

Proposed electrification project within Taung Skull buffer zone in Buxton (Norlim), North West Province

PALAEONTOLOGICAL IMPACT ASSESSMENT

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1. Introduction

The palaeontological heritage of South Africa is unsurpassed and can only be described in superlatives. The South African palaeontological record gives us insight in *i.a.* the origin of life, dinosaurs and humans. Fossils are also used to identify rock strata and determine the geological context of the geological formations and the chronostratigraphy of Southern Africa.

The first evidence of tectonic plate movement was discovered after studying the distribution of Karoo-age fossils in South Africa and other continents and subcontinents such as India, Antarctica, South America and Australia. Fossils are also used to study evolutionary relationships, sedimentary processes and palaeoenvironments.

South Africa is probably best known palaeontologically for having more than half of all the hominin specimens in the world, the greatest variety of hominins in a country and the longest record of continuous hominin occupation in the world.

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 which may be impacted by the proposed development.

2. 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 regulation 28 of the National Environmental Management Act (No. 107 of 1998) Regulations on Environmental Impact Assessment. 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.

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

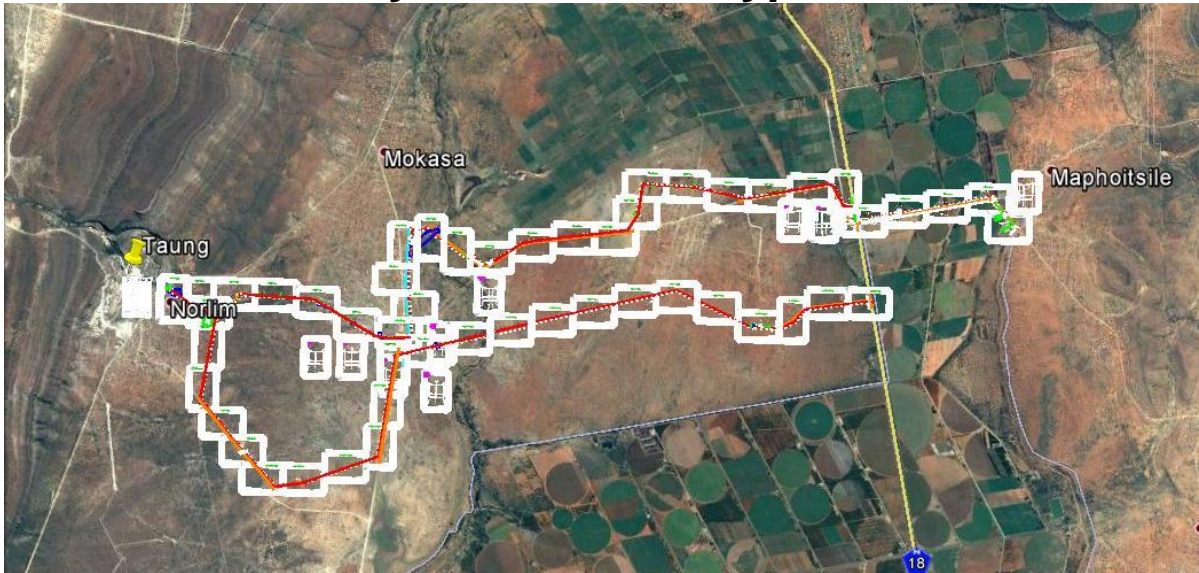
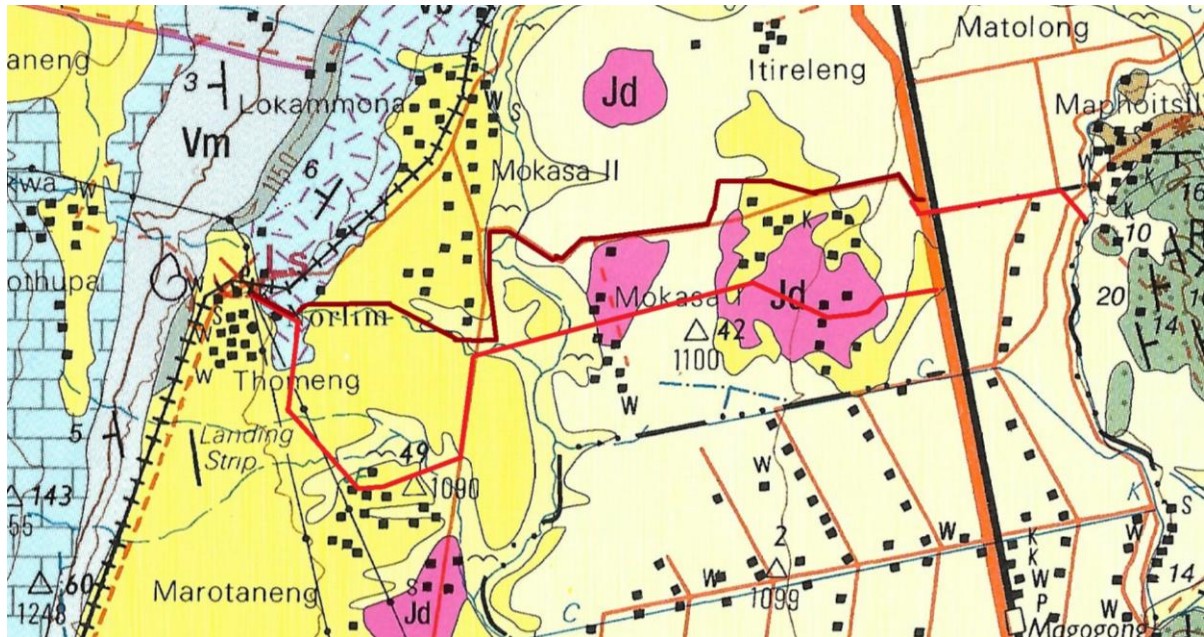


