# Palaeontological Impact Assessment for the proposed sand mining operation farm Jannelsepan northeast of Louisvale, !Kai Garib Municipality, Northern Cape Province

**Desktop Study**

**For**

**Van Zyl's Blasting en Grondwerke CC**

**25 February 2018**

**Prof Marion Bamford**
Palaeobotanist
P Bag 652, WITS 2050
Johannesburg, South Africa
Marion.bamford@wits.ac.za

# 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 Van Zyl's Blasting en Grondwerke CC, 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

Van Zyl's Blasting en Grondwerke CC approached the palaeontologist to conduct a desktop Palaeontological assessment for the proposed sand mining site along the Donkerhoekspruit on the farm Jannelsepan, north east of Louisvale, !Kai Garib Municipality, Northern Cape.

The proposed mining area lies on Kalahari sands and ancient volcanic and plutonic rocks of the Namaqua-Natal Province and in particular the Jannelsepan Formation migmatitic amphibolites and calc-silicates and the amphibolites of the Dagbreek Formation. These rocks are too old for body fossils and of the wrong type, being igneous. The sand to be mined is alluvial and would not contain fossils either. As far as the palaeontological heritage is concerned the project can continue and no further assessment is required.

# Table of Contents

# 1. Background

Van Zyl's Blasting en Grondwerke CC approached the palaeontologist to conduct a desktop palaeontological impact assessment on a proposed sand mining site along the Donkerhoekspruit on the farm Jannelsepan, north east of Louisvale, !Kai Garib Municipality, Northern Cape.

The environment of the proposed mining site is within the banks of a narrow spruit on the farm Jannelsepan, about 5.5 km east of the Orange River, and 4.5 km north east of Louisvale near Upington. The surrounding landscape is typical of what occurs a short distance away from the Orange River in this region. It tends to be rocky with shallow sandy soils and relatively little to extremely sparse vegetation. This particular stretch of the Donkerhoekspruit has quite marked riverine vegetation, where patches of deeper sediment are preserved. It was indicated that the major anticipated impact of sand mining would be directly within the dry sandy bed of the spruit, between its current banks.

As requested here is the palaeontological impact assessment.

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 1 |
| 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 2 |
| The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure | Section ii<br>**Error! Reference source not found.** |
| 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 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 |

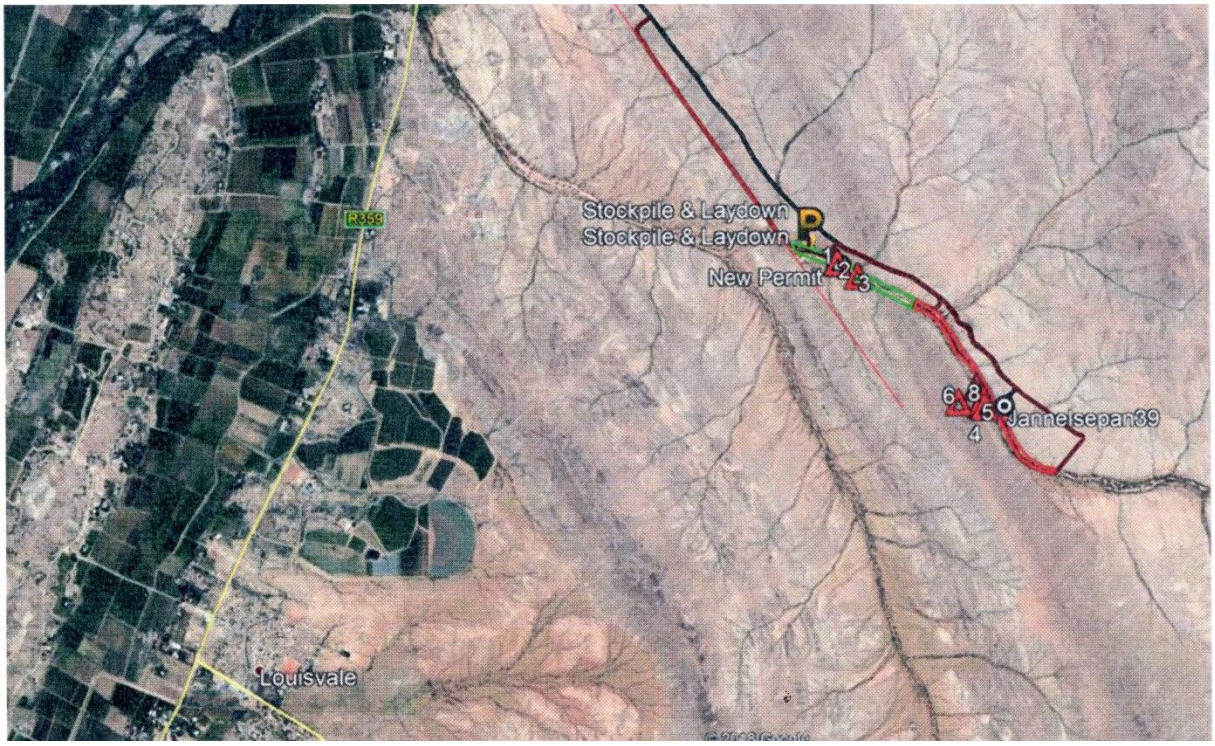


Figure 1: Detailed map from Google Earth of the proposed mining areas along the Donkerhoekspruit about 5.5km east of the Orange River, and 4.5 km northeast of Louisvale near Upington, Northern Cape Province.

