

DESKTOP PALAEONTOLOGICAL ASSESSMENT

**PALAEONTOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED
FARM RAMONS DRIFT 24 AND FARM HOM 25 PROSPECTING SITE,
NAMA KHOI LOCAL MUNICIPALITY, NAMAKWA DISTRICT
MUNICIPALITY, NORTHERN CAPE PROVINCE**

FOR

Felicity Links

DATE: 14 July 2023

By

**Dr Gideon Groenewald
Cell: 078 713 6377**

EXECUTIVE SUMMARY

Dr Gideon Groenewald was appointed by the McGregor Museum on behalf of Felicity Links to conduct a Palaeontological Impact Assessment (PIA) for the proposed Farm Ramons Drift 24 and Farm Hom 25 prospecting site, Nama Khoi Local Municipality, Namakwa District Municipality, Northern Cape Province. The development falls in a rural setting where the natural desert ecosystem has, to a large degree, been preserved due to the very low impact of agricultural activities in the lower Orange River region.

This palaeontological assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 (revised 2017). In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint. The regional competent authority responsible for this assessment is the Northern Cape Heritage Resources Authority (NCHRA) and the South African Heritage Resources Agency (SAHRA).

The geology underlying the development area for the proposed Farm Ramons Drift 24 and Farm Hom 25 prospecting site, Nama Khoi Local Municipality, Namakwa District Municipality, Northern Cape Province, comprises Mokolian (Kheisian) aged metamorphic and igneous rocks with typical extensive plains underlain by Tertiary and Quaternary aged moderately fossiliferous sediments.

Although it is imperative to indicate the moderate sensitivity on the initial maps, the *modus operandi* of the project palaeontologist, when appointed, must be to train the ECO and team members to adhere to the “Chance Find Protocol” recommendation. Fossils recorded during construction must be curated and moved to the institute indicated by NCHRA and SAHRA.

Recommendations

- The EAP and developer must be informed that the development site is underlain by sediments with a moderate sensitivity for palaeontological heritage. The metamorphic and igneous rocks will not contain any fossils.
- The project will require a formal “Chance Find Protocol” (attached to this report).
- It is the professional opinion of Dr Gideon Groenewald, accredited palaeontologist, that **NO FURTHER MITIGATION FOR THE “ROD” IS NEEDED** for Palaeontological Heritage at this site. The findings of this desktop survey must however be incorporated into the EMP. The development can proceed, provided that the recommendations of the Chance Find Protocol (attached) is adhered to.
- Recommendations for palaeontological monitoring and mitigation will have to be incorporated into the EMP for approval by NCHRA and SAHRA.

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INTRODUCTION

Dr Gideon Groenewald was appointed by the McGregor Museum on behalf of Ms Felicity Links to conduct a Palaeontological Impact Assessment (PIA) for the proposed Farm Ramons Drift 24 and Farm Hom 25 prospecting site, Nama Khoi Local Municipality, Namakwa District Municipality, Northern Cape Province. The development falls in a rural setting where the natural desert ecosystem has, to a large degree, been preserved due to the very low impact of agricultural activities in the lower Orange River region. The prospecting sites are either situated in the areas where seasonal flooding can occur on the extensive alluvial/colluvium plains or in the rugged rocky outcrops of metamorphic rocks (Figure 1)

