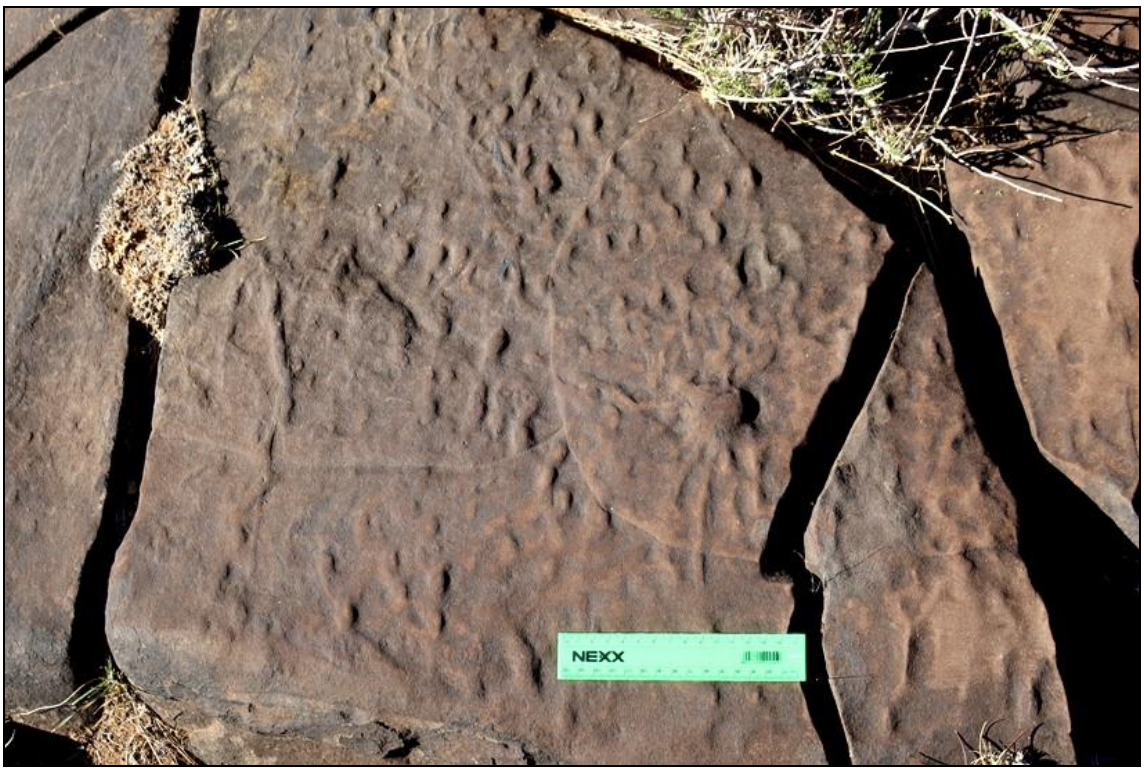

Figure 21: Weathered koffieklip surface showing a central plug surrounded by radiating linear "burrows" (Scale = *c*. 15 cm).

7. ASSESSMENT OF IMPACT SIGNIFICANCE

The construction phase of the proposed MTS will entail excavations into the superficial sediment cover (soils, surface gravels *etc*) and also into the underlying, potentially fossiliferous Beaufort Group bedrocks. The development may adversely affect potential legally protected and scientifically important fossil heritage within the study area by destroying, damaging, disturbing or permanently sealing-in fossils that are then no longer available for scientific research or other public good.

The significance of anticipated impacts on fossil heritage resources in the amended MTS project area as a consequence of the proposed substation development is assessed for the **Construction Phase** in Table 1, both with and without mitigation. It is concluded that the proposed development will have a NEGATIVE LOW impact significance without mitigation, decreasing but still remaining NEGATIVE LOW following full implementation of the proposed mitigation measures (See Section 8). Negative residual impacts during the construction phase will be partially offset by an improved palaeontological data base and fossil collections due to mitigation (*positive* impacts). Confidence levels for this assessment are Medium, given the very low bedrock exposure levels encountered in the project area.

Once constructed, the **Operational and De-commissioning Phases** of the MTS will not involve further adverse impacts on palaeontological heritage, so these are not assessed here.

In the case of the **No-Go Option** - *i.e.* development of the already authorised MTS site – impacts before and after mitigation were rated as NEGATIVE LOW by Almond (2019) (Table 2). However, since bedrock exposure levels – and hence the chance of unrecorded fossils being exposed at surface – for the authorised site are substantially higher than for the amended site, *the latter is preferred here on palaeontological heritage grounds.*

Table 1. Assessment of impacts on fossil heritage resources of developing the amended MTS site (Construction Phase)

Nature: **Disturbance, damage or destruction of legally protected, scientifically valuable fossil heritage resources preserved at or beneath the ground surface through surface clearance and excavations within the project footprint**		
	Without mitigation	**With mitigation**
Extent	**Low (1)**	**Low (1)**
Duration	**Permanent (5)**	**Permanent (5)**
Magnitude	**Minor (2)**	**V. small (1)**
Probability	**Improbable (2)**	**Very improbable (1)**
Significance	**Low (16)**	**Low (7)**
Status (positive or negative)	**Negative**	**Negative**
Reversibility	**Low**	**Low**
Irreplaceable loss of resources?	**No**	**No**
Can impacts be mitigated?	**Yes**	
Mitigation: **On-going Construction Phase monitoring for fossils of surface clearance and excavations by ECO / ESO.** **Application of Chance Fossil Finds Protocol during construction phase with recording and collection of significant new finds by qualified palaeontologist.**		
Residual Impacts: **Small residual impacts may be off-set by improved palaeontological database following mitigation.**		

Table 2. Assessment of impacts on fossil heritage resources of the No-Go Option (*i.e.* developing the authorised MTS site)

Nature: **Disturbance, damage or destruction of legally protected, scientifically valuable fossil heritage resources preserved at or beneath the ground surface through surface clearance and excavations within the project footprint**		
	Without mitigation	**With mitigation**
Extent	**Low (1)**	**Low (1)**
Duration	**Permanent (5)**	**Permanent (5)**
Magnitude	**Minor (3)**	**V. small (1)**
Probability	**Improbable (2)**	**Very improbable (1)**
Significance	**Low (18)**	**Low (7)**
Status (positive or negative)	**Negative**	**Negative**
Reversibility	**Low**	**Low**
Irreplaceable loss of resources?	**No**	**No**
Can impacts be mitigated?	**Yes**	
Mitigation: **On-going Construction Phase monitoring for fossils of surface clearance and excavations by ECO / ESO.** **Application of Chance Fossil Finds Protocol during construction phase with recording and collection of significant new finds by qualified palaeontologist.**		
Residual Impacts: **Small residual impacts may be off-set by improved palaeontological database following mitigation.**		

Given the low significance of anticipated impacts on palaeontological heritage, professional palaeontological mitigation would only be triggered if substantial fossil remains (*e.g.* assemblages of fossil vertebrate remains, petrified wood) were encountered or freshly exposed during the construction phase of development. In this case the ECO / ESO should safeguard the fossil material, preferably *in situ*, and alert Heritage Western Cape (HWC) as soon as possible so that appropriate action (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist. If triggered, these mitigation actions are considered to be essential.

It should be emphasized that, *providing appropriate mitigation is carried out*, the majority of developments involving bedrock excavation can make a *positive* contribution to our understanding of local palaeontological heritage.

7.1. Cumulative impacts

According to the DFFE Renewable Energy EIA Applications Database (REEA) for the first quarter of 2021, the only currently proposed or authorised renewable energy facilities within a 35 km radius of the MTS project area near Merweville are the authorised Komsberg East and Komsberg West WEFs, for which field-based PIAs were submitted by Almond (2015**, 2015**), and the authorised Suurplaat WEF for which only a desktop PIA is currently available (Almond 2010b).

Given the outstanding palaeontological heritage field data, Almond (2019) concluded that it is not yet feasible to meaningfully assess cumulative palaeontological impacts for proposed 132 kV grid line and associated MTS. However, pending the outcome of these and several other outstanding palaeontological field-based studies for the several WEF projects in the Sutherland – Merweville region, it is provisionally concluded (following Almond 2019) that the cumulative impact significance of the proposed new MTS and associated electrical grid infrastructure developments in the context of other renewable energy and electrical infrastructure developments in the region is NEGATIVE MEDIUM without mitigation (Table 3). This would fall to *NEGATIVE LOW provided*

that the proposed monitoring and mitigation recommendations made for *all* these various renewable energy projects are fully implemented (which is doubtful).

These anticipated cumulative impacts following mitigation lie within acceptable limits. Unavoidable residual negative impacts may be partially offset by the improved understanding of Karoo palaeontology resulting from appropriate professional mitigation. This is regarded as a *positive* impact for Karoo palaeontological heritage.

Table 3. Assessment of cumulative impacts on fossil heritage resources of the authorised or amended MTS in the context of other renewable energy and electrical infrastructure developments in the region

Nature: **Disturbance, damage or destruction of legally protected, scientifically valuable fossil heritage resources preserved at or beneath the ground surface through surface clearance and excavations within the project footprint**		
	Without mitigation	**With mitigation**
Extent	**Low (1)**	**Low (1)**
Duration	**Permanent (5)**	**Permanent (5)**
Magnitude	**Moderate (6)**	**Low (4)**
Probability	**Definite (5)**	**Probable (3)**
Significance	**Medium (60)**	**Low (30)**
Status (positive or negative)	**Negative**	**Negative**
Reversibility	**Low**	**Low**
Irreplaceable loss of resources?	**Yes**	**No**
Can impacts be mitigated?	**Yes**	
Mitigation: **Specialist palaeontological walk-downs of project footprints in the pre-construction phase in cases where no field-based palaeontological study has yet been conducted.** **On-going Construction Phase monitoring for fossils of surface clearance and excavations by ECO / ESO.** **Application of Chance Fossil Finds Protocol during construction phase with recording and collection of significant new finds by qualified palaeontologist.**		
Residual Impacts: **Small residual impacts may be off-set by improved palaeontological database following mitigation.**		

8. CONCLUSIONS & RECOMMENDATIONS

The authorised and amended MTS sites are both underlain at depth by potentially fossiliferous sedimentary rocks of the Abrahamskraal Formation, Lower Beaufort Group (Karoo Supergroup) which are of Middle Permian Permian age. The majority of the amended site is occupied by low relief terrain mantled by alluvial and downwasted surface gravels as well as finer-grained deposits of low palaeosensitivity, with very little fresh bedrock exposure. Previous field surveys of the 400 kV grid corridor have recorded fragmentary cranial and post-cranial bones as well as teeth of large-bodied tetrapods (dinocephalians or pareiasaurs), locally abundant petrified wood, plant stem moulds and low-diversity invertebrate trace fossils on the farm Hamel Kraal 16 (Almond 2019). Sparse blocks of petrified wood have been recorded within the authorised MTS site. No new fossil sites were recorded within the amended site during the recent one-day site visit. To the east and shortly *outside* the amended substation project area new fossil sites comprising downwasted large tetrapod bones, moulds of plant stems within channel sandstones and locally abundant (but equivocal) trace fossils have been recorded. None of these new sites would require mitigation as a result of the MTS or associated 132 kV grid connection developments.

The construction phase of the proposed MTS on the amended site will have a NEGATIVE LOW impact significance without mitigation, remaining NEGATIVE LOW with implementation of the proposed mitigation measures (See below). Negative residual impacts will be partially offset by an improved palaeontological data base and fossil collections (*positive* impacts). Confidence levels for this assessment are Medium, given the low bedrock exposure levels encountered in the project area. Once constructed, the Operational and De-commissioning Phases of the MTS will not involve further adverse impacts on palaeontological heritage so these are not assessed here.