Figure 1: Google Earth photo indicating the study areas (the Taung fossil site is indicated with the yellow pin)

Geomorphologically the study area lays on a flat area flanked by a low escarpment in the west. The study areas lay north of the Vaalharts Irrigation Scheme. Farms and the villages of Matolong, Rooiwal and Taung lay to the north of the study area. The famous Taung fossil site is situated less than a kilometre west from the proposed development (see Fig.1).

The site was visited and the relevant literature and geological maps for the region in which the development is proposed to take place, have been studied for a Palaeontological Impact Assessment.

4. Geological setting of the study area



[The study areas are indicated by the red lines]

Figure 2: Geological Map of the study area and surroundings (adapted from the 2724 CHRISTIANA 1:250 000 Geology Map, Council for Geoscience, 1994)

GEOLOGICAL LEGEND

	Lithology	Formation	Group	Age
	Alluvium			Recent – Quaternary
	Aeolian sand			Quaternary
	Calcrete			Tertiary
	Dolerite			Jurassic
	Dolomite, limestone and chert, interbedded shale	Reivilo Formation of the Campbell Rand Subgroup	Ghaap Group of the Griqualand West Supergroup	Vaalian
	Dolomite with stromatolitic limestone	Monteville Formation of the Campbell Rand Subgroup		
	Shale, siltstone with interbedded dolomite	Clearwater Formation of the Schmidtsdrif Subgroup		
	Oolitic and stromatolitic dolomite, interbedded with quartzite, shale and flagstone	Boomplaas Formation of the Schmidtsdrif Subgroup		
	Carbonate rocks with chert layers, conglomerate, sandstone and tuffaceous sediments	Rietgat	Platberg Group of the Ventersdorp Supergroup	Randian

The study site is largely situated on alluvium and aeolian sand of Quaternary age and calcrete of Tertiary age. The central portion of the two lines runs partly over dolerite.

The calcrete of the study area form part of a much larger layer of calcrete that was set down on the Ghaap Plato. This calcrete layer formed when lime-rich groundwater moved up through fractured and crumbling rocks and set down as calcium carbonate during the Tertiary (Schutte, 1994).

Large parts of the study area and surroundings are covered by Quaternary aged aeolian sand. Alluvium was set down over the aeolian sand adjacent to the rivers in the region.



Figure 3: The Norlim Substation looking south (27°37.263' S, 24° 38.407 E')

Approximately 500m of the western extremity of the proposed development runs from the Norlim Substation over the oolitic and stromatolitic dolomite of the Boomplaas Formation of the Schmidtsdrif Subgroup of the Ghaap Group of the Griqualand West Supergroup (see Figs. 3 & 4).



Figure 4: The area east adjacent to the Norlim Substation

The Boomplaas Formation consists of dolomite interbedded with quartzite, shale and flagstone. All varieties of pure limestone to pure dolomite occur in this formation. The dolomite is dark grey but erode to a brownish red colour while the limestone weathers to a blue-grey colour (Schutte, 1994). The dolomite changes from argillaceous in the south (where the study area is situated) to oolitic and stromatolitic in the north (Beukes, 1979).

5. Palaeontological heritage of Taung



Figure 5: The Taung Skull (Illustration: JF Durand)

The Taung Skull Fossil Site was declared as a National Heritage Site in 2002. It was inscribed on the World Heritage List (WHL) by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 2005. It forms part of the Cradle of Humankind World Heritage Site (WHS), together with Sterkfontein, Swartkrans, Kromdraai and Environs, and the Makopane Valley fossil hominid sites in South Africa.