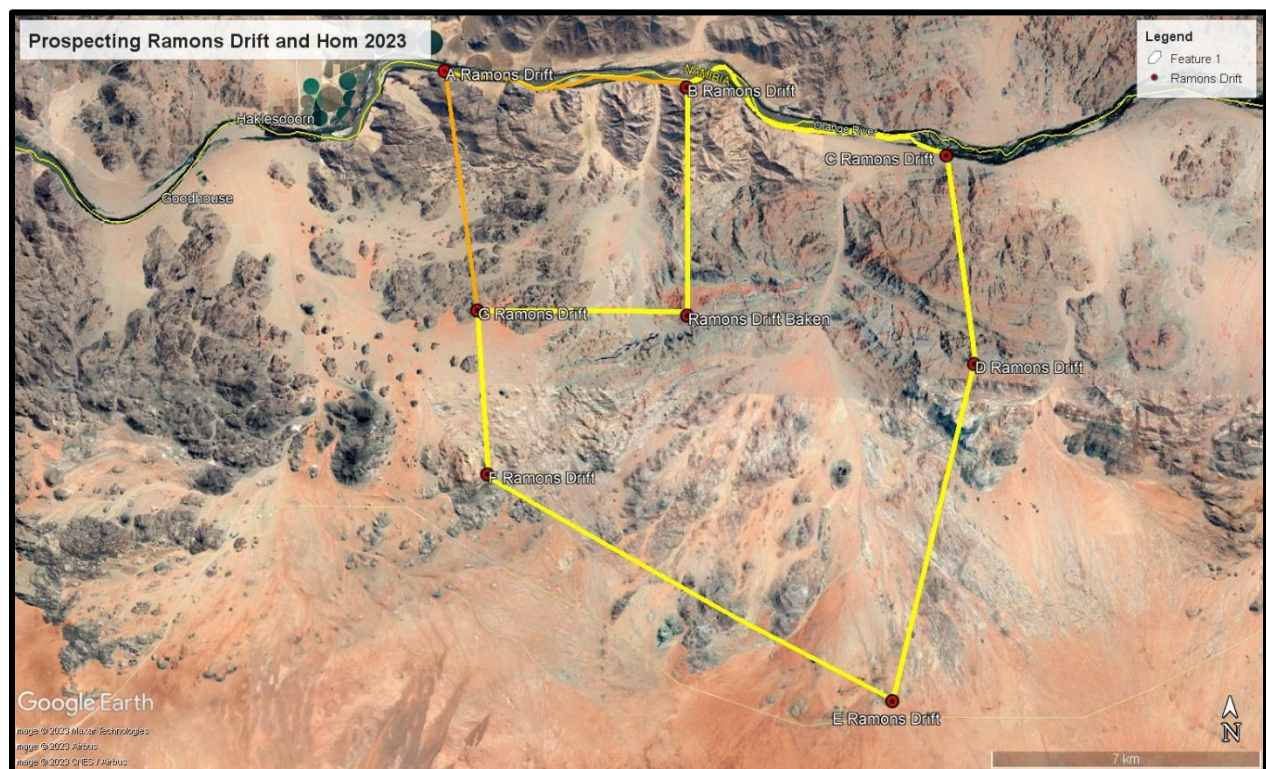


Figure 1 Locality of the proposed prospecting site south of the Orange River

The aims of this independent assessment of the Palaeontological Heritage is to:

- a. *Review findings and impact assessment of previous Paleontological Assessments in the same area*

- b. Determine and assess the possible impacts of significance (if any), specifically in relation to the various amendments to be applied for (particularly to the localities of specific infrastructures, property boundary etc.; and
- c. Review and comment on mitigation and management measures (if any) for inclusion into the Environmental Management Programme (EMPr).

Modus operandi

- Review documentation of existing PIA studies of the area
- Review reality of the palaeontology of the site to determine reasoning for previous recommendations
- Desktop PIA Report with recommendations and indication of any significant changes in the impact assessment as reported – GIS mapping of palaeontological sensitivity - **first deliverable**
- Inclusion of a “Chance Find Protocol” (CFP) document to assist the EAP and the ECO with operational management issues regarding possible impact on palaeontological heritage – **secondary deliverable**

Summary of Project Parameters as per ToR's

Client name: **Felicity Links**

Site name: **Ramons Drift and Hom Prospecting site**

Property description: **Farm Ramons Drift 24 and Farm Hom 25, Namakwa District, Northern Cape**

Project title: **Ramons Drift and Hom EIA Application – Palaeontological Impact Assessment**

This desktop palaeontological impact assessment is therefore a general assessment of the entire proposed area and, due to the fact that all the sites applicable for review falls within a geological environment with a moderate and very low sensitivity rating for Palaeontological Heritage (Almond and Pether, 2009; Groenewald et al., 2014)(SAHRIS database 2023), the report aims to address some of the specific sites in the development footprint.

Legal Requirements

This palaeontological assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 (revised 2017). In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint. The regional competent authority responsible for this assessment

is the Northern Cape Heritage Resources Authority (NCHRA) and the South African Heritage Resources Agency (SAHRA).

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens; and
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

Aims and Methodology

A desktop investigation is often the only opportunity to record the fossil heritage within the development footprint. These records are very important to understand the past and form an important part of South Africa's National Estate.

Following the “*SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports*” the aims of the palaeontological impact assessment are:

- to identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

Prior to a field investigation, a preliminary assessment (desktop study) of the topography and geology of the study area is made, using appropriate 1:250 000 geological information (2818 Onseepkans and 2918 Pofadder) in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc.) are identified within the study area and 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.

Priority palaeontological areas are identified within the development footprint to focus the field investigator's time and resources. The aim of the desktop survey is to document any exposed fossil material and to assess the palaeontological potential of the region in terms of the type and extent of rock outcrop in the area.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature

and scale of the development itself, most notably the minimal extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 below.

Table 1 Palaeontological Sensitivity and Vulnerability Classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of (Almond et al., 2009; Almond and Pether, 2008; Groenewald, 2012; Groenewald et al., 2014)	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example, areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) compulsory.

BLUE	<p>Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. Collection of a representative sample of potential fossiliferous material recommended. At least a Desktop Survey and "Chance Find Protocol" is compulsory. The Chance Find Protocol must be included in the EMPr for the project.</p>
GREY	<p>Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during emplacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of</p>

	highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least a Desktop Survey and “Chance Find Protocol” document is compulsory. The Chance Find Protocol must be included in the EMP of the project.
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When rock units of **moderate** to very high Palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures must be incorporated into the Environmental Management Plan. A suitably qualified Palaeontologist must clear all projects falling on low to **very low** Palaeontological sensitive geology.

Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA and the Kingdom of Lesotho. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an 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 weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc.).

Locality and Proposed Development

The project comprises the proposed Farm Ramons Drift 24 and Farm Hom 25 prospecting site, Nama Khoi Local Municipality, Namakwa District Municipality, Northern Cape Province (Figure 2).

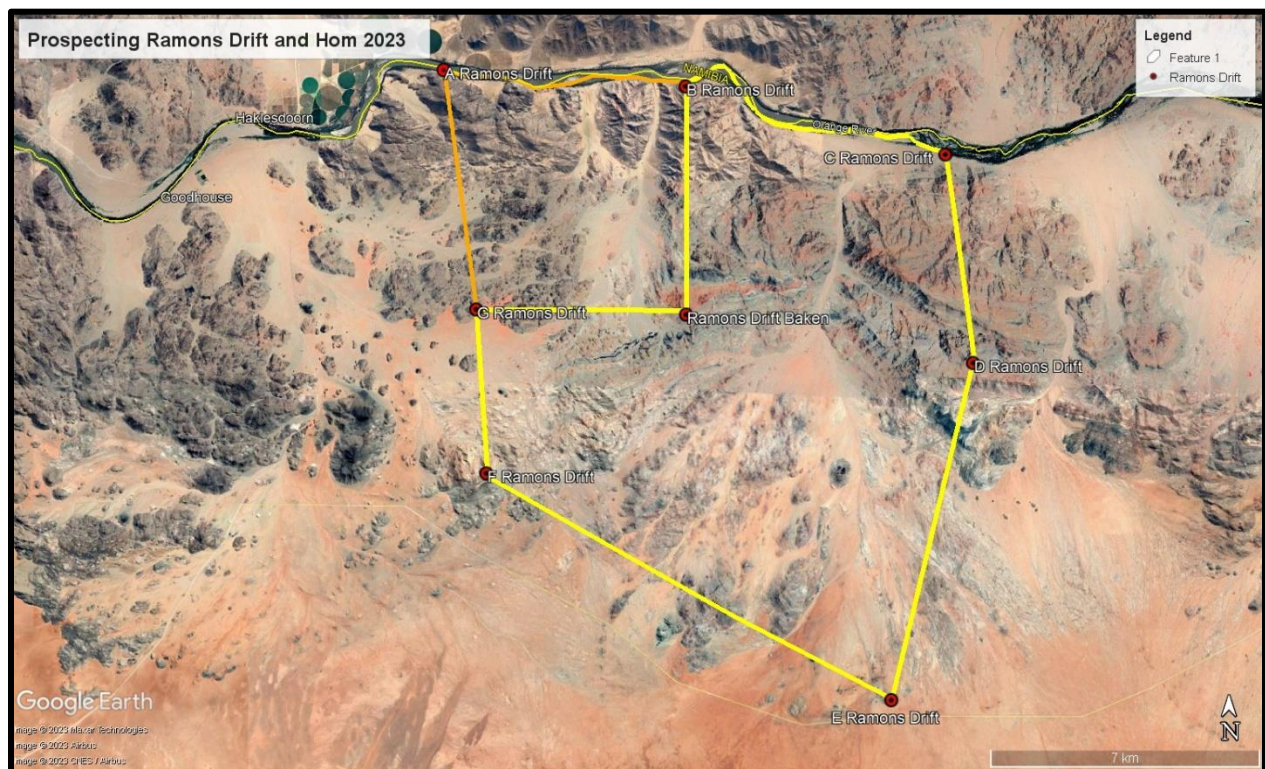


Figure 2 Locality of the proposed prospecting site south of the Orange River

The study area is characterised by a typical desert landscape in the lower Orange River region, with extensive very dry plains and exposed rocky hills and mounds indicating very long cycles of low water stand but also cyclic flooding where water levels will rise to cover the sandy alluvial plains in at least a few meters of floodwaters. The hydrology of the flooding is not known to the author and there is very little information

available to relate the rate of erosion of the sandy plains to the intensity or duration of major flood events.

It is important to note that the proposed developments vary from single excavations or specific point sites, to linear trenches for the prospecting. This desktop survey aims to provide the decision making authority with a detailed summary of the geology and palaeontology of the proposed prospecting site.

GEOLOGY

The development site is underlain by recent sandy alluvium of the Orange River system as well as extensive alluvium and colluvium that results from sporadic thunderstorm episodes that cause flooding over very short periods of time. The rocky outcrops, hills and mounds are mostly exposed with very shallow sandy soils and sparse vegetation. It is assumed that the target alluvial material will comprise of some layers of conglomerate and clay, depending on the rate and duration of flooding in the hydrological system (Figure 3).

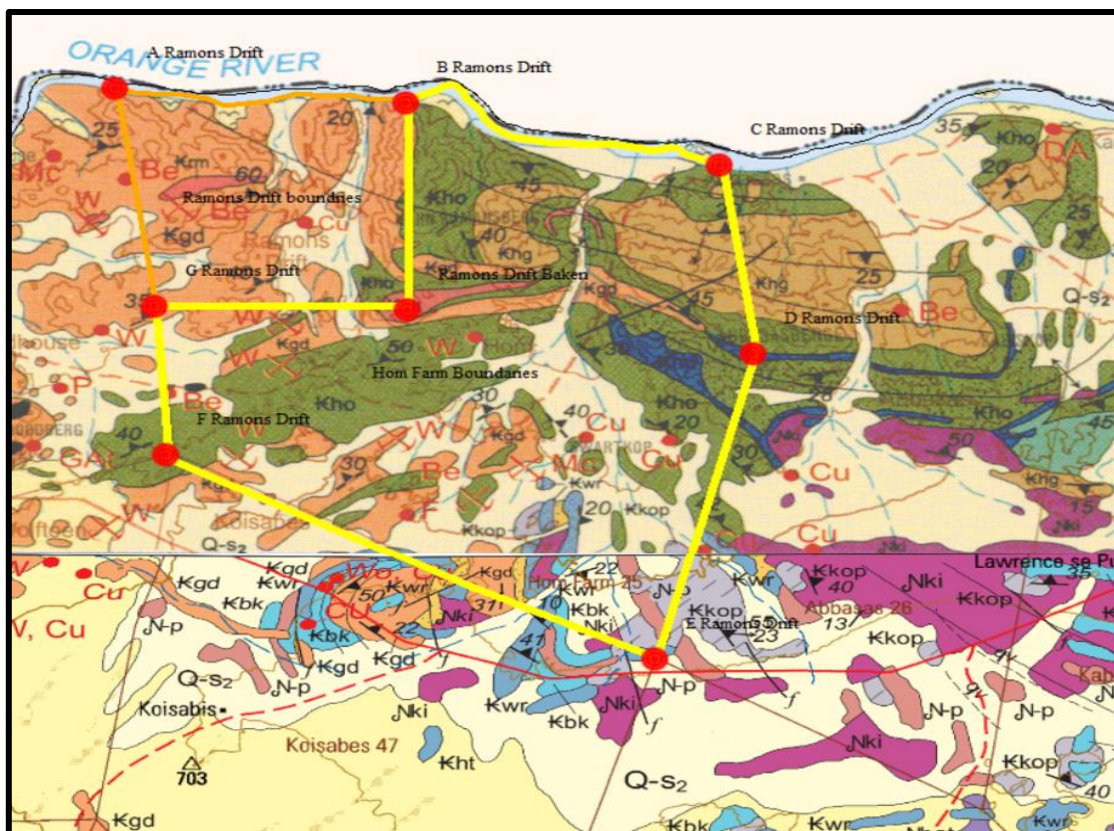


Figure 3 Geology of the Study Area comprises complex outcrops of metamorphic and igneous rocks (see Figure 4) as well as alluvium/colluvium (Q-S₂) in the desert environment

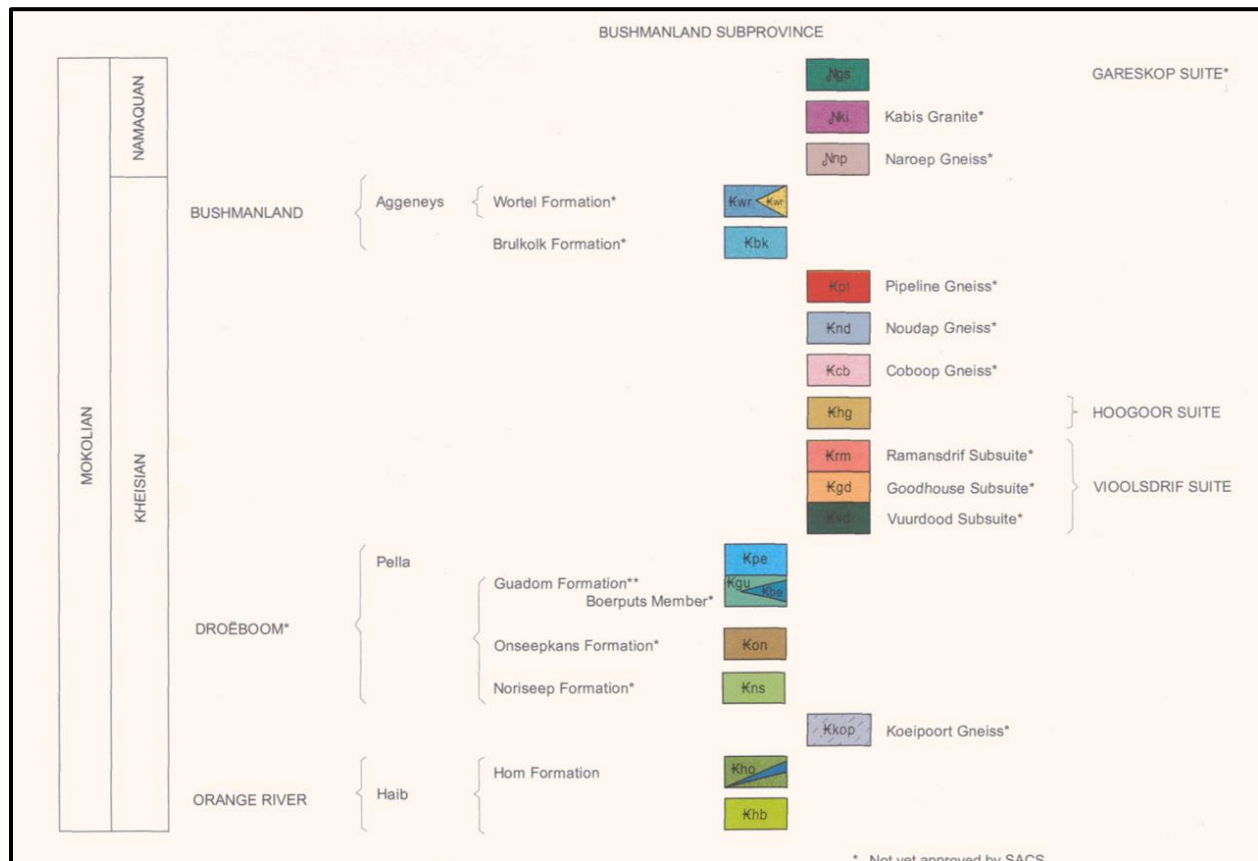


Figure 4 Geological legend for metamorphic and igneous rocks in the study area

Bushmanland Sub Province

Orange River Group, Haib Subgroup

Hom Formation (Kho)

Kheisian aged Hom Formation consists of fine-grained quartzofeldspathic gneiss, biotite- and hornblend bearing gneiss and schist. Quartz-feldspar-muscovite schist or quartzite zones are mapped out as unique associations.

Koeipoort Gneiss (Kkop)

Kheisian aged medium- to coarse-grained red-brown weathering leucogneiss.

Vioolsdrif Suite

Goodhouse Subsuite (Kgd)

Kheisian aged grey- granodiorite and hornblende-biotite granite, porphyritic in places.

Ramansdrif Subsuite (Krm)

Kheisian aged alkali feldspar leucogranite.

Hoogoor Suite (Khg)

Kheisian aged grey- and red-brown weathering, medium-grained gneisses.

Bushmanland Group

Aggeneys Subgroup

Brulkolk Formation (Kbk)

Kheisian aged amphibolite, calc-silicate rocks, minor pelitic schist.

Wortel Formation (Kwr)

Kheisian aged quartzite, muscovite and biotite-bearing schist.

Kabis Granite (Nki)

Namaquan aged megacrystic granite, in places with a rapakivi tecture, medium grained biotite granite gneiss.

Pegmatite (N-p)

Namaquan aged pegmatite.

Tertiary to Quaternary Soils and Alluvium/Colluvium

Tertiary to Quaternary aged red sand, scree, gravelly and sandy soils (Q-s₂) underlies desert plains and typical colluvium covered slopes that are interspersed with outcrops of metamorphic and igneous rocks of the lower Orange River region.

Quaternary aged alluvium is associated with the valley-floor of the Orange River.

Gravel and sandy deposits build the more permanent higher ground areas that get overgrown with typical sparse vegetation that prevents the total destruction of the these “sandbars” during normal cyclic flooding of the desert plain colluvium system. The alluvium/colluvium typically consists of sequences with basal conglomerate that is fining upward into sand and clay. The main interest of prospectors will be in the conglomerate layers associated with fast deposition of coarser grained material during sudden waning of flood cycles, a natural geological phenomenon in fluvial sedimentology (Groenewald GH., 1989).

PALAEONTOLOGY

The palaeontological heritage of the geological units underlying the Ramons Drift 24 and Hom 25 farms prospecting site will have a clear variance between the outcrops of the Kheisian aged metamorphic and igneous rocks as compared to the alluvium/colluvium that is associated with catastrophic flood or drought events in the Lower Orange River eco-system. Due to the metamorphic and igneous character of the prominent rock outcrops in the study area, no fossils will be associated with these rock units.

In the case of the alluvium and colluvium, the typical catastrophic drought and flood events would have caused identifiable cyclic patterns of sedimentation in the desert plains sedimentary sequence into which pits or trenches will be dug for prospecting purposes. Sedimentary cycles, caused by catastrophic events, might contain significant remains of Tertiary to Quaternary aged plants and animals, that will reveal much about the palaeoclimate and the Lower Orange River eco-system of South Africa .(Almond and Pether, 2009).

Tertiary to Recent Alluvium

The palaeontological heritage of the Tertiary and Recent alluvial deposits of major river systems, such as the Orange River, lacks the intensity of studies that were made of older sedimentary sequences in South Africa (Almond, 2020, 2016; Almond and Pether,

2009; Johnson et al., 2009; MacRae, 1999; McCarthy and Rubidge, 2005). Most of the detailed information is associated with studies that were related to alluvial mining along the west coast and in the alluvial deposits associated with river terraces (Almond and Pether, 2009, 2008).

According to Almond and Pether (2008)

“Important late Caenozoic biotas of Miocene age and younger are also recorded from relict bands and patches of sediments (eg consolidated gravels) deposited by ancient river networks that drained the subcontinental interior. Thick fluvial gravels are preserved along the Vaal, Orange and Olifants Rivers, as well as the long-extinct Geelvloer-Koa River Valley system south of the Orange. They have yielded fascinating but sparse bones and teeth of large mammals (eg proboscideans such as elephants and mastodons, rhinos, bovids, horses and carnivores), reptiles (crocodiles etc), freshwater molluscs and well preserved petrified wood”.

Literature surveys reveal the potential wealth of palaeontological heritage items that can be associated with these alluvial deposits (Table 2).

Table 2 Summary of palaeontological elements associated with Tertiary to Recent Alluvial deposits in the major river basins of South Africa

EON	ERA	Period	Supergroup/ Sequence	Group	Subgroup	Formation	Member	Lithology	Fossil Heritage	Comments
PHANEROZOIC	Cenozoic		ALLUVIAL DEPOSITS			mmm; Several symbols used for alluvium (Q-a), colluvium and scree (Q17)		Recent sandy and clayey deposits along water courses	Wide range of fossils possible, including mammalian bones and teeth, tortoise remains, ostrich egg etc.	Alluvial deposits associated with recent water courses of main rivers and streams. These sediments are presently not well studied and records of fossil occurrences are mainly associated with archaeological reports. Fossils recorded from these beds for example fossils from Rouxville and Wepener, are highly significant
			CAENOZOIC SUPERFICIAL DEPOSITS (Q) Quaternary (1.6 to 0 Ma)			Q; Qs; Q-s; Qw; Qd; Qg Diamondiferous gravel (Qa) Masotcheni (Qm); River Terrace Gravel (Qg)		Aeolian sand, alluvium, colluvium, spring tufa (calcareous) and sinter (siliceous), lake deposits, peats, pedocretes or duricrusts (calcrete, ferricrete), soils and gravel	Very wide range of possible fossil remains, though these are often sparse, such as: mammalian bones and teeth, tortoise remains, ostrich eggshells, non-marine mollusc shells, ostracods, diatoms and other microfossil groups, trace fossils (e.g. calcretised termitaria, rhizoliths, burrows, vertebrate tracks), freshwater stromatolites, plant material such as peats, foliage, wood, pollens	Extensive alluvial and colluvial deposits are not well studied. Refer to archaeological publications for possible reference to important fossil assemblages from these units.
			MAINLY CALCRETES			Qc; Q16; T12; Q-c		Calcrete, pandune and surface limestone		
			Superficial Deposits Not mapped on 1:250 000 scale Predominantly Pleistocene to Recent (1.6 to 0 Ma)			Examples: Cornelia (T-Qc); Florisbad		Terrestrial sediments, including diatomite (diatom deposits), spring deposits, pedocretes, calcareous tufa and other cave deposits, peats, soils and gravel	Bones and teeth of mammals (e.g. proboscideans, rhinos, bovids, horses, micromammals, early Homo (Florisbad Man (Homo heidelbergensis)); Cornelian and Florisian Mammal Age faunas), reptiles, fish, freshwater molluscs, petrified wood, trace fossils (e.g. termitaria), rhizoliths, diatom floras. Fauna generally sparse but locally very rich.	Scattered records with many areas being poorly studied (e.g. from ancient drainage systems). Key examples include sites at Cornelia, Uitzoek, Erfkroon, Florisbad, Viakkraal and several sites where Orange River Gravels are preserved

Palaeontological Impact Assessment

The impact rating for Palaeontological Heritage is therefore predicted and mapped according to the underlying geology (Figure 5).

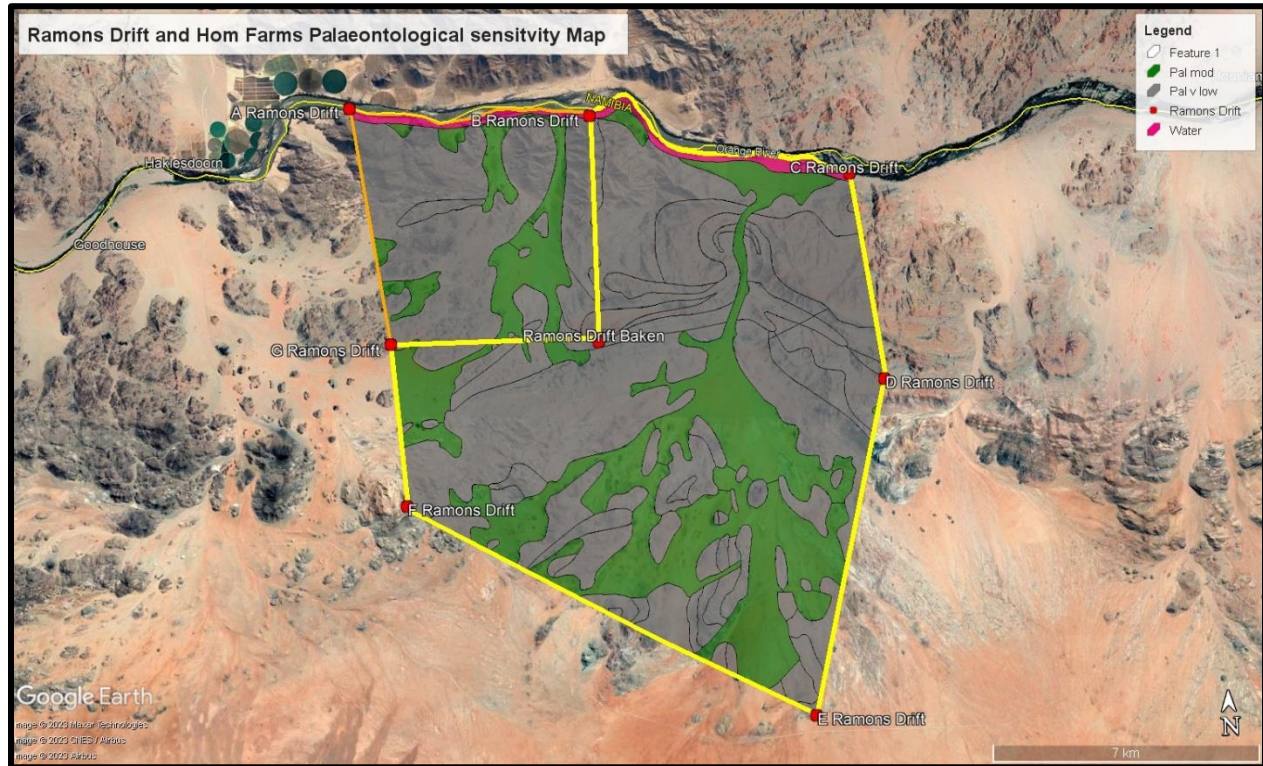


Figure 5 The Palaeontological sensitivity for the prospecting site is rated as moderate and very low (for colour coding see Table 1)

Following a detailed desktop survey of the existing database, the palaeontological sensitivity for Farm Ramons Drift 24 and Farm Hom 25 is based on the sensitivity of the underlying geological formations (Table 3).