The No-Go alternative - *i.e*. development of the authorized MTS site - would also have a NEGATIVE LOW impact on palaeontological heritage, with and without mitigation. However, the amended site is *preferred* here on palaeontological heritage grounds because of the higher probability of significant unrecorded fossil sites being present in the more dissected, hilly terrain of the authorised site.

Pending the outcome of outstanding palaeontological field-based studies for several WEF projects in the Sutherland – Merweville region (*e.g.* the authorised Suurplaats WEF), it is provisionally concluded that the cumulative impact significance of the proposed new MTS and associated electrical grid infrastructure developments in the context of other renewable energy and electrical infrastructure projects in the region is NEGATIVE MEDIUM without mitigation. This would fall to *NEGATIVE LOW provided that* the proposed monitoring and mitigation recommendations made for *all* these various renewable energy projects are fully implemented. These anticipated cumulative impacts following mitigation lie within acceptable limits.

The MTS project is not fatally flawed and there are no objections on palaeontological heritage grounds to authorisation of the proposed site amendment, *provided that* the recommended mitigation measures for the construction phase outlined below and in Appendix 2 are included in the EMPr for the development and are fully implemented.

8.1. Recommended mitigation measures

In view of the low palaeosensitivity of the amended MTS project area and the inferred low impact significance of the proposed development on palaeontological heritage resources, it is concluded that no further palaeontological heritage studies or specialist palaeontological mitigation are required for this project, pending the exposure of any substantial fossil remains (*e.g.* vertebrate bones and teeth, large blocks of petrified wood) before or during the construction phase. None of fossil sites recorded in the vicinity lies within the proposed MTS project area itself (or within the authorised 400 kV grid corridor) and so they do not require mitigation in this regard.

The ECO / ESO responsible for the development should be alerted to the possibility of fossil remains being found on the surface or exposed by fresh excavations during construction. Should substantial fossil remains be discovered during construction, these should be safeguarded (preferably *in situ*) and the ECO / ESO should alert Heritage Western Cape, HWC at the earliest opportunity (Contact details: Heritage Western Cape. 3rd Floor Protea Assurance Building, 142 Longmarket Street, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 5959 Email: ceoheritage@westerncape.gov.za)). This is so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a qualified palaeontologist.

The palaeontological specialist involved would require a collection permit from HWC. Fossil material must be curated in an approved repository (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA (2013) and HWC (2021).

These recommendations are summarized in Appendix 2 and must be incorporated into the EMPr for the MTS development as a condition accompanying environmental authorisation of the project.

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11. QUALIFICATIONS & EXPERIENCE OF SPECIALIST

The author, Dr John Almond, is a specialist palaeontologist who has over 40 years of experience in palaeontological research and teaching in Europe, South Africa and elsewhere. He also has more than 20 years of experience in the palaeontological heritage impact assessment world in the RSA and has been involved with numerous PIAs in the Karoo region and elsewhere.

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, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

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

APPENDIX 1: GPS LOCALITY DATA FOR FOSSIL SITES LISTED IN TEXT

Data for fossil sites previously recorded on Farm Hamel Kraal 16 have been tabulated by Almond (2019).

All GPS readings were taken in the field using a hand-held Garmin GPSmap 64s instrument. The datum used is WGS 84. Please note that:

- Locality data for South African fossil sites in *not* for public release, due to conservation concerns.
- The table does *not* represent all potential fossil sites within the project area but only those sites recorded during the one-day field survey. The absence of recorded fossil sites in any area therefore does *not* mean that no fossils are present there.

Loc.	GPS data	Comments
511	32 42 38.8 S 21 15 53.6 E	Farm Hamel Kraal 16. Scatter in float of fragmentary postcranial bones of a large-bodied tetrapod (pareiasaur or dinocephalian). Provisional Field Rating IIIB Local Resource. No mitigation recommended since fossils lie outside MTS project area.
522	32 42 39.4 S 21 15 48.7 E	Farm Hamel Kraal 16. Low diversity purported invertebrate trace fossil assemblages (*possibly* pseudofossils) with positive-weathering, horizontal to oblique burrows as well as vertical plug-like components, all preserved within well-developed *koffieklip* lenses at the top of a channel sandstone body. Provisional Field Rating IIIB Local Resource. No mitigation recommended since fossils / pseudofossils lie outside MTS project area. *N.B.* Numerous similar occurrences of these trace fossil-like features are present within the yellow dotted area shown in Fig. A1.1.
548	32 42 46.1 S 21 15 54.6 E	Farm Hamel Kraal 16. Channel sandstone float blocks containing ferruginised moulds of plant axes (c. 2 cm wide). Provisional Field Rating IIIB Local Resource. No mitigation recommended since fossils lie outside MTS project area.

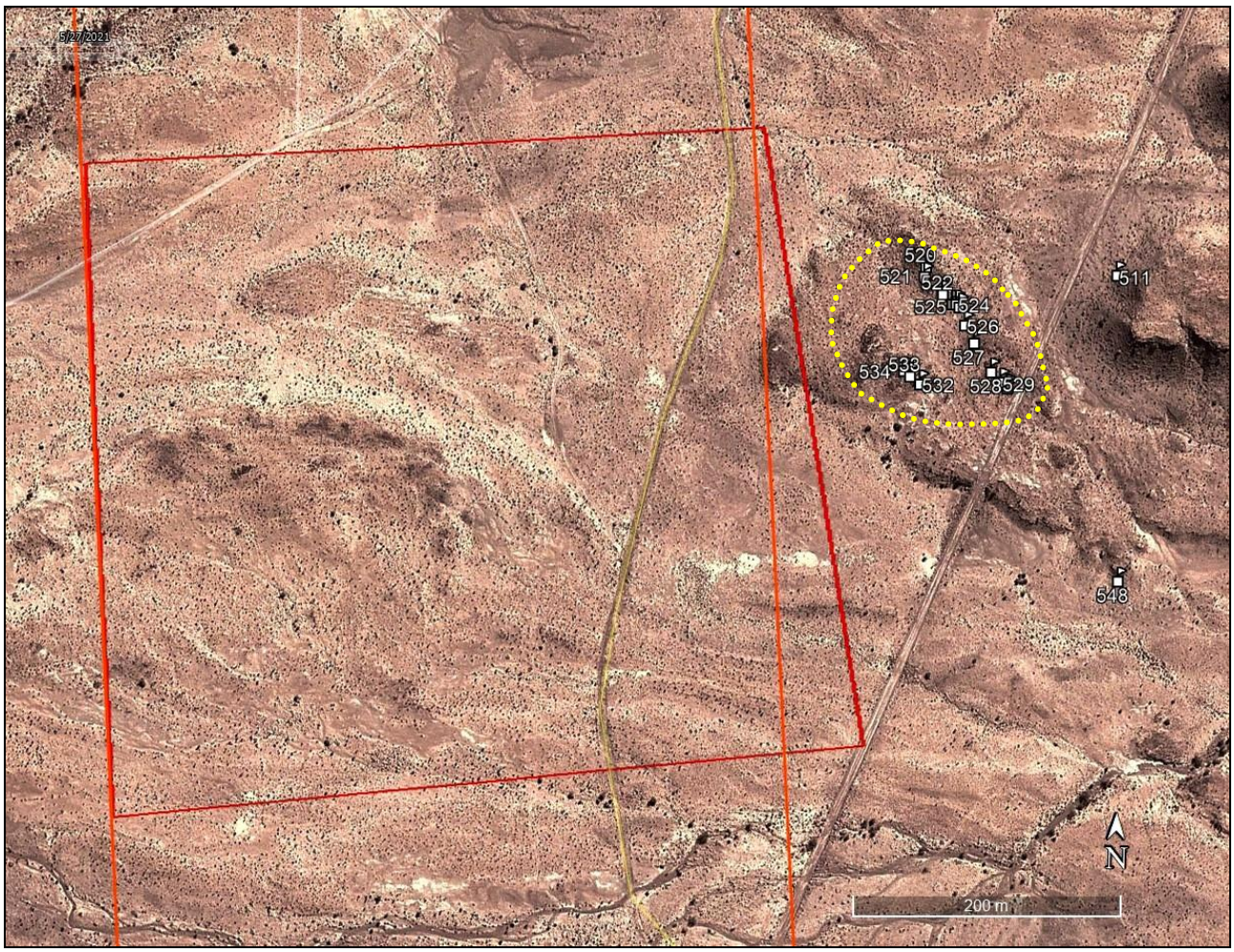

Figure A1.1: Google Earth© satellite image of the amended site for the MTS (red rectangle) in the context of the authorised grid corridor (orange). Numbered fossil sites recorded during the recent site visit – all *outside* the MTS and 132 kV grid connection project area – are indicated in white (See table above for details). None of these fossil sites requires mitigation. The concentration of numbered sites within the yellow dotted area refer to equivocal low-diversity invertebrate trace fossil assemblages preserved within well-developed *koffieklip* lenses just east of and outside the substation project area.

APPENDIX 2: CHANCE FOSSIL FINDS PROTOCOL

<table>
<tr><td colspan="3">MTS development within 132 kV WEF grid connection corridor on Farm Hamel Kraal 16 near Merweville</td></tr>
<tr><td>Province & region:</td><td colspan="2">Western Cape (Central Karoo District): Beaufort West Municipality</td></tr>
<tr><td>Responsible Heritage Resources Agency</td><td colspan="2">Heritage Western Cape (Contact details: Heritage Western Cape. 3rd Floor Protea Assurance Building, 142 Longmarket Street, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 5959 Email: ceoheritage@westerncape.gov.za)</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Abrahamskraal Formation (Lower Beaufort Group), Late Caenozoic alluvium</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Fossil vertebrate bones, teeth, trace fossils, trackways, petrified wood, plant-rich beds in the Lower Beaufort Group bedrocks. Fossil mammal bones, teeth, horn cores, freshwater molluscs, plant material in Late Caenozoic alluvium.</td></tr>
<tr><td rowspan="4">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="3">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>

APPENDIX 3: SITE SENSITIVITY VERIFICATION

In accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification has been undertaken in order to confirm the current land use and environmental sensitivity of the proposed MTS project area on Farm Hamel Kraal 16 near Merweville as identified by the National Web-Based Environmental Screening Tool. Key references are listed in the main body of the PIA report.