According to the Government Gazette (No. 29352 10 November 2006) the: “Taung Palaeoanthropological Fossil Site is the type locality for the early hominin, *Australopithecus africanus*, as this was the first site in the world where this species was found. The find, a fossilized skull and lower jaw of a young individual with some human-like characteristics [Taung child skull], was discovered in 1924 in the Buxton Limestone quarry. Raymond Dart, of the University of the Witwatersrand, who identified the fossil, recognized its importance in understanding our early human ancestors and their relatives in Africa. Similar early hominid fossils are now known from Sterkfontein, the Makapan Valley Limeworks site, possibly at Gladysvale and sites in East Africa. No further hominid fossils were found at Taung because mining destroyed the deposits. The associated animal bones, especially baboons, from the Thabasikwa tufa date the fossil between 2.4 and 2.8 million years old. The area has other important features including stromatolites, stone age sites, historical sites, as well as traditional ties to the land”.

No fossils were reported from the study area which lays to the east of the Taung Skull fossil site. No fossils were found during the site inspection.

References:

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

Beukes, N.J. (1979) Litografiese onderverdeling van die Schmidtsdrif Subgroep van die Ghaap Groep in Noord-Kaapland. Verh. geol. Ver. S. Afr. 82:313-327.

Council for Geoscience (1994) 2724 Christiana 1: 250 000 Geology Map.

Government Gazette (No. 29352 10 November 2006) Taung Palaeoanthropological Fossil Site.

Schutte, I.C. (1994) Die geologie van die gebied Christiana. Council for Geoscience.

6. Conclusion and recommendations:

The study area is considered to be low in palaeontological sensitivity despite its proximity to Norlim Limestone Mine where the Taung skull was found. There is a low likelihood that the Quaternary alluvium and aeolian sand and Tertiary calcrete may contain fossils. Elsewhere rare fossils of ostrich egg shells, mollusc shells, isolated bones, root casts, burrows and termitaria were found in Quaternary deposits (Almond & Pether 2008) and the possibility of finding similar fossils in the area cannot be excluded.

In the unlikely event of fossils being discovered in the sands, soils, calcrete or limestone in the study area, the CEO should follow the instructions below. Although disturbed fossils should be collected and stored safely until it can be inspected by a palaeontologist, no attempt should be made to remove such accidentally discovered fossils from the rock by an unqualified person.

It is unlikely that stromatolites may be exposed during excavations in the rocks of the Boomplaas Formation in the 500 m section adjacent to the Norlim Substation. Although stromatolites are considered to be fossils, there are hundreds of square kilometres of stromatolites in South Africa and it is not considered to be so scarce that every stromatolite has to be preserved. In the event of the discovery of an exceptional stromatolite formation it is advised that it should on principle not be destroyed if an alternative position for the placing of the pylon can be found.

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.

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



Palaeontological specialist:

Dr JF Durand (Sci. Nat.)

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

Experience:

- Urban development in Cradle of Humankind World Heritage Site (Gauteng):
Letamo, Honingklip, Windgat, Sundowners, Ekutheni
- Urban development at Goose Bay, Vereeniging, Gauteng
- Urban development on Portions 98, 99, 179, 236, 284 and 364 of the farm
Waterkloof 306 JQ, Rustenburg, North West Province
- Upgrade of R21 between N12 and Hans Strydom Drive, Gauteng
- Vele Colliery, Limpopo Province
- De Wildt 50 MW Solar Power Station, Gauteng
- 10 MW PV Plant Potchefstroom, North West Province
- Omega 342 50MW Solar Power Station, Viljoenskroon, Free State
- Springfontein wind and solar energy facility, Free State
- Solar power plant, Bethal, Mpumalanga
- Diamond mine on Endora, Limpopo Province
- Development at Tubatse Ext.15, Limpopo Province
- Manganese mine south of Hotazel, Northern Cape
- Wind energy facility at Cookhouse, Eastern Cape
- Energy facility at Noupoot, Northern Cape
- Fluorspar mine near Wallmannsthal, Gauteng
- ESKOM power line, Dumo, KwaZulu-Natal
- ESKOM Gamma-Omega 765KV transmission line, Western Cape
- ESKOM 44KV power line at Elandspruit near Middelburg, Mpumalanga
- ESKOM Makopane Substation, Limpopo Province
- ESKOM Platreef Substation and power lines to Borutho MTS Substation,
Limpopo Province
- Solar energy facility at Prieska, Northern Cape.

