Palaeontological Impact Assessment for the proposed Mbali-Glencore pipeline, Mpumalanga Province

HCI4929

Site Visit Report

For

Digby Wells Environmental

19 March 2018

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Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford

Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf

Experience: 30 years research; 22 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Digby Wells, Johannesburg, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

Mbali Coal (Pty) Ltd propose to meet their coal processing water requirement by constructing a new water pipeline from the TWRP to the coal washing plant, i.e. between . the Mbali Colliery and Glencore Goedgevonden Coal Mine. The pipeline diameter will be 250 mm and the length will be 3.6 km, running alongside the R545 and the mines access road. The proposed servitude for the water pipeline will be 5m in width. The mine is located on Portions 16, 17, 20 and 31 of the farm Klippoortjie 32 IS, located in Emalahleni Local Municipality of the Mpumalanga Province.

The site lies on the shales, sandstones and coals of the *Vryheid Formation*, Ecca Group, Early Permian of the main Karoo Basin. Associated with the shales between the coal seams fossil plants of the *Glossopteris* flora would be expected. The water pipeline will run along or just into the surface soils. From the site visit there are NO fossils of any kind in the loose surface soils and the coal seams are at least 10 m below surface. As far as the palaeontology is concerned the project may proceed.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1. Background

The Project comprises an Environmental Authorisation Process in support of the construction of a pipeline between the Mbali Colliery and the Glencore Goedgevonden Mine, Mpumalanga. Mbali Coal (Pty) Ltd are proposing to meet their coal processing water requirement by constructing a new water pipeline from the TWRP to the coal washing plant. The pipeline diameter will be 250 mm and the length will be 3.6 km, running alongside the R545 and the mines access road. The proposed servitude for the water pipeline will be 5m in width. The mine is located on Portions 16, 17, 20 and 31 of the farm Klippoortjie 32 IS, located in Emalahleni Local Municipality of the Mpumalanga Province.

Digby Wells Environmental (Pty) Ltd have been appointed to undertake the Environmental Impact Assessment process in support of an Environmental Authorisation application, in terms of the National Environmental Management Act, No. 107 of 1998 (NEMA). To meet the requirements of section 38(8) of the National Heritage Resources Act, no 25 of 1999 a Heritage Impact Assessment (HIA) by their in-house specialist was submitted to SAHRA for commenting.

Du Piesanie, J. January 2018. Heritage Basic Assessment Report, Basic Assessment and Environmental Management Plan for the proposed pipeline from the Mbali Colliery to the Tweefontein Water Reclamation Plant, Mpumalanga Province.

The proposed pipeline is underlain by sandstones, shales and coals rocks of the Vryheid Formation and Volkrust Formation, Ecca Group, Karoo Supergroup, which is of Moderate to Very High palaeontological sensitivity. Potential fossils within this region consist of *Glossopteris* Flora and trace fossils. No impacts to the fossiliferous bedrock are foreseen by the proposed pipeline project. No surface heritage resources were identified along the proposed pipeline route therefore there will be no direct impacts to heritage resources. The author recommended a Chance Fossil Finds Procedure to be developed and implemented as a condition of authorisation. However the Interim Comment by SAHRA (CaseID: 12104) requests that a site visit be carried out by a professional palaeontologist.

The mine was visited by a professional palaeontologist on 14 March 2018 and the finds are presented here.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014)

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	Relevant section in report
Details of the specialist who prepared the report	Appendix A
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix A
A declaration that the person is independent in a form as may be specified by the competent authority	Page i
An indication of the scope of, and the purpose for which, the report was prepared	Section 1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 0
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4 Figure 2 and Figure 3
An identification of any areas to be avoided, including buffers	N/A
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
Any mitigation measures for inclusion in the EMPr	N/A
Any conditions for inclusion in the environmental authorisation	n/a
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	N/A
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	N/A

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	Relevant section in report
A description of any consultation process that was undertaken during the course of carrying out the study	N/A
A summary and copies if any comments that were received during any consultation process	N/A
Any other information requested by the competent authority.	N/A

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA inclusive of a site-visit and provide feasible management measures to comply with the requirements of SAHRA.
The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance;
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility; and
4. Determination of fossils' representatively or scientific importance to decide if the fossils can be destroyed or a representative sample collected.

