

Proposed extension of air strip on Portion 29 of the Farm 585 Mier near Askham, Northern Cape

PALAEONTOLOGICAL DESKTOP STUDY

REPORT

Compiled by: Dr JF Durand (Sci.Nat.)

HillLand Environmental cc
166 Mountview Farm, Victoria Heights
PO Box 590, George, 6530
environmental2@hilland.co.za

31 January 2026

Table of Contents:

1. Executive Summary.....	3
2. Introduction.....	4
3. Terms of reference for the report.....	5
4. Details of study area and the type of assessment.....	8
5. Geological setting of the study area	9
6. Palaeontological potential of the study area.....	10
7. Conclusion and Recommendations.....	12
8. Declaration of independence.....	14
APPENDIX 1: Palaeontological Sensitivity Rating.....	15
APPENDIX 2: Methodology for assessing the significance of impacts.....	16

List of Figures:

Figure 1: Google Earth photo indicating the study site (yellow polygon).....	8
Figure 2: Geology Map of the study site (adapted from the 2620 TWEE RIVIEREN 1:250 000 Geology Map, Geological Survey, 1988).....	9
Figure 3: Palaeosensitivity map of the study area and surroundings (SAHRA, 2026).....	10

1. Executive Summary

A layer of reddish windblown sand of the Gordonia Formation underlies the largest part of the study site and obscures the underlying layer of calcrete of the Mokalanen Formation. Fossils are scarce and fossil sites occur very sporadically in the Gordonia Formation.

The Mokalanen Formation that consists of calcrete, underlies the study area contains microfossils. Isolated patches of calcrete are exposed in the easternmost part of the study site.

An overview of the literature on the palaeontology and associated geology of the area is given. No publications exist that mention fossils from the study site.

The ECO should take responsibility for supervising the development and should follow the Chance Find Procedure (pp.12-13) if a significant fossil discovery is made.

2. Introduction

The Heritage Act of South Africa stipulates that fossils and fossil sites may not be altered or destroyed. The purpose of this document is to detail the probability of finding fossils in the study area that may be impacted by the proposed development.

The palaeontological heritage of South Africa is unsurpassed and can only be described in superlatives. The South African palaeontological record gives us insight in inter alia the origin of dinosaurs, mammals and humans.

Fossils are also used to identify rock strata and determine the geological context of the subregion with other continents and played a crucial role in the discovery of Gondwanaland and the formulation of the theory of plate tectonics. Fossils are also used to study evolutionary relationships, sedimentary processes and palaeoenvironments.

South Africa has the longest record of palaeontological endeavour in Africa. South Africa was even one of the first countries in the world in which museums displayed fossils and palaeontologists studied earth history. South African palaeontological institutions and their vast fossil collections are world-renowned and befittingly the South African Heritage Act is one of the most sophisticated and best considered in the world.

Fossils and palaeontological sites are protected by law in South Africa. Construction in fossiliferous areas may be mitigated in exceptional cases but there is a protocol to be followed.

This is a Palaeontological Desktop Study that was prepared in line with the South African Heritage Resources Act (Act 25 of 1999) and Appendix 6 of the Environmental Impact Assessment Regulations 2014 as amended and the General Assessment Protocol for Site Sensitivity Verification. This involved an overview of the literature on the palaeontology and associated geology of the area for a Palaeontological Desktop Study.

3. Terms of reference for the report

According to the South African Heritage Resources Act (Act 25 of 1999) (Republic of South Africa, 1999), certain clauses are relevant to palaeontological aspects for a terrain suitability assessment.

- **Subsection 35(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 with the detection or recovery of metals or archaeological material or objects, or use such equipment for the recovery of meteorites.
- **Subsection 35(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 procedures 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.

South Africa's unique and non-renewable palaeontological heritage is protected in terms of the NHRA. According to this act, heritage resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

As areas are developed and landscapes are modified, heritage resources, including palaeontological resources, are threatened. As such, both the environmental and heritage legislation require that development activities must be preceded by an assessment of the impact undertaken by qualified professionals. Palaeontological Impact Assessments (PIAs) are specialist reports that form part of the wider heritage component of:

- Heritage Impact Assessments (HIAs) called for in terms of Section 38 of the National Heritage Resources Act, Act No. 25, 1999 by a heritage resources authority.
- Environmental Impact Assessment process as required in terms of other legislation listed in s. 38(8) of NHRA;
- Environmental Management Plans (EMPs) required by the Department of Mineral Resources.

HIAs are intended to ensure that all heritage resources are protected, and where it is not possible to preserve them in situ, appropriate mitigation measures are applied. An HIA is a comprehensive study that comprises a palaeontological, archaeological, built environment, living heritage, etc specialist studies. Palaeontologists must acknowledge this and ensure that they collaborate with other heritage practitioners. Where palaeontologists are engaged for the entire HIA, they must refer heritage components for which they do not have expertise on to appropriate specialists. Where they are engaged specifically for the palaeontology, they must draw the attention of environmental consultants and developers to the need for assessment of other aspects of heritage. In this sense, Palaeontological Impact Assessments that are part of Heritage Impact Assessments are similar to specialist reports that form part of the EIA reports. The standards and procedures discussed here are therefore meant to guide the conduct of PIAs and specialists undertaking such studies must adhere to them. The process of assessment for the palaeontological (PIA) specialist components of heritage impact assessments, involves:

Scoping stage in line with African Heritage Resources Act (Act 25 of 1999) and Appendix 6 of the Environmental Impact Assessment Regulations 2014 as amended and the General Assessment Protocol for Site Sensitivity Verification. This involves an **initial assessment** where the specialist evaluates the scope of the project (based, for example, on NID/BIDs) and advises on the form and extent of the assessment process. At this stage the palaeontologist may also decide to compile a **Letter of Recommendation for Exemption from further Palaeontological Studies**. This letter will state that there is little or no likelihood that any significant fossil resources will be impacted by the development. This letter should present a reasoned case for exemption, supported by consultation of the relevant geological maps and key literature.

A Palaeontological Desktop Study – the palaeontologist will investigate available resources (geological maps, scientific literature, previous impact

assessment reports, institutional fossil collections, satellite images or aerial photos , etc) to inform an assessment of fossil heritage and/or exposure of potentially fossiliferous rocks within the study area. A Desktop studies will conclude whether a further field assessment is warranted or not. Where further studies are required, the desktop study would normally be an integral part of a field assessment of relevant palaeontological resources.

A Phase 1 Palaeontological Impact Assessment is generally warranted where rock units of high palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large-scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed project area is unknown. In the recommendations of Phase 1, the specialist will inform whether further monitoring and mitigation are necessary. The Phase 1 should identify the rock units and significant fossil heritage resources present, or by inference likely to be present, within the study area, assess the palaeontological significance of these rock units, fossil sites or other fossil heritage, comment on the impact of the development on palaeontological heritage resources and make recommendations for their mitigation or conservation, or for any further specialist studies that are required in order to adequately assess the nature, distribution and conservation value of palaeontological resources within the study area.

A Phase 2 Palaeontological Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or the recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before Phase 2 may be implemented.

A 'Phase 3' Palaeontological Site Conservation and Management Plan may be required in cases where the site is so important that development will not be allowed, or where development is to co-exist with the resource. Developers may be required to enhance the value of the sites retained on their properties with appropriate interpretive material or displays as a way of promoting access of such resources to the public.

The assessment reports will be assessed by the relevant heritage resources authority, and depending on which piece of legislation triggered the study, a response will be given in the form of a Review Comment or Record of Decision (ROD). In the case of PIAs that are part of EIAs or EMPs, the heritage resources authority will issue a comment or a record of decision that may be forwarded to the consultant or developer, relevant government department or heritage practitioner and where feasible to all three.

4. Details of study area and the type of assessment:

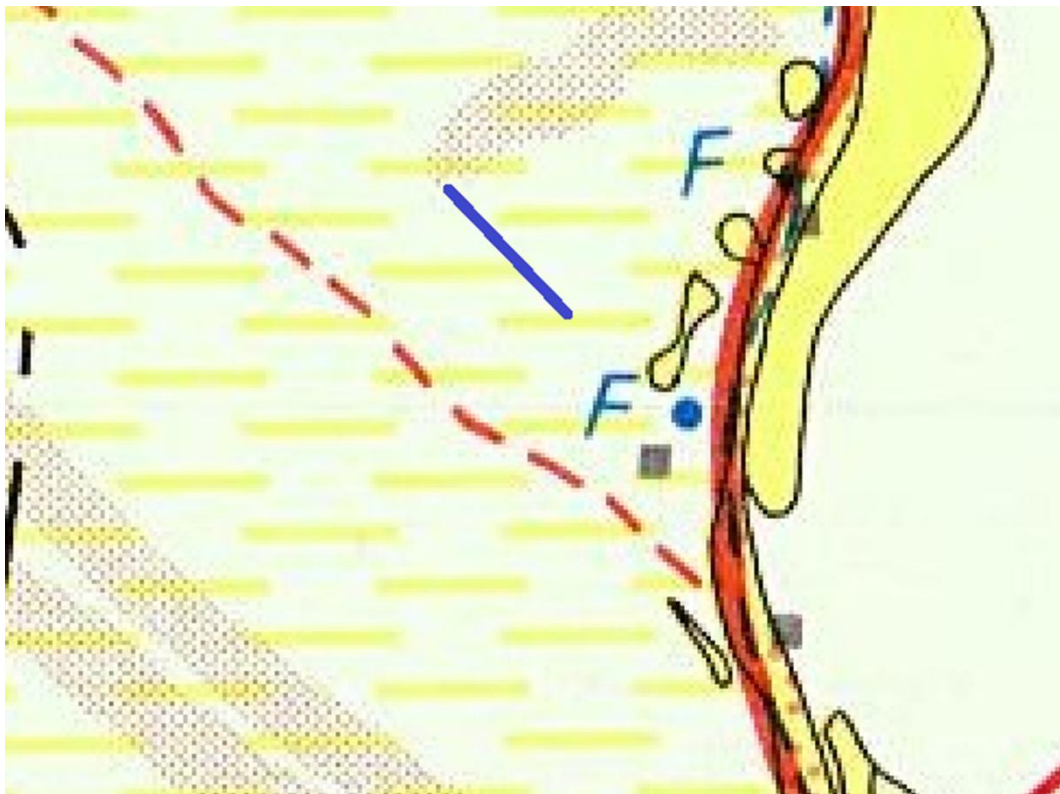


Figure 1: Google Earth photo indicating the study site (yellow polygon)

The relevant literature and geological map for the study area in which the development is proposed to take place (see Fig. 1) have been studied for a Palaeontological Desktop Study.

The study site is situated in the Kalahari Desert on the Molopo River which forms the border between South Africa and Botswana.

5. Geological setting of the study area



The study site is indicated by the blue line.

Figure 2: Geology Map of the study site (adapted from the 2620 TWEE RIVIEREN 1:250 000 Geology Map, Geological Survey, 1988)

GEOLOGICAL LEGEND

	Lithology	Geological unit		Age
	Dunes		Kalahari Group	Recent
Qg	Red to flesh-coloured wind-blown sand and dunes	Gordonia Formation		Quaternary
T-Qm	Calcrete, diatomaceous in places	Mokalanen Formation		Tertiary

The study area is covered by sands and dunes of the Gordonia Formation of the Quaternary-aged Kalahari Group. The sand covers a layer of Tertiary-aged calcrete of the Mokalanen Formation of the Kalahari Group. Isolated patches of calcrete are exposed in the easternmost part of the study site.

6. Palaeontological potential of the study area



The study site is indicated by the black line

Figure 3: Palaeosensitivity map of the study area and surroundings (SAHRA, 2026)

Colour	Palaeontological Significance	Action
GREEN	MODERATE	Desktop study is required.
ORANGE	HIGH	Desktop study is required and based on the outcome of the desktop study; a field assessment is likely.

The aeolian deposits of the Kalahari Group that cover the study site have a low to moderate potential to yield fossils, but the possibility of finding fossil material cannot be ignored. The fossil record of the Kalahari Group is sparse, occurs sporadically and is low in diversity. Although no fossils have been reported for the study area, fossils such as root casts, burrows, termitaria, ostrich eggshells, mollusc shells and isolated bones have been discovered in the Kalahari Group elsewhere (Almond & Pether 2008).

The calcrete exposures in the eastern part of the study site contain microfossils (Almond & Pether, 2008).

Impact Assessment and Mitigation Measures (see Appendix 1 & 2)

The significance of impacts is determined using the following criteria:

Extent: The physical extent of impacts on potential palaeontological resources relates directly to the extents of subsurface disturbance. The extent of impacts for the proposed construction of pylons and access roads is LOCALISED.

Duration: If fossils are found they should be preserved for posterity. Whether they are destroyed during development or collected to take to a museum, the duration of impact is PERMANENT.

Intensity: The intensity/magnitude of a palaeontological impact is determined by the palaeontological sensitivity of the affected geological formation, together with the extent or volume of excavations made into the formation. Fossils in the Kalahari Group are sparse, occur sporadically, low in diversity and are usually fragmentary and eroded and therefore the impact of the development on the potential palaeontological heritage is seen to be MARGINAL.

Probability: (describes the likelihood of the impact actually occurring). Fossils are scarce and have a sparse and erratic distribution. The probability of exposing fossils during development at the site is considered to be IMPROBABLE.

IMPACT ASSESSMENT TABLE					
Extent	Duration	Intensity	Probability	Significance	Status
1	5	2	2	$(1+5+2) \times 2 = 16$	LOW
Significance Sum (Extent + Duration + Intensity) x Probability					

Results:

Due to the improbability of making a significant fossil find during development, the significance of development in the study area is LOW. There is no objection against the proposed development of the study site as long as the stipulations set out in the Chance Find Procedure are adhered to.

References:

Almond, J.E. & Pether, J. (2008) Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

Geological Survey (1988) 2620 TWEE RIVIEREN 1:250 000 Geology Map.

SAHRA (2023) Palaeosensitivity Map <http://www.sahra.org.za/sahris/map/palaeo>

7. Conclusion and recommendations:

There is a low likelihood that the Quaternary aeolian sand that covers the study site may contain fossils. Elsewhere rare fossils of root casts, burrows, ostrich egg shells, mollusc shells, isolated bones, root casts, burrows and termitaria have been found and the possibility of finding similar fossils at the study area cannot be excluded. No macroscopic fossils have been reported from the underlying surface limestone in the study area.

In the event of a significant fossil find being made in the sandy soil covering the study area, or the underlying rocks, the ECO should follow the Chance Find Procedure.

PROCEDURE FOR CHANCE PALAEOLOGICAL FINDS

Extracted and adapted from the National Heritage Resources Act, 1999 Regulations Reg No. 6820, GN: 548.

The following procedure must be considered in the event that previously unknown fossils or fossil sites are exposed or found during the life of the project:

1. Surface excavations should continuously be monitored by the ECO and any fossil material be unearthed the excavation must be halted.
2. If fossiliferous material has been disturbed during the excavation process it should be put aside to prevent it from being destroyed.
3. The ECO then has to take a GPS reading of the site and take digital pictures of the fossil material and the site from which it came.
4. The ECO then should contact a palaeontologist and supply the palaeontologist with the information (locality and pictures) so that the palaeontologist can assess the importance of the find and make recommendations.
5. If the palaeontologist is convinced that this is a major find an inspection of the site must be scheduled as soon as possible in order to minimise delays to the development.

From the photographs and/or the site visit the palaeontologist will make one of the following recommendations:

- a. The material is of no value so development can proceed, or:
- b. Fossil material is of some interest and a representative sample should be collected and put aside for further study and to be incorporated into a recognised

fossil repository after a permit was obtained from SAHRA for the removal of the fossils, after which the development may proceed, or:

c. The fossils are scientifically important and the palaeontologist must obtain a SAHRA permit to excavate the fossils and take them to a recognised fossil repository, after which the development may proceed.

7. If any fossils are found then a schedule of monitoring will be set up between the developer and palaeontologist in case of further discoveries.

8. Declaration of Independence:

I, Jacobus Francois Durand 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.



Palaeontological specialist:

Dr JF Durand (Sci. Nat.)

BSc Botany & Zoology (RAU), BSc Zoology (WITS), Museology Dipl. (UP),
Higher Education Diploma (RAU), PhD Palaeontology (WITS)

APPENDIX 1: PALAEOONTOLOGICAL SENSITIVITY RATING

(Palaeontological Sensitivity refers to the likelihood of finding significant fossils within a geologic unit)

VERY HIGH: Formations/sites known or likely to include vertebrate fossils pertinent to human ancestry and palaeoenvironments and which are of international significance.

HIGH: Assigned to geological formations known to contain palaeontological resources that include rare, well-preserved fossil materials important to on-going palaeoclimatic, palaeobiological and/or evolutionary studies. Fossils of land-dwelling vertebrates are typically considered significant. Such formations have the potential to produce, or have produced, vertebrate remains that are the particular research focus of palaeontologists and can represent important educational resources as well.

MODERATE: Formations known to contain palaeontological localities and that have yielded fossils that are common elsewhere, and/or that are stratigraphically long-ranging, would be assigned a moderate rating. This evaluation can also be applied to strata that have an unproven, but strong potential to yield fossil remains based on its stratigraphy and/or geomorphologic setting.

LOW: Formations that are relatively recent or that represent a high-energy subaerial depositional environment where fossils are unlikely to be preserved, or are judged unlikely to produce unique fossil remains. A low abundance of invertebrate fossil remains can occur, but the palaeontological sensitivity would remain low due to their being relatively common and their lack of potential to serve as significant scientific resources. However, when fossils are found in these formations, they are often very significant additions to our geologic understanding of the area. Other examples include decalcified marine deposits that preserve casts of shells and marine trace fossils, and fossil soils with terrestrial trace fossils and plant remains (burrows and root fossils)

MARGINAL: Formations that are composed either of volcanoclastic or metasedimentary rocks, but that nevertheless have a limited probability for producing fossils from certain contexts at localized outcrops. Volcanoclastic rock can contain organisms that were fossilized by being covered by ash, dust, mud, or other debris from volcanoes. Sedimentary rocks that have been metamorphosed by the heat and pressure of deep burial are called metasedimentary. If the metasedimentary rocks had fossils within them, they may have survived the metamorphism and still be identifiable. However, since the probability of this occurring is limited, these formations are considered marginally sensitive.

NO POTENTIAL: Assigned to geologic formations that are composed entirely of volcanic or plutonic igneous rock, such as basalt or granite, and therefore do not have any potential for producing fossil remains. These formations have no palaeontological resource potential.

(Adapted from Society of Vertebrate Paleontology (1995). Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources - Standard Guidelines. News Bulletin 163: 22-27)

APPENDIX 2: METHODOLOGY FOR ASSESSING THE SIGNIFICANCE OF IMPACTS

EFFECT	Extents/Spatial Scale E		
	Localized	At localized scale and a few hectares in extent.	1
	Study area	The proposed site and its immediate environs.	2
	Regional	District and Provincial level.	3
	National	Country.	4
	International	Internationally.	5
	Duration/Temporal Scale D		
	Very short	Less than 1 year.	1
	Short term	Between 2 to 5 years.	2
	Medium term	Between 5 and 15 years.	3
	Long term	Exceeding 15 years and from a human perspective almost permanent.	4
	Permanent	Resulting in a permanent and lasting change.	5
	Intensity/Magnitude (Palaeontological Sensitivity) I		
	No potential	Formations entirely lacking fossils such as igneous rocks.	0
	Marginal	Limited probability for producing fossils from certain contexts at localized outcrops.	2
	Low	Depositional environment where fossils are unlikely to be preserved, or are judged unlikely to produce unique fossil remains.	4
	Medium	Strong potential to yield fossil remains based on stratigraphy and/or geomorphologic setting.	6
	High	Formations known to contain palaeontological resources that include rare, well-preserved fossil materials.	8
	Very high	Formations/sites known or likely to include vertebrate fossils pertinent to human ancestry and palaeoenvironments and which are of international significance.	10
	Probability/Likelihood P		
	Very improbable	Probably will not happen.	1
	Improbable	Some possibility, but low likelihood.	2
	Probable	Distinct possibility of these impacts occurring.	3
	Highly probable	The impact is most likely to occur.	4
	Definite	The impact will definitely occur regardless of prevention measures.	5

SIGNIFICANCE = (E+D+I) P		
< 30	LOW	The impact would not have a direct influence on the decision to develop in the area.
30-60	MEDIUM	The impact could influence the decision to develop in the area unless it is effectively mitigated.
> 60	HIGH	The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.