Table 3 Summary of Palaeontological Sensitivity for Farm Ramons Drift 24 and Farm Hom 25 Prospecting Project

Item	Geology and Palaeontology	Site indication	Colour code
1	Alluvium moderately fossiliferous	Open plains	
2	Metamorphic and igneous rocks – very low to insignificant palaeontological sensitivity	Rugged outcrops	

It is however very important to note that, although a moderate sensitivity rating is allocated to areas underlain by alluvium, the actual impact per site of excavation might be limited. Although it is imperative to indicate the moderate sensitivity on the initial maps, the *modus operandi* of the project palaeontologist, when appointed, must be to train the ECO and team members to implement the “Chance Find Protocol” (attached to this report) so that they know what to look for during excavation and are able to inform the palaeontologist of a significant find immediately. Fossils recorded during construction must be curated and moved to the institute indicated by Northern Cape Heritage Resources Authority (NCHRA) and SAHRA.

In all sections of the prospecting site with a moderate sensitivity rating, the impact rating for Palaeontological Heritage will be **high negative** if no mitigation is implemented, whereas mitigation (collecting and recording of significant fossils) will contribute significantly towards our understanding of the Tertiary and Quaternary eco-systems, resulting a **positive impact** of high significance.

CONCLUSIONS

The geology underlying the development area for the proposed Farm Ramons Drift 24 and Farm Hom 25 prospecting site, Nama Khoi Local Municipality, Namakwa District Municipality, Northern Cape Province, comprises Mokolian (Kheisian) aged metamorphic and igneous rocks with typical extensive plains underlain by Tertiary and Quaternary aged moderately fossiliferous sediments.

Although it is imperative to indicate the moderate sensitivity on the initial maps, the *modus operandi* of the project palaeontologist, when appointed, must be to train the ECO and team members to adhere to the “Chance Find Protocol” recommendation. Fossils recorded during construction must be curated and moved to the institute indicated by NCHRA and SAHRA.

Recommendations

- The EAP and developer must be informed that the development site is underlain by sediments with a moderate sensitivity for palaeontological heritage. The metamorphic and igneous rocks will not contain any fossils.
- The project will require a formal “Chance Find Protocol” (attached to this report).
- It is the professional opinion of Dr Gideon Groenewald, accredited palaeontologist, that **NO FURTHER MITIGATION FOR THE “ROD” IS NEEDED** for Palaeontological Heritage at this site. The findings of this desktop survey must however be incorporated into the EMPr. The development can proceed, provided that the recommendations of the Chance Find Protocol (attached) is adhered to.

- Recommendations for palaeontological monitoring and mitigation will have to be incorporated into the EMPr for approval by NCHRA and SAHRA.

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.



Dr Gideon Groenewald
Geologist

CHANCE FIND PROTOCOL FOR PALAEONTOLOGICAL HERITAGE

Environmental Authorisation for the proposed Farm Ramons Drift 24 and Farm Hom 25 prospecting site, Nama Khoi Local Municipality, Namakwa District Municipality, Northern Cape Province

Mitigation for excavation Impact on Palaeontological Heritage Resources during prospecting activities

It is essential that the appointed palaeontologist, in consultation with the Project Environmental Manager and the contractors and ECO's of further excavation works during the implementation phase of the project, develop a short-term strategy for the recovery of significant fossils during the excavation operation. As part of such a strategy, the discussions with the palaeontologist must include:

- Initially, and at least for the *duration of excavations*, visit the site on request of the ECO of the specific construction site, to ensure recording of all potentially significant fossil strata. Due to the longevity of this contractual involvement it is not possible to have pre-determined timing on further visits and it is a conclusion from present observations, that more frequent visits by the Palaeontologist during excavations into the Alluvium **will be required** at this stage.
- Determine a short-term strategy and budget for the recording of significant fossils. This Strategy is simply an oral agreement on when the site is to be inspected and what the finds are that might be recorded. The site visit must include an introduction session with all the managers of the Project Team, including training of the ECO and site managers by the appointed palaeontologist, to basically train people to know what to look out for in terms of fossil heritage on site. This action will be required at the start of each individual construction activity for the duration of construction in the “greenfield sections” of the site.
- **Following the Desktop Survey, follow-up site visits (Phase 1 PIA) are essential.**
- In the **likely** case of reporting of any unusual sedimentary structures, the Palaeontologist must be notified, and a site visit must be arranged at the earliest possible time with the Palaeontologist. In the case of the site ECO or the Site Manager becoming aware of suspicious looking material that might be a “Significant Find”, the construction must be halted in that specific area and the Project Environmental Manager (PEM) must be informed who will inform the Project Engineer. The Palaeontologist must be given enough time to reach the site and the PEM will request a Site Instruction from the Engineer to allow for removal the material before excavation continues.

Mitigation Measures Normally Encountered

1. Mitigation of palaeontological material must begin as soon as possible and preferably when “trial excavation” takes place. The appointed specialists must acquaint themselves with the operation and determine feasible mitigation strategies.
2. A plan for systematic sampling, recording, preliminary sorting and storage of palaeontological and sedimentological samples will be developed during the early stages of the project, in collaboration with the Evolutionary Studies Institute (ESI) at WITS University, which is the closest Institute to the site.
3. Mitigation will involve an attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labelled, boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

Functional responsibilities of the Developer

1. Ensuring, at their cost, that a representative archive of palaeontological samples and other records is assembled to characterise the palaeontological occurrences affected by the excavation operation.
2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas. In the case of this project it is foreseen that vertebrate, invertebrate, plant and trace fossils will be present. *(If fossils of Tertiary and Quaternary age are exposed, it will be Very Highly significant and the Palaeontologist will obviously be in close communication with the site ECO and the PEM to act as required by NCHRA without causing undue standing time for the contractors).*
3. “Facilitate” systematic recording of the stratigraphic and palaeo-environmental features of exposures in the fossil-bearing excavations, by allowing time to describe and measure geological sections, and by providing aid in the surveying of positions where significant fossils are found. *(In the case of this specific development, the likelihood of such finds is moderate).*
4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.
5. Provide covered, dry storage for samples and facilities that is defined as a work area for sorting, labelling and boxing/bagging of samples.
6. Costs of basic curation and storage in the sample archive at the ESI, WITS University (labels, boxes, shelving and, if necessary, specifically-tasked temporary employees).

Documentary record of palaeontological occurrences

1. The contractors will, after consultation with the PEM and in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which the following information are indicated on the plan in the site office at the excavation site. This must be done in conjunction with the appointed specialist and form part of the on-going revision of this “Chance Find Protocol” (CFP), during the excavation stage of the project:

1.1. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period.

1.2 Locations of samples and measured sections are to be pegged, and routinely accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any significant fossils are recorded during the time of excavation. This information must be recorded during the first site visit and a clearance from the Palaeontologist (e-mail message will suffice) must be followed up with subsequent e-mail communications with the Site Specific ECO, Site Manager and the PEM.

Functional responsibilities of the appointed Palaeontologist

1. If applicable after completion of the Phase 1 site visit, apply for a permit to collect fossils during the lifetime of the Project and establishment of a representative collection of fossils and a contextual archive of appropriately documented and sampled palaeoenvironmental and sedimentological geodata in collaboration with the ESI at WITS University, or the McGregor Museum, depending on the expertise available at each Institute.

2. Undertake an initial evaluation of potentially affected areas and of available exposures in excavations. A short training session, inclusive of the PEM, Project Managers and the ECO's or their representatives, was presented during the second site visit to this project.

3. On the basis of the above, and evaluation during the early stages of excavation development, in collaboration with the PEM and the contractor management team, more detailed practical strategies to deal with the fossils encountered routinely during excavation, as well as the strategies for major finds must briefly be agreed on.

4. Informal on-site training in responses applicable to “normal” fossil finds must be provided for the PEM, ECO and environmental staff by the appointed specialist. This step is will only be arranged following the discovery of significant fossils at the time of the Phase 2 site visits.

5. Respond to significant finds and undertake appropriate mitigation.

6. Initially, for the first year of operation, and if the PEM or the appropriate ECO indicates significant “strange looking rocks” that might be similar to the fossils indicated to the staff during the information sessions, visit at least once in twelve weeks to “touch base” with the monitoring progress. Document interim “normal” finds and undertake an inspection and documentation of new excavation faces. A strategy for further visits during the life of the excavation must be discussed.

7. Transport of material from the site to the ESI, WITS University or the allocated Institute where an expert on the specific fossils discovered, is presently employed.
8. Reporting on the significance of discoveries, as far as can be preliminarily ascertained. This report is in the public domain and copies of the report must be deposited at McGregor Museum, ESI, NCHRA and SAHRA. It must fulfil the reporting standards and data requirements of these bodies.
9. Reasonable participation in publicity and public involvement associated with palaeontological discoveries.

Exposure of palaeontological material

1. In the event of construction exposing new palaeontological material, not regarded as normative/routine as outlined in the initial investigation, such as a major fossil find, the following procedure must be adhered to:
 - 1.1 The appointed specialist or alternates (NCHRA; McGregor Museum; ESI WITS University) must be notified by the responsible officer (e.g. the PEM, Chief Engineer, ECO or Contractor Manager), of major or unusual discoveries during excavation, found by the Contractor Staff.
 - 1.2 Should a major *in situ* occurrence be exposed, excavation will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed specialist or scientists from the McGregor Museum, NCHRA; SAHRA; ESI at WITS University, or its designated representatives, have had reasonable opportunity to investigate the find. Such work will be at the expense of the Developer.
 - 1.3 Significant fossil finds are known from this area and the appointed palaeontologist must clear continued excavation on the proviso that any suspicious material will be indicated by the ECO to the Palaeontologist via emailed photographic information.

CONCLUSION

The development site for the proposed Farm Ramons Drift 24 and Farm Hom 25 prospecting site, Nama Khoi Local Municipality, Namakwa District Municipality, Northern Cape Province, falls on alluvium/colluvium with a moderate rating for Palaeontological Heritage. Fossils are known from the areas underlain by the alluvium and, further mitigation for Palaeontological Heritage (Phase 1 field inspection and report during prospecting) is recommended at this stage.

It is recommended that:

- The PEM and ECO's must be informed of the fact that a moderate Palaeontological Sensitivity was allocated to parts of the study area.
- This "Chance Find Protocol" must be included in the EMP of the Project and a reasonable budget must be allocated to ensure compliance with the legal

responsibility of the developer in terms of the proper conservation of and storage of Palaeontological Heritage.

- NCHRA and SAHRA must be informed of the content of this “Chance Find Protocol” and EMPr arrangements by the PEM and the Developer, for inclusion in the ROD for the Project.
- **Following the desktop survey, it is the professional opinion of Dr Gideon Groenewald, accredited palaeontologist, that NO FURTHER MITIGATION for Palaeontological Heritage is required at this stage, but that a Phase 1 survey is essential during prospecting, specifically where parts of the development is underlain by moderately sensitive alluvium/colluvium.**