3. Geology and Palaeontology

I. Project location and geological context

The Mbali Colliery and the Glencore Goedgevonden Mine are in the Witbank Coalfield and the coals are part of the *Vryheid Formation*. The predominant seams are numbered 1-5, lower to upper, with seams 2 and 4 generally thicker (Snyman, 1998). Typically the uppermost seam is 15-45 m below surface so the overburden has to be stripped away first for the opencast or strip mining operations. The proposed pipeline will run alongside the national road, R545, (from Ogies in the north, towards Kriel and Bethal in the south).

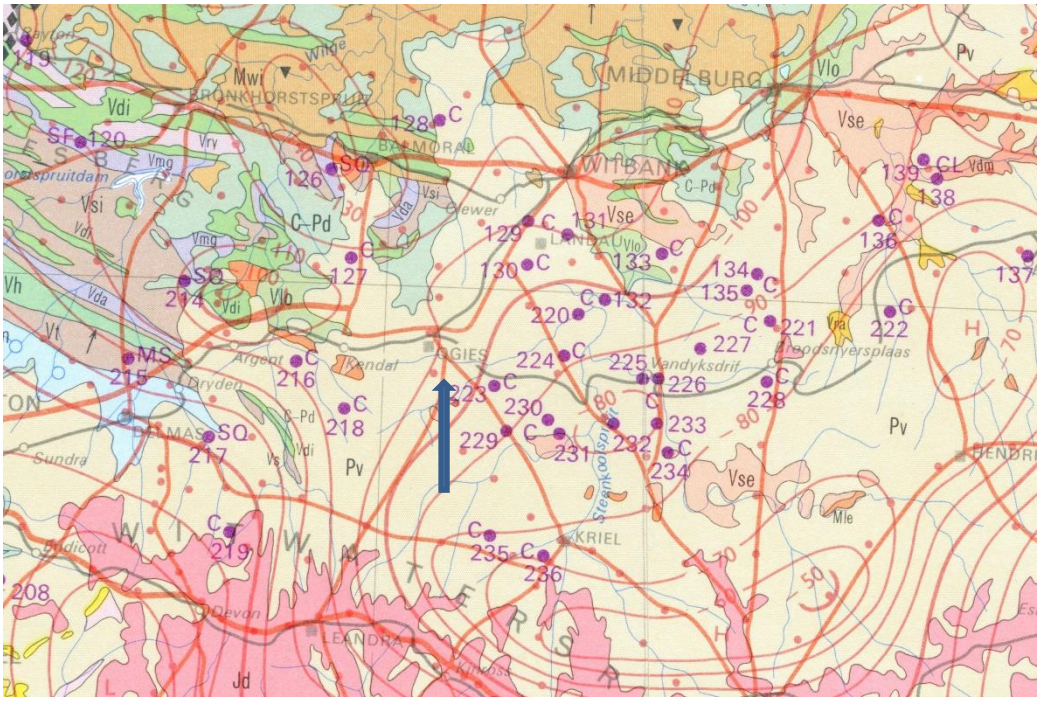

Figure 1: Geological Map of the Area around eMalahleni (Witbank) and Ogies

The site of interest, Mbali Colliery and the Glencore Goedgevonden Mine, are to the southwest of eMalahleni and south of Ogies, as indicated with the arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 2: Explanation of symbols for the geological map and approximate ages

Symbol	Group/Formation	Lithology	Approximate Age
Jd	Jurassic dolerite dykes	Dolerite	Ca 180 Ma
Pv	Vryheid Fm	Shales, sandstone, coal	Lower Permian, Middle Ecca
C-Pd	Dwyka	Tillite, sandstone, mudstone, shale	Upper Carboniferous, Early Permian 295-290 Ma
Vlo	Loskop Fm, Middleburg Basin	Shale, sandstone, conglomerate, volcanic rocks	Ca 2000 – 1700 Ma
Vse	Selons River Fm, Rooiberg Group, Bushveld Magmatic Province	Red porphyritic rhyolite	Ca 2061 - 2052 Ma

SG = Supergroup; Fm = Formation

(Buchanan, 2006; Erikssen et al., 2006. Johnson et al., 2006)

The other major rock formations in the region are the ancient volcanic rocks of the Rooiberg Group or the sedimentary rocks of the Loskop Formation but these are not being mined and do not occur along the road.

II. Palaeontological context

Although coal was formed from thick accumulations of plants in a swampy environment during the Permian, the coal itself is of no palaeontological interest because the plant matter has been compressed and altered by heat to such an extent that no material is distinguishable. In some settings fossil leaf impressions are preserved in the carbonaceous shales between the coal seams but these tend to be rare and very difficult to find. The expected flora is that of the Ecca *Glossopteris* flora comprising impressions of leaves, fructifications and scale leaves of *Glossopteris,* as well as a variety of ferns, lycopods, sphenophytes and ginkgophytes (Plumstead, 1969; Anderson and Anderson, 1985).

The palaeontological sensitivity of the area under consideration is presented in Figure 2.

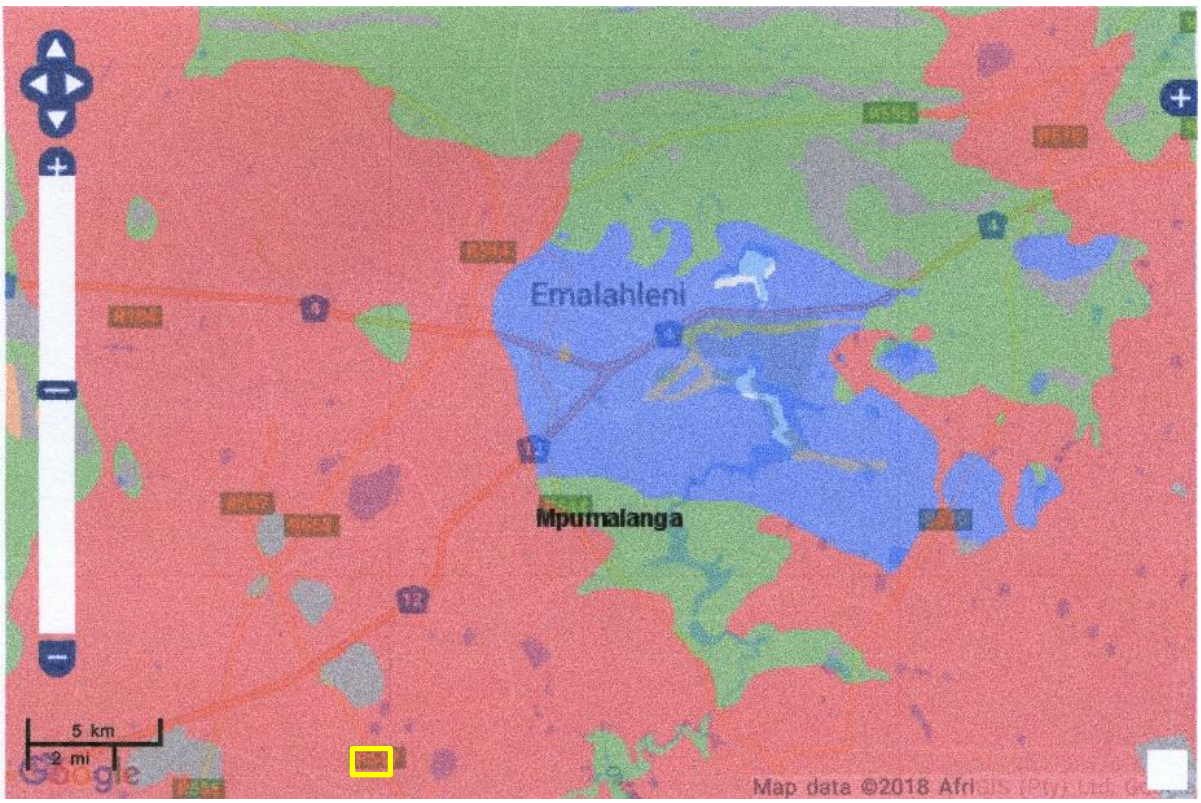

Figure 2: SAHRIS Palaeosensitivity Map for the Region around eMalahleni and Ogies

Mbali Colliery and the Glencore Goedgevonden Mine are shown within the yellow rectangular outline. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

III. Site Visit

Figure 3: Proposed route for the pipeline between Mbali and Glencore Goedgevonden Mine in pink

Several stops were made along the very busy road, the R545, along the east side to look for fossils where the pipeline could be constructed.

a. Stop 1 - just south of the flyover bridge at Glencore Goedgevonden Mine, where the water treatment facility is located; GPS: 26°06,017”S and 29°06,63”E (Figure 4a-d).