# 2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA 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 (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

# 3. Geology and Palaeontology

## i. Project location and geological context

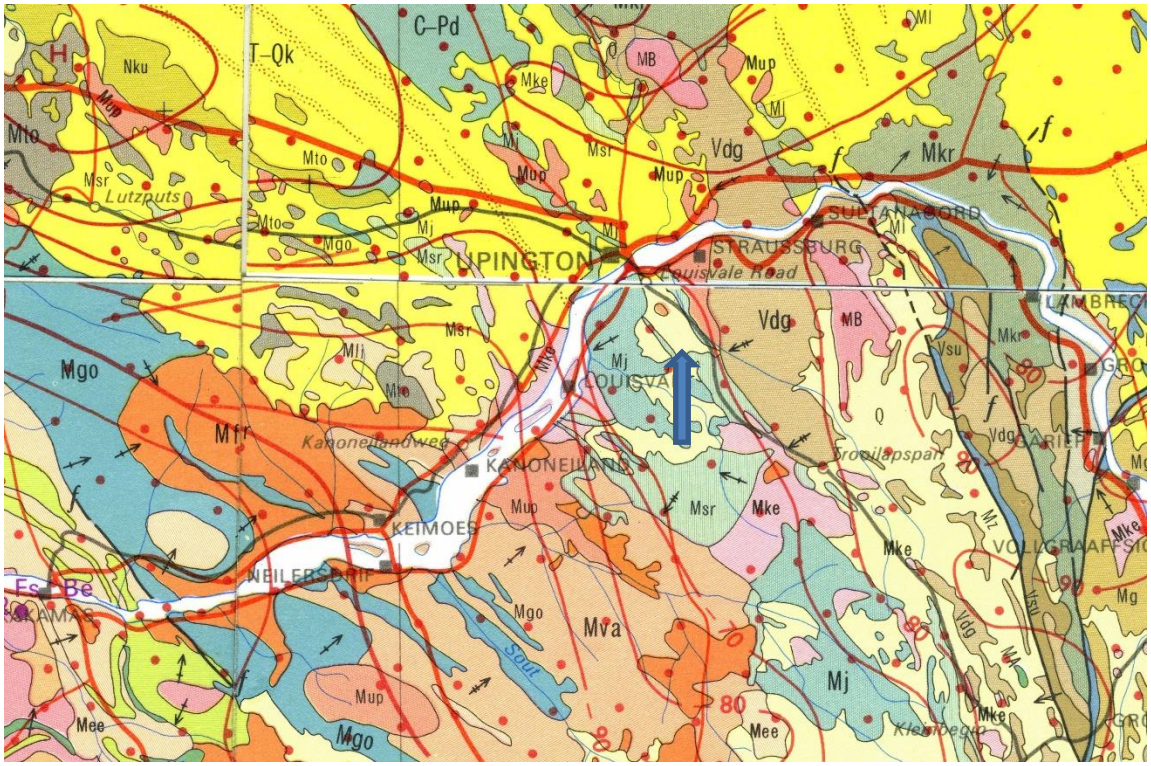


Figure 2: Geological map of the area northeast of Louisvale and south of the Orange River that has been selected for sand mining operations. The proposed site is indicated by the blue arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 2: Explanation of symbols for the geological map and approximate ages (Cornell et al., 2006; Erikssen et al., 2006. Johnson et al., 2006; Partridge et al., 2006). SG = Supergroup; Fm = Formation.

| Symbol | Group/Formation | Lithology | Approximate Age |
|---|---|---|---|
| Q | Quaternary sand; Gordonia Fm | Sands, alluvium, calcrete | Last 2.5 Ma |
| Mho | Hoogoor Suite | Pink gneiss | |
| Mva | Vaalputs Gneiss, Keimos Suite | gneiss | |
| Mfr | Friersdale Charnockite, Keimos Suite | Charnockitic adamellite | 1080-1090 Ma |
| Mke | Granite (undifferentiated) | granite | |
| MA | Basic intrusive rocks | Metanorite, met gabbro | |
| MB | Daberas Granodiorite | Gneiss, granite | |
| Mto | Toeslaan Fm, Koranaland Group | Kinzigite | Ca 1240 Ma |
| Msr | Eierdoppan and Sprigg, Koranaland Group | Schist, gneiss, kinzigite | |
| Mj | Jannelsepan Fm, (Koranaland) Areachap Group | Migmatitic amphibolite, calc-silicate rocks | |
| Mgo | Goede Hoop Fm, Koranaland Group Sequence | Pink gneiss, quartzite, schist, amphibolite, calc-silicate rocks | |
| Mge | Geelvloer | Quartzite, calc-silicate rocks | |
| Vdg | Dagbreek Fm, Vaalkoppies Group | Schist, quartzite, amphibolite | Ca 1300 Ma |

The proposed sand mining site lies in the Areachap Terrane of the Namaqua-Natal Province which has been broadly dated to between 1200 and 1000 Ma (Cornell et al., 2006). This complex of metamorphic rocks has been intruded by pre-tectonic intrusive orthogneisses and also by syn- to late-tectonic granitoids, such as the Eendoorn Suite and Daberas Granodiorite, and the Friersdale Charnokite.

This region is called the Namaqua-Natal Province and comprises igneous and metamorphic rocks that were formed or metamorphosed during the Namaqua Orogeny about 1200-1000 million years ago. The Jannelsepan Formation comprises migmatitic amphibolite and calc-silicate rocks. It has been interpreted as metamorphosed basaltic lavas and dolerite (Cornell et al., 2006). Precise dating of the various rocks is problematic. To the northeast are the schists, quartzites and amphibolites of the Dagbreek Formation. They are close to the Trooilapspan Shear Zone.

Overlying part of these ancient rocks are extensive deposits of the Kalahari Group that are considerably younger and are composed of aeolian sands, alluvium and calcrete. A thin film of haematite on the rounded sand grains gives them a reddish colour (Partridge et al., 2006). In some parts the sands form dunes that have been stabilised by vegetation.

## ii. Palaeontological context

The intrusive rocks are plutonic or volcanic in origin and post-date the surrounding metamorphic rocks of the Areachap and Koranaland Groups. The broad age range of 1200 – 1000 Ma is too old for body fossils and the rock type, metamorphic or igneous, would not preserve fossils. Sedimentary rocks are required for preservation of fossils. Because of the age and rock type there would be no chance of finding fossils in this region.

Quaternary alluvial sands do not preserve fossils because of their friable and transported nature. Almond and Pether (2009) do not record fossils from this region.

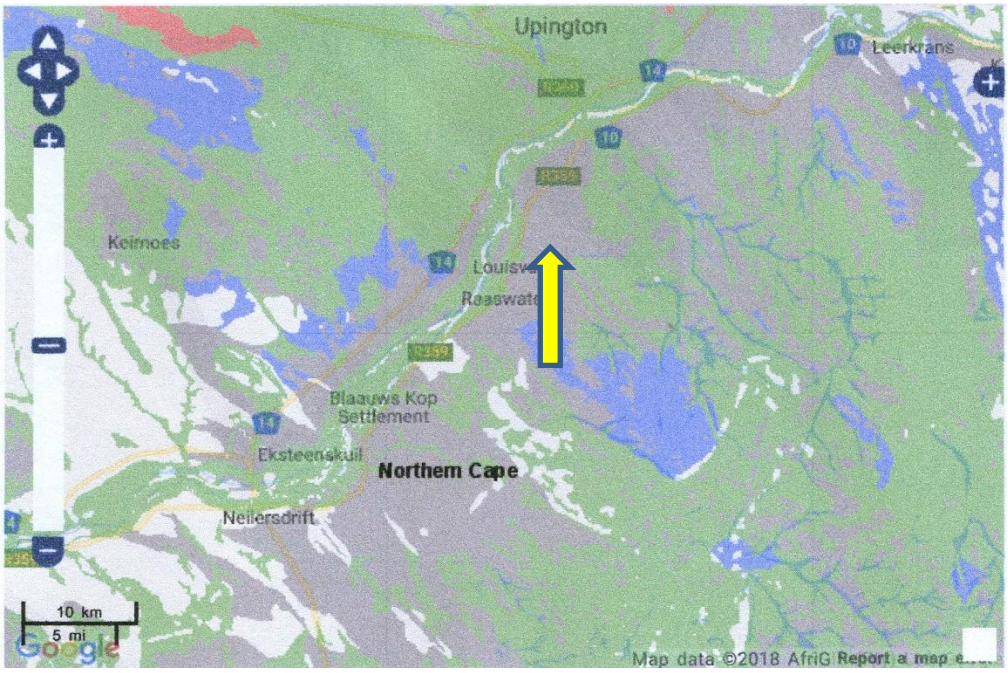


Figure 3: SAHRIS palaeosensitivity map of the region around Louisvale. The site in the grey area (arrow). Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

# