Palaeontological Impact Assessment for Proposed Continuous Ash Disposal Facility for the Matimba Power Station in Lephalale, Limpopo Province

Phase 2 – site visits

for

Royal HaskoningDHV

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Summary

Two alternative sites have been proposed for the continuous ash disposal facility for Matimba Power Station..:. Both alternative sites were visited as well as the proposed route for the conveyor belt. No fossils were found on any of the farms or areas surveyed by a professional palaeontologist. The area has almost no relief and is covered by deep Kalahari sand and bushveld vegetation (mature trees, shrubs and little grass). As far as the palaeontology is concerned both alternates can be utilized for the proposed continuous project.

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Background

As requested by Royal HaskoningDHV, on behalf of Eskom here is a quotation to carry out a palaeontological impact assessment for the above project. There are two alternatives for this project: Alternative 1 (blue polygon to the southeast of Matimba) is deemed by SAHRA (CaseID 2195) to be moderately and Alternative 2 (red polygon to the northeast of Matimba) and the conveyor route are considered to have a high to very high sensitivity and a site visit is requested by SAHRA.

Included in the development are the following types of infrastructure:
• Conveyor system for ash transportation
• Drainage system
• Site office
• Workshop
• Contractors' yard
• Water supply pipelines, for ash/dust suppression
• Ash water return dams
• Storm water control dams (these will be constructed as per the GN 704 of the National Water Act (No. 36 of 1998)
• Storm water control berms
• Access roads to, on and around the facility. These roads include temporary roads during construction and permanent roads during the operation.
Ash disposal site – The design of this site will be dependent on aspects such as the results of the ash classification study, topography, etc.

In accordance with the national legislation (National Heritage Resources Act (Section 25 of 1999) the sites to be developed must be assessed for the occurrence of any palaeontological material. If any fossils are likely to be present then their importance and rarity must be gauged and if they are important then plans must be put in place to remove the fossils (under a SAHRA permit and housed in an recognized institution), protect them and/or divert the proposed construction.

Extract from SAHRA Case ID 2195

"No palaeontological assessment was undertaken for this project. According to the SAHRA fossil sensitivity map, Alternative 2 and the conveyor route is situated in an area that has a high to very high fossil sensitivity. A field based palaeontological assessment would be required before authorisation is granted for this alternative. Alternative 1 is located in an area of moderate sensitivity; a desktop assessment is required and dependent on the results of this, a field assessment may be necessary.

"Comment:
SAHRA has reviewed the Final Scoping Report and Heritage Assessment and recommends the following:
1. SAHRA requests that the heritage impact assessment is revised in the light of the heritage sites highlighted in Figure 14 and 32 of the Scoping Report. The impact that the proposed Alternative 1, 2 and the conveyor belt will have on these sites must be clearly explained in the assessment.
2. A palaeontological desktop assessment be undertaken for Alternative 1. If the paleontologist deems it suitable, a letter of exemption may be submitted to the heritage authority suggesting that no further palaeontological studies are necessary.
3. A palaeontological impact assessment be undertaken for Alternative 2 and the related conveyor belt.

4. If Alternative 2 is preferred for the ash disposal facility, a palaeontological field assessment will be required and must be submitted to SAHRA for commenting before authorisation is granted. The field assessment must include the proposed conveyor route alignment."

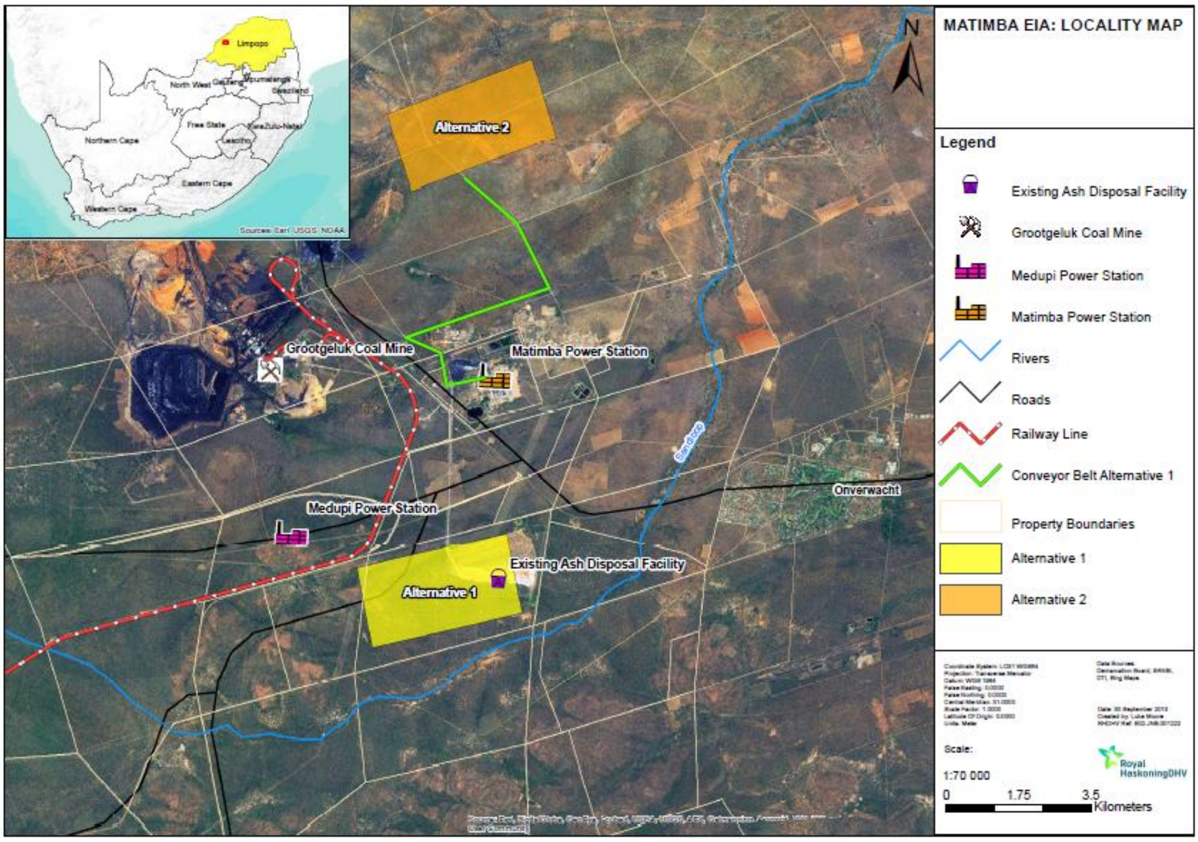

Figure 1: Map showing the two alternative proposed sites for the continuous ashing plant at Matimba, Limpopo. Map supplied by Prashika Reddy of Royal HaskoningDHV. Alternative 2 (northern site in red) is considered to be highly or very highly sensitive as far as palaeontological deposits are concerned. Alternative 1 (southern blue area) is considered to be moderately sensitive.

Methods

The published geological and palaeontological literature, unpublished records and databases were consulted to determine if there are any records of fossils from the sites and the likelihood of any fossils occurring there.

Geology and Palaeontology

According to the maps by the Geological Survey, the site lies in the undifferentiated Permian and Triassic deposits, with very old rocks to the south and east of Lephalale (Figure 2, Table 1). From more detailed studies of the coal deposits in South Africa (Snyman 1998) the Grootgeluk Mine lies on the edge of the Ecca deposits, adjacent to Beaufort Group sediments (Figure 3). Both Alternative 1 (south, blue polygon) and Alternative 2 (north, red polygon) most probably lie on the edge of the Ecca sediments or within the Ecca sediments with the Waterberg Group formations, Sandriviersberg and Mokalakwena (Msm), further south (Figure 3). However it is not clear from the literature where the boundary is. Imprints of fossil leaves from this area are mentioned by Johnson *et al.*, (2006) but no references are given. The palynology has been studied by MacRae (1988) and correlated with that from the Pafuri Basin.

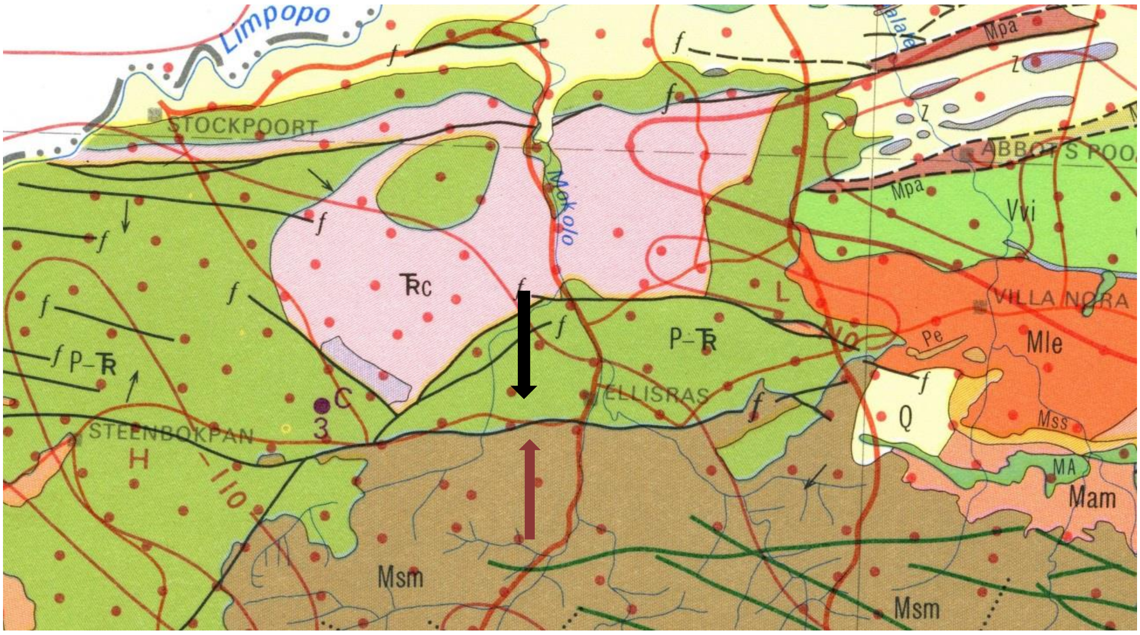

Figure 2: Geological map of northwestern Limpopo showing the proposed area for the Matimba continuous ashing project to the west of Lephalale (Ellisras). Arrows show Alternative 1 (southern, medium sensitivity) and Alternative 2 (northern, high to very high sensitivity). Abbreviations of the rock types are explained in Table 1. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 1: Explanation of symbols for the geological map in Figure 2, and approximate ages from the references: Barker *et al*., 2006; Cawthorn *et al*., 2006; Johnson *et al*., 2006.

Symbol	**Group/Formation**	**Lithology**	**Approximate Age**
Q	Quarternary	Alluvium, sand, calcrete	Last ca 20 Ma
Trc	Clarens Formation	Sandstone, siltstone	Upper Triassic-Jurassic ca 220-180 Ma
P-Tr	Undifferentiated Permian and Triassic	Shale, sandstone, mudstone, coal	Ca 300-200 Ma
Msm	Sandriviersberg and Mokalakwena Fms, Kransberg Subgroup, Waterberg Group	Sandstones, conglomerates	1700-2000 Ma
Mam	Aasvoëlkop and Makgabeng Formations, Matlabas subgroup, Waterberg Group	Sandstones, mudstones	1700-2000 Ma
Mle	Lebowa Granite Suite	Hornblende and biotite granites	>2000 Ma