The road sides are highly disturbed by the road shoulders, the farm fences and at this stop the agricultural field was being mown for the grass. The soil was compacted and densely covered by weeds and grass. A shallow drainage ditch showed only soil to a depth of 0.5m.

b. Stop 2 – farther south along the R545. GPS 26°06,471”S, 029°06,827” E (Figure 5a-d)

The road sides are highly disturbed by the road shoulders, the farm fences and at this stop the field had a mature crop of mealies (Zea mays). The vegetation around this circular irrigated filed was mown grass. Between the road verge and the mealie field was a dilapidated fence and old road surface. Only soil was visible here and no shales or sandstones. No sediments potentially containing fossils were present.

c. Stop 3 – farther south along the R545. GPS: 26°07,71” S, 29°07,417” E (Figure 6a-d).

Alongside the road the soils was heavily vegetated but there was a narrow trench, about 40cm wide and 1m deep parallel to the road. The sol in the trench was only loose horizon a and b soil. No shales or sandstones were present in this section.

d. Stop 4 – farther south along the R545, past the turnoff to the west for Mbali Colliery. GPS 26°07,94”S, 29°07,52”E (Figure 7a-d).

The road side is highly disturbed all along this section and truncates a small pan that is thickly vegetated with grasses (*Eragrostis* spp.) and a sedge (*Cyperus denudatus*). Alongside the road are well-established weeds (*Bidens cosmos* and *Tagetes minuta*). The land surface has heavily compacted soil but no sandstones or shales.

e. West side of the road – along the proposed pipeline route (Figure 8a, b).

From the road it is possible to see current mining operations where the surface 10 m or more soils are removed and dumped. The uppermost coal seam is below this and is mined for coal. There are no fossils in the loose soils.