- Marang B - a 3 x 500MVA 400/132kV Main Transmission Substation east of Rustenburg, North West Province
- Upgrading of storm water infrastructure in Valencia, Addo, Eastern Cape
- Development of a 10 MW Solar Energy facility on the Farm Liverpool 543 KQ Portion 2 at Koedoeskop, Limpopo Province
- Development of a fluorspar mine at Wallmannsthal, North of Pretoria
- Extension of limestone mine on the farms Buffelskraal 554 KQ Portion1 and Krokodilkraal 545 KQ, Limpopo Province
- Lesego Platinum Mine, Sekhukhune Area, Steelpoort, Limpopo Province
- Mine at Hotazel, Northern Cape
- Pollution control dams at Transalloys in Clewer, Emalahleni, Mpumalanga
- Erection of spill points on the Farm Kwikstaart 431 KQ Portion 2, Thabazimbi, Limpopo Province
- Construction of dam at Ethemba, Swaziland
- Construction of bridge at Busingatha, KwaZulu Natal
- Water Reticulation System - Kei Road and Berlin General, Eastern Cape
- Development at Kromdraai, COHWHS (Portion 26 of the Farm Kromdraai, West Rand Municipality)
- Construction of Nhlezi Bridge, KwaZulu Natal
- Erection of spill point and dam on the Farm Faure 72 KQ Portion 8, Makoppa near Thabazimbi, Limpopo Province
- Colliery on the Farm Goedeheop near Piet Retief, Mpumalanga
- Erection of spill points on the Farm Diepwater 302 KQ Portions 4 -8 near Thabazimbi, Limpopo Province
- Construction of 2 MW photovoltaic power plant on the farm De Hoek 32, Pixley ka Seme District Municipality, Northern Cape Province
- Road upgrade near Magogo, KwaZulu/Natal
- Construction of haul road & waste dump: Lylyveld, Sishen, Northern Cape
- Construction of 4 weirs and a road culvert on Portion 3 of the Farm Roodekrans 133JT, Dullstroom Area, Mpumalanga
- Construction of a solar energy facility on Blaubospan near Groblershoop, Northern Cape
- Construction of road from Macengeni to Macijo, KwaZulu/Natal
- Construction of the John Taole Gaetsewe school and hostels in Dithakgong, Northern Cape
- Development at Duduza Township, Gauteng
- Construction of roads near Ndanyana KwaZulu/Natal
- Development of colliery on the farm Goedeheop near Piet Retief, Mpumalanga
- Construction of Tiger Solar power plant near Windsorton, Northern Cape
- Development of Amandelbult Open Cast Mine near Thabazimbi, Limpopo
- Development at The Shed in the Cradle of Humankind World Heritage Site
- Development of 800 ha dry lands on Farm Hoylesdale 163 KQ portion 1, Makoppa, Thabazimbi Local municipality, Limpopo Province

- Construction of solar energy facility on Blauwpospan near Groblershoop, Northern Cape.
- Development of the Doornhoek Fluorspar Mine near Zeerust, Northwest.
- Development on the Farm Haakdoringdrift, 373 KQ Portion 3, Thabazimbi, Limpopo Province.
- Development of bulk sewer line, Motherwell, Eastern Cape.
- Erection of spill points on the Farm De Hoop, Koedoeskop, near Thabazimbi, Limpopo Province.
- Development of orchards on the Farm Kromdraai, near Thabazimbi, Limpopo Province.
- Upgrade of Section 3 and Section 4 of the National Route R75, Eastern Cape.
- Construction of Concentrated Power Plants at Olyvenhout Drift, Upington, Northern Cape.
- Borrow pit at New Payne in Mthatha, Eastern Cape.
- Borrow pit for rural road to Centuli Clinic, Eastern Cape.
- Juno Gromis 400kV power line (West Cape and North Cape).
- Barberton IAPS Waste Water Treatment Works, Barberton, Mpumalanga.
- Development of orchards on the Farm Kromdraai, Thabazimbi, Limpopo Province.
- Erection of spill points on the farm Knoppieskop, Limpopo Province.
- Development at O.R. Tambo International Airport, Gauteng.
- Development at Erasmus Park (Waterkloof 378 JF), Pretoria, Gauteng.
- Development on Portion 12 of the Farm Tregaron in the Sundays River Municipality, Eastern Cape
- Development of spill points and dam on the Farm Fairfield 306 KQ, Makoppa near Thabazimbi, Limpopo Province

Palaeontological research:

- Gauteng: Wonder Cave
- KwaZulu/Natal: Newcastle, Mooi River, Rosetta, Impendle, Himeville Underberg, Polela & Howick Districts, Sani Pass
- Eastern Cape: Cradock District, Algoa Basin
- Western Cape: Clanwilliam District
- Free State: Memel & Warden Districts
- Limpopo Province: Nyalaland (KNP), Vhembe Reserve, Pont Drift
- Zimbabwe: Sentinel Ranch, Nottingham