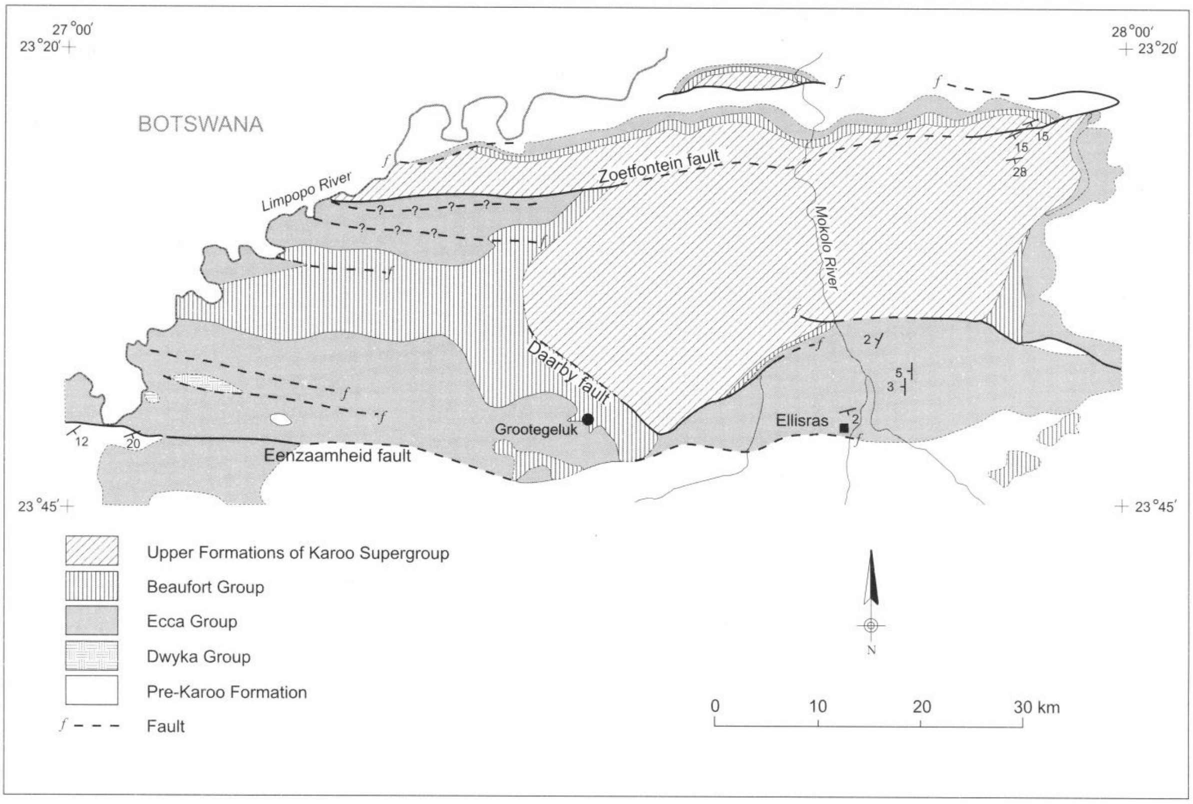

Figure 3: More detailed geological map of the area taken from Snyman, 1998 who based it on the unpublished MSc thesis of Botha, 1984). Grootgeluk is the name of the Exxaro Mine close to Matimba power station.

The Ellisras Basin is important economically for coal, especially the Grootgeluk Formation and interfingering Goedgedacht Formation, which are being mined by Exxaro for export and for the Matimba Power Station. It is also not clear how deep these coal and related shale layers (that would have well preserved leaves) are. If they are exposed at the surface then the fossils will have been badly weathered and of no palaeontological interest or value. Unless there are exploratory trenches or pits in the two sites, it will not be possible to evaluate the fossil potential.

Recommendation from SAHRA

Since fossil leaves of the *Glossopteris* flora have been recorded from this area a site study is required. Both alternatives are within close proximity so both should be investigated on the same visit. However it is critical to have the potentially fossiliferous layers exposed in order for them to be assessed by a palaeontologist.

Site visits

Southern site (blue polygon – Alternative 1 – medium sensitivity)

A site visit was conducted on 18 December 2014. The dump here is active and the area was cleared of vegetation and the adjacent still vegetated extension site.

The area has very little relief, no outcrops and no river cuttings. The soil is deep Kalahari sand with large, mature trees dominated by *Sclerocarya birrea* (marula), *Terminalia sericea, Acacia nigrescens, Acacia erioloba, Grewia flava* and *Grewia flavescens*, plus many others (Figure 4). Areas that had had the topsoil and vegetation removed revealed more deep sand and some patches of small gravel

(Figure 4d). No rocks and no fossils were found. According to the engineer and based on drill cores, the ash dump sites are not over coal deposits.

Northern site – (red polygon – Alternate 2 – high sensitivity)
On Friday 16 January 2015, the following farms were visited Vooruit 449 LQ, Appelvlakte 448 LQ and Nelsonskop 445 LQ. Then Mr Louis Grobler's assistant unlocked gates for me to access Droogeheuvel 447 LQ. Finally Mr Louw Swanepoel provided access to the farm Ganzepan 446 LQ.

<u>Vooruit 449LQ</u> – the southeast portion of this farm is almost flat with no relief, no rocky outcrops and no river cuttings. The deep Kalahari sand supports a dense vegetation of large, mature trees including, *Acacia karroo, Boscia albitrunca, Burkea africana, Combretum apiculatum, Dichrostachys cinerea* (locally dominant), *Terminalia sericea, Sclerocarya birrea* and shrubs of *Grewia flava* and tall grass cf *Digitaria eriantha*. Figure 5 shows typical views of the farm. No fossils were found.

<u>Applevlakte 448LQ</u> – the northeast portion of the farm has the same topography and vegetation as Vooruit (Figure 6). No fossils were found. Even from the vantage of a bit of height from the top of Nelsonskop kopjie no change in the topography or vegetation could be seen.

<u>Nelsonskop 445LQ</u> – the conveyer belt system is proposed to run along the southern and northeastern borders of this farm. Here the vegetation and topography are the same as the two farms to the north – almost flat, Kalahari sand and bushveld woody vegetation (Figure 7). No outcrops or fossils were found along this route. The vegetation here is the same as the other farms except it also has dense stands of *Spirostachys africana* (tamboti).

<u>Droogeheuvel 447LQ</u> – the northwestern part of this farm was surveyed (Figure 8). It has the same vegetation and almost flat topography as the others but there is some minor local relief where depressions have become wetlands (one natural one near the homestead and not part of the affected area, and one artificial within the area). This revealed deep Kalahari sands with a local thin layer of neoformed clay supporting sedges (*Cyperus laevigatus* and *Schoenoplectus cf limona*). Tracts of land have been cleared for agriculture and abandoned. The regrowth comprises *Tephrosia* sp.-dominated herbaceous vegetation or mixed grasses. Only saplings have recolonized the previously cleared tracts and some tracts also have large *Acacia erioloba* trees that were not removed. No fossils were found.

<u>Ganzepan 446LQ</u> – the southeastern part of the farm was surveyed (Figure 9). The topography and vegetation were the same as the other farms. *Terminala sericea* was the dominant tree; many small fenced paddocks for cattle were present, some very disturbed, others appeared unaffected. The farmhouse was derelict and abandoned but appears to be used for storage and occasional game hunting. No fossils were found on this farm.

Conclusion

There was no evidence of fossils on the southern site (Alternative 1) and no fossils on any of the farms of the northern site, including the boundary where the conveyor belt is planned to run (Alternative 2). There were no rocks, no rocky outcrops, shale or sandstones, only deep loose sand which is not suitable for the preservation of fossils.

Recommendation

As far as the palaeontological assessment is concerned BOTH alternatives are suitable for the proposed continuous ash disposal facility for Matimba power plant.

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Photographs from site visits

Figure 4 – Alternative 1 (blue polygon, southern). Site close to active continuous ash disposal site.