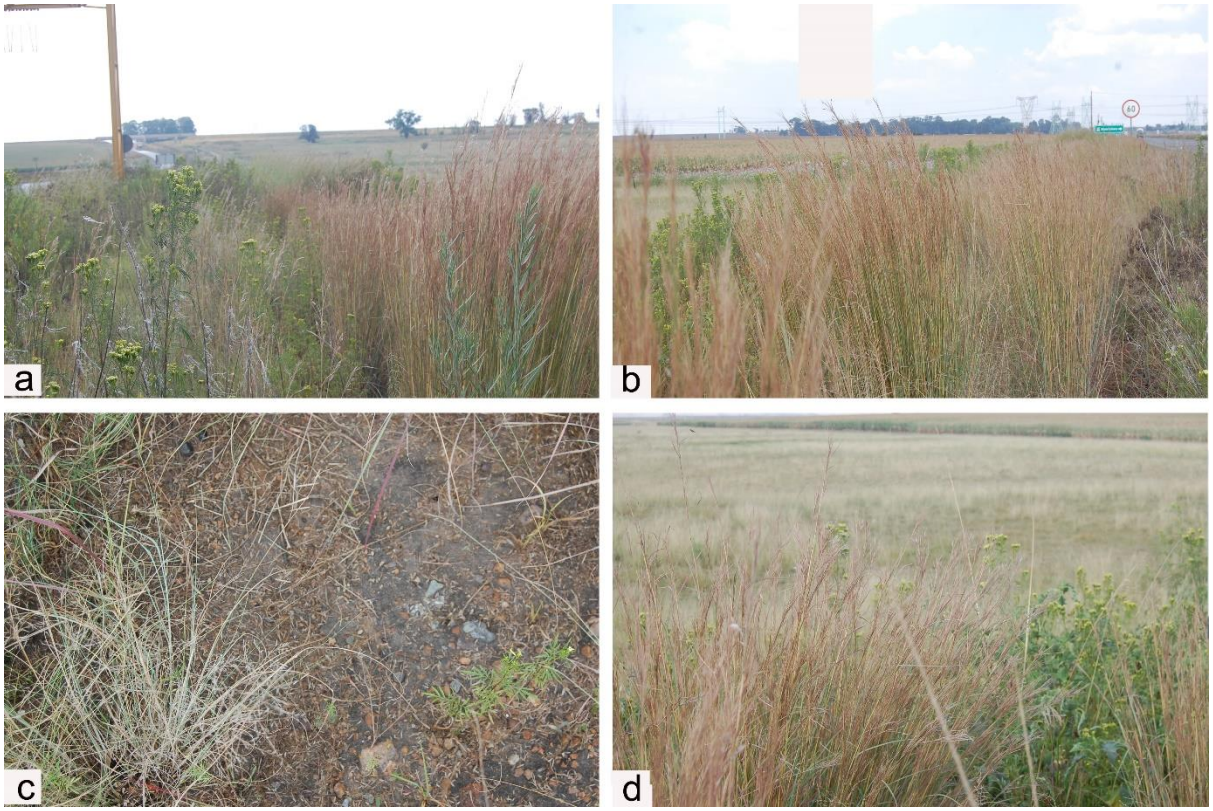

Figure 4: Photographs from Stop 1 close to the Glencore Goedgevonden waterworks

A – view looking north towards the waterworks to the right of the bridge. B - view to the south along the road. C – soil surface. C – view of the field to the east of the roads.

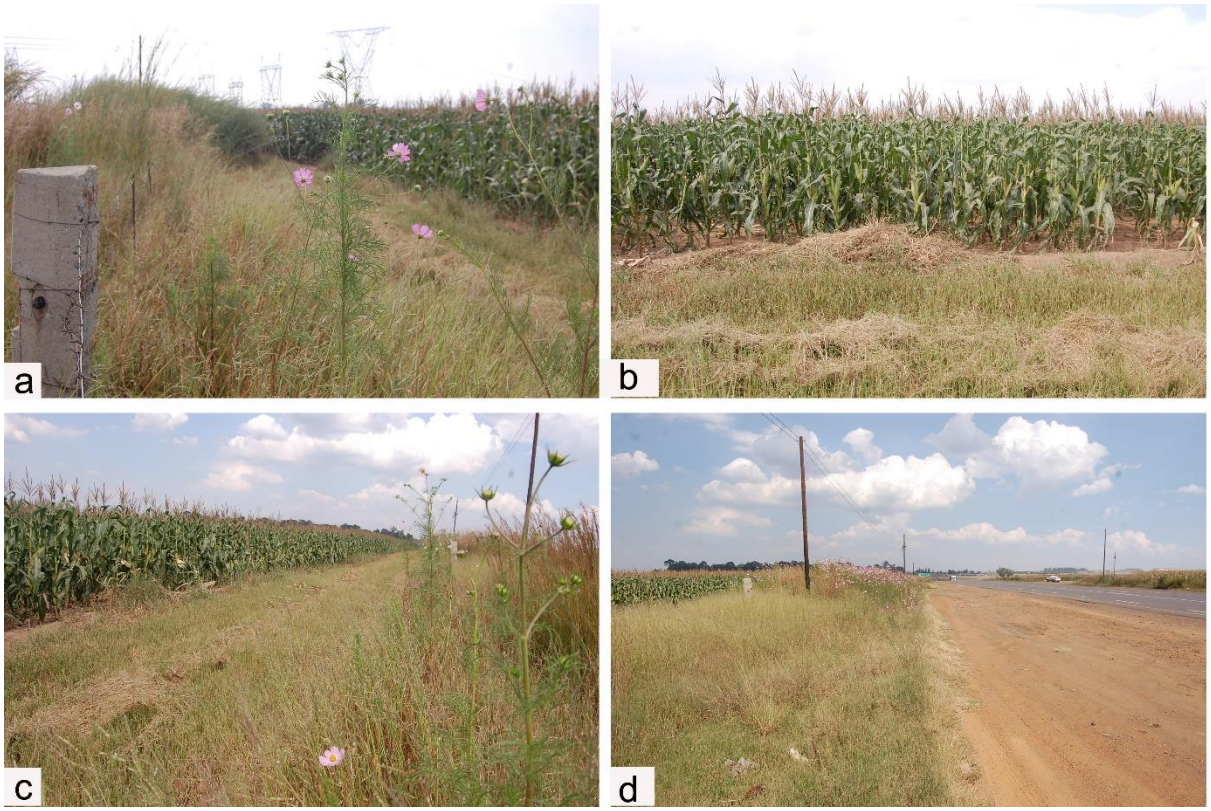

Figure 5: Photographs from Stop 2 mealie field along the R545.

A – View looking north parallel to the road. B – View to the east at right angles to the road. C – view southwards parallel to the road. D – view looking south along the road. Note the wide verge used by trucks for turning and the disturbed (weeds)

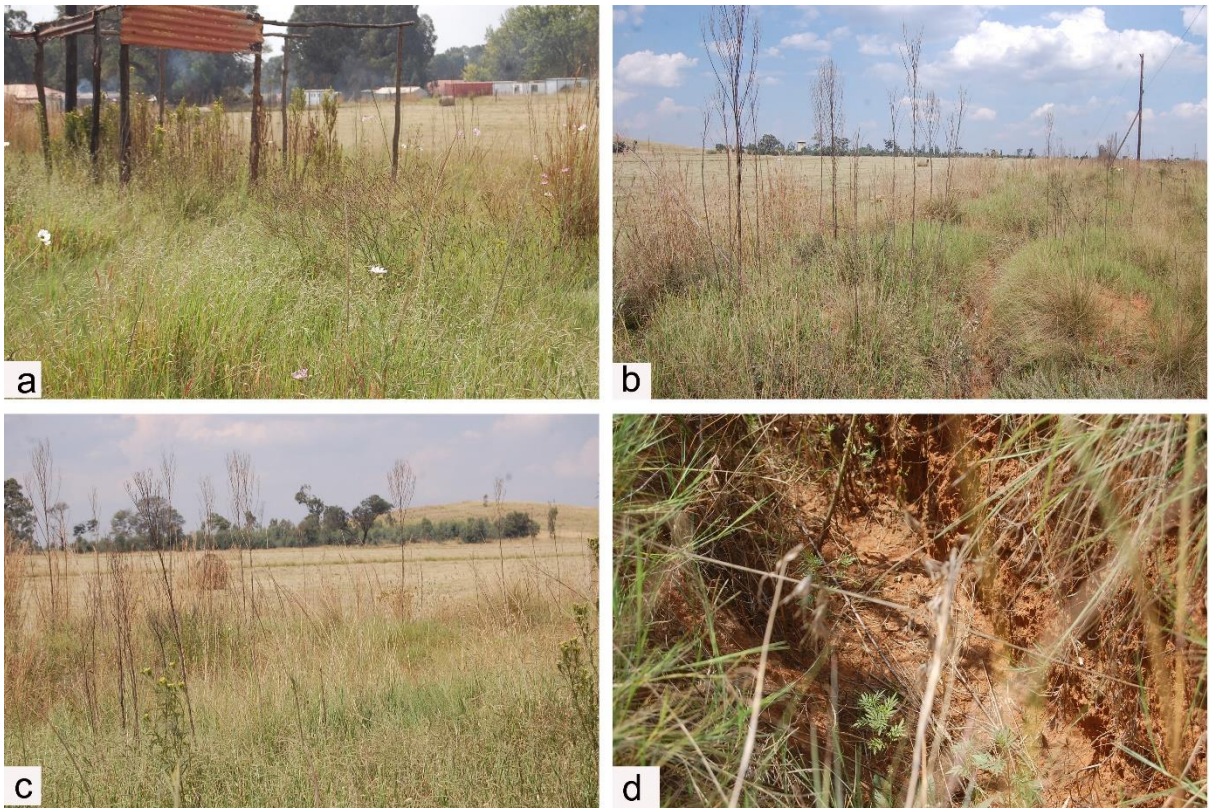

Figure 6: Photographs from Stop 3 with mown grass, along the R545.

A – view to the north along the road with temporary structures. B – view to the south along the road. Note the 1m deep trench that is partially hidden by grasses and dead weeds. C – view to the east away from the road. D – close up of the trench that runs parallel to the road with loose soil only.

Figure 7: Photographs of the east side of the road with mine workings

A – Area of active mining with topsoil dumps in the foreground and coally shale dumps in the background. B – draglines in the background and the coal seam, blow surface soils, is just visible in the cleft in the high ground.

4. Impact Assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3 and Table 4 below.

Table 3: Criteria for assessing impacts

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	H	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	L	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	L	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	H	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

Table 4: Impact Assessment

PART B: ASSESSMENT		
SEVERITY/NATURE	H	-
	M	-
	L	The chance of finding fossil plants would be low because the preservation is very poor and they are extremely rare. There would be minor deterioration of the surface of sites and a minor impact on any potential fossils. Therefore the SEVERITY/NATURE of the environmental impact would be low.
	L+	-
	M+	
	H+	-
DURATION	L	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	L	Since only the possible fossils within the area would be fossil plants such as leaf impressions and reproductive structures from the *Glossopteris* flora in the shales, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	H	-
	M	
	L	There is no chance of finding leaf fossils in the loose surface soils. Fossils would only occur in the shales that are below ground.

Three sections of along the road were thoroughly investigated and although it was heavily vegetated there were some exposures of soils – but no consolidated shales or sandstones. The water pipe will be along the surface or in shallow sediments so there is no chance of finding fossils for this aspect of the project.

It is the opinion of the professional palaeontologist (a palaeobotanist in this instance) that the proposed construction of a water pipe, and the 5m servitude, will not affect the

palaeontological heritage in any way. The project may proceed as far as the palaeontology is concerned.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and coals are typical for the country and do NOT contain fossil plant, insect, invertebrate and vertebrate material in the overlying sols. The shales of the lower Permian *Vryheid Formation* could contain impression fossils of plants of the *Glossopteris* flora that are recognisable and are typical of the South African fossil flora but these will not be affected by the laying of the pipeline.

Based on the site visit and experience only the loose surface soils will be affected and these do not contain fossils because of their friable and fragmentary nature. The underlying rocks could have the fossil plants in the shales between the coal seams but even then they would not be abundant.

6. Recommendation

Based on the site visit there are NO fossil plants, insects, traces or vertebrates in the loose surface soils. While there may be fossils associated with the shales and sandstones these will not be affected by the construction of a water pipeline along the highly disturbed road, the R545. This confirms the recommendation made in the earlier report by Digby Wells (HCI4929) that there would be no fossils in the surface soils along the R545, so the construction of the water pipeline between Mbali Colliery and Glencore Goedegevon Mine is recommended.

7. References

Anderson, J.M., Anderson, H.M., 1985. Palaeoflora of Southern Africa: Prodromus of South African megafloras, Devonian to Lower Cretaceous. A.A. Balkema, Rotterdam. 423 pp.

Barbolini, N., Bamford, M. K., Rubidge, B., 2016. Radiometric dating demonstrates that Permian spore-pollen zones of Australia and South Africa are diachronous. Gondwana Research 37, 241–251.

Du Piesanie, J. January 2018. Heritage Basic Assessment Report, Basic Assessment and Environmental Management Plan for the proposed pipeline from the Mbali Colliery to the Tweefontein Water Reclamation Plant, Mpumalanga Province.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

Plumstead, E.P., 1969. Three thousand million years of plant life in Africa. Geological Society of southern Africa, Annexure to Volume LXXII. 72pp + 25 plates.

Curriculum Vitae (Short) - Marion Bamford PhD

January 2018

I) Personal Details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor;
		Director of the Evolutionary Studies Institute.

Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-

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		marionbamford12@gmail.com

II) Academic Qualifications

Tertiary Education: All at the University of the Witwatersrand:

1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.

1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.

1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.

1986-1989: PhD in Palaeobotany. Graduated in June 1990.

III) Professional Qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):

1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps

1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer

1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

IV) Membership of Professional Bodies/Associations

Palaeontological Society of Southern Africa

Royal Society of Southern Africa - Fellow: 2006 onwards

Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

V) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
Honours	5	2
Masters	6	3
PhD	9	3
Postdoctoral fellows	5	3

VI) Undergraduate Teaching

Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

VII) Editing and Reviewing

Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Cretaceous Research: 2014 - Review of manuscripts for ISI-listed journals: 25 local and international journals

VIII) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC

IX) Research Output

Publications by M K Bamford up to January 2018 peer-reviewed journals or scholarly books: over 110 articles published; 5 submitted/in press; 8 book chapters.

Scopus h index = 22; Google scholar h index = 24;

Conferences: numerous presentations at local and international conferences.

X) NRF Rating

NRF Rating: B-2 (2016-2020)

NRF Rating: B-3 (2010-2015)

NRF Rating: B-3 (2005-2009)

NRF Rating: C-2 (1999-2004)