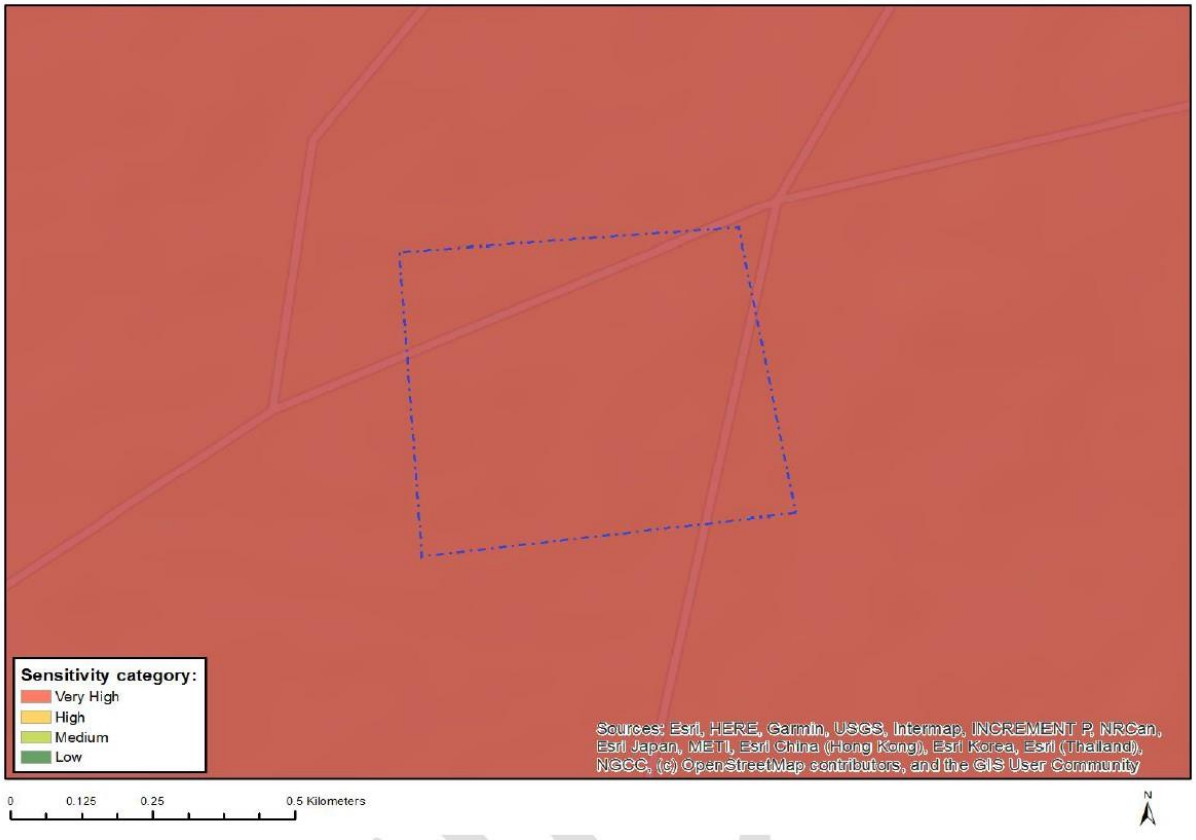

Figure A3.1. Paleontological sensitivity map for the amended site for the MTS on Hamel Kraal 16 near Merweville, Western Cape Province abstracted from the DFFE Screening Report for an environmental authorization prepared by Nala Environmental (May 2021). Due to the scarcity of well-preserved, scientifically important fossils in this region, based on desktop studies and fieldwork, it is inferred herein that the project area is in fact largely of LOW palaeontological sensitivity.

The DFFE Screening Report for the proposed development provisionally assigns a VERY HIGH palaeosensitivity to the project area (Fig. A3.1).

The site sensitivity verification of the proposed amended site for the MTS is based on:

- A desktop review of (a) the relevant 1:50 000 scale topographic and the 1:250 000 scale topographic map 3220 Sutherland and 1: 50 000 map 3221CB Ongeluksfontein, (b) Google Earth© satellite imagery, (c) published geological and palaeontological literature, including 1:250 000 geological maps (3222 Beaufort West) and relevant sheet explanations (Theron 1983) as well as (d) several previous and on-going fossil heritage (PIA) assessments in the Great Karoo region to the south of Beaufort West by the author (especially Almond 2019 for the associated 132 kV WEF grid corridor) .

- A one-day field assessment of the amended MTS project area and adjoining terrain by the author and an experienced field assistant (3 June 2021).

3. Outcome and Conclusions

Due to (1) the scarcity of well-preserved, scientifically important fossils within the amended MTS project area, (2) the lack of fresh bedrock exposures as well as (3) the low sensitivity of the Late Caenozoic superficial sediments present (alluvial soils, eluvial surface gravels *etc*), based on desktop studies as well as fieldwork, it is inferred that the project area is in fact largely of LOW PALAEONTOLOGICALLY SENSITIVITY. However, sparse, and largely unpredictable fossils might occur here.

The results of the DFFE screening tool sensitivity (Figure A3.1) is therefore *contested*.