Figure 5 – Alternative 2 (red polygon) – Farm Vooruit

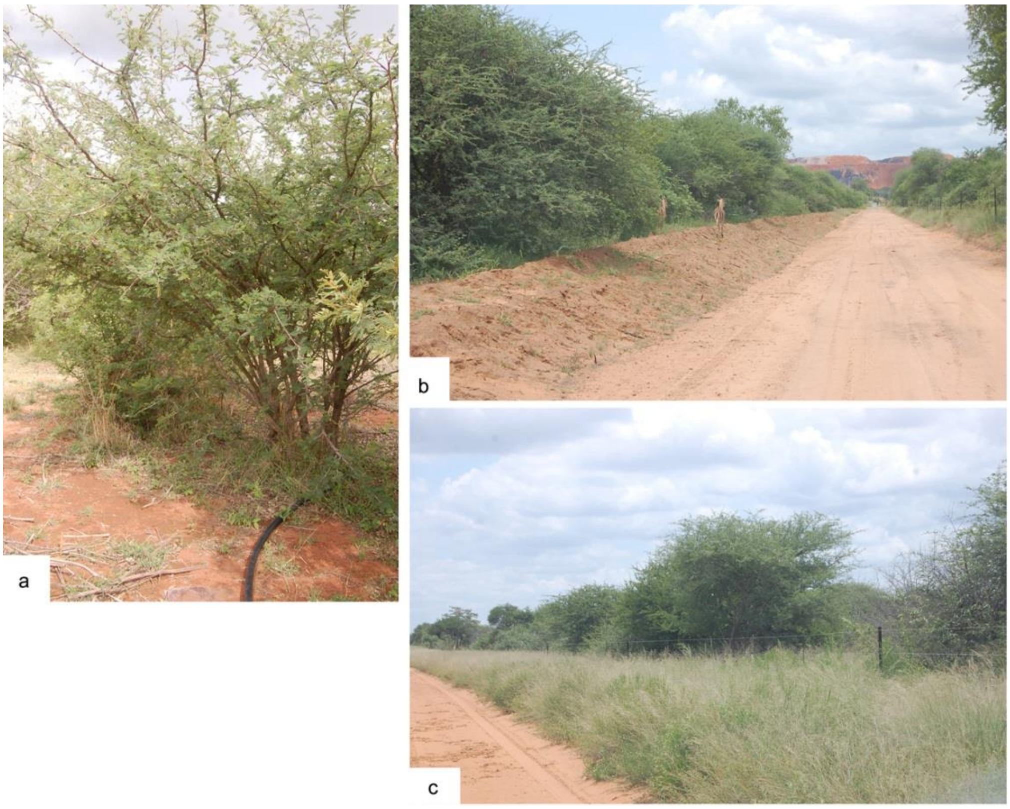

Figure 6 – Alternative 2 (red polygon) – Farm Appelvlakte

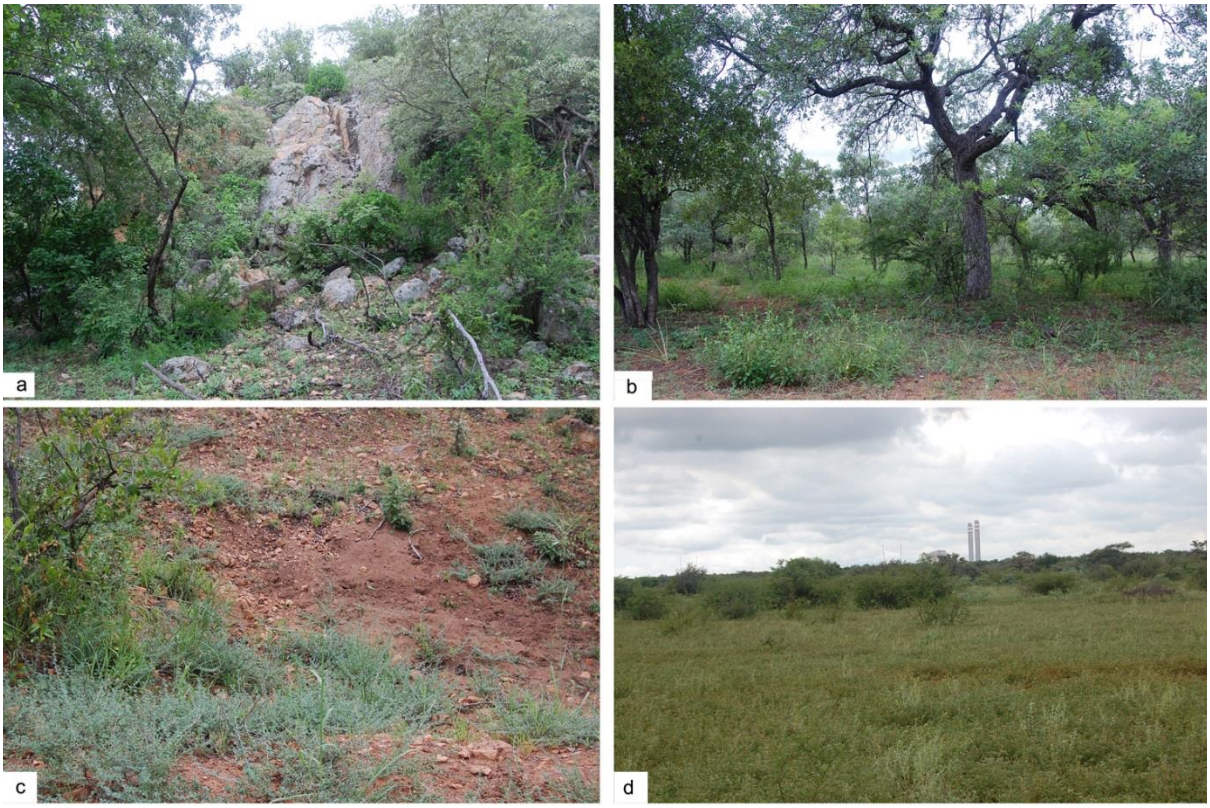

Figure 7 – Alternative 2 (red polygon) - Farm Nelsonskop

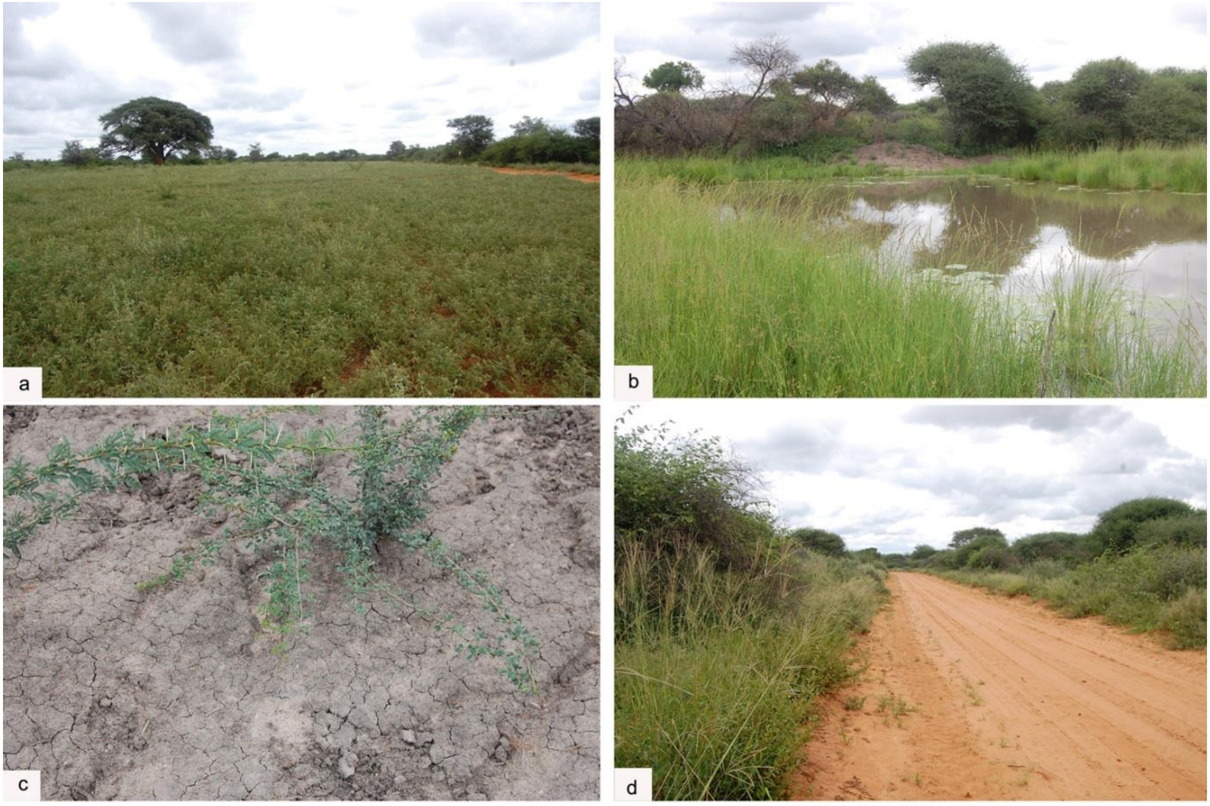

Figure 8 - Alternative 2 (red polygon) Farm Droogheuvel

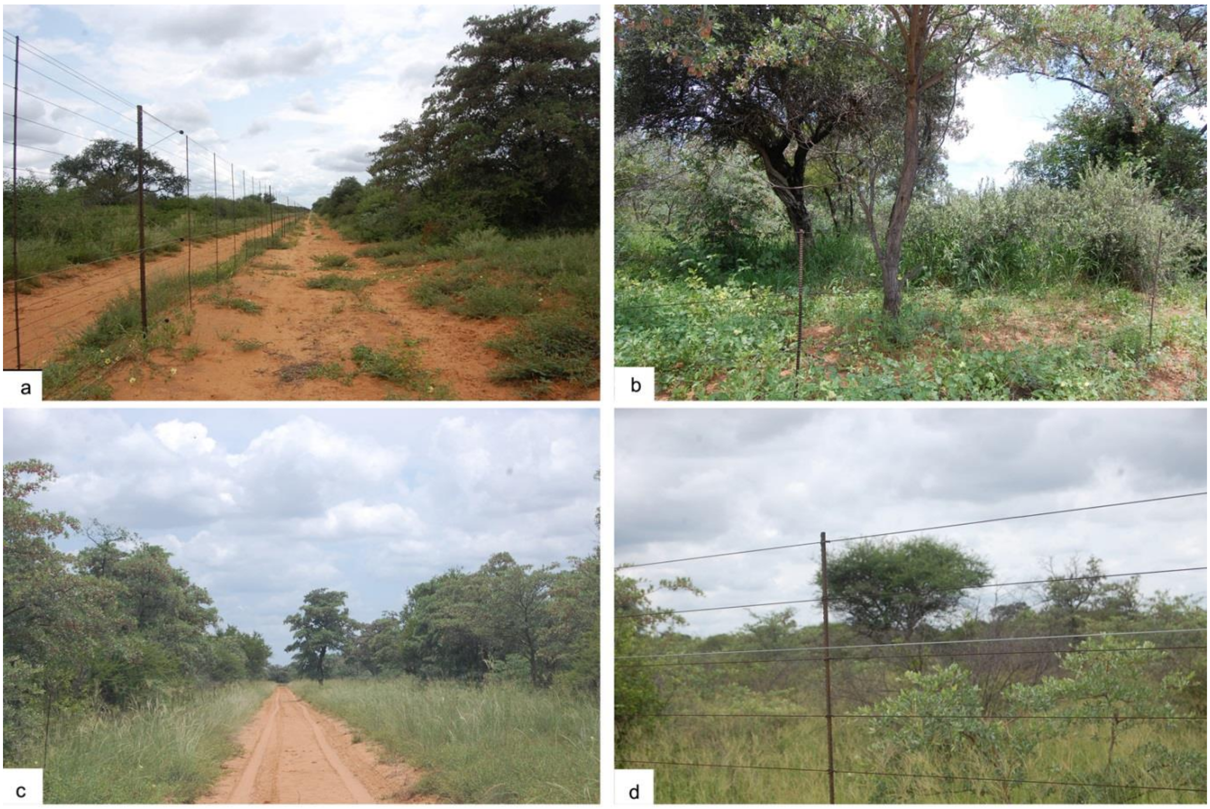

Figure 9 – Alternative 2 (red polygon) Farm Droogheuvel

Declaration of No Conflict of Interests

I, Marion Kathleen Bamford, declare that I have performed this Palaeontological Impact Assessment to the best of my ability and experience and hereby declare no conflict of interest between myself, Royal HaskoningDHV, Eskom, Exxaro or the local community.

Signed ………………………………………………………………… in Johannesburg on the 21st of January 2015.

Qualifications and Experience:
PhD, University of the Witwatersrand, 1990
Thirty years of research experience in Palaeontology, including field work in southern and eastern Africa, South America, Europe, Australia.
Twenty years of experience in Palaeontological Impact Assessments.
Published over 85 peer-reviewed journal articles, book chapters, scholarly works.
Presented my research at over 40 local and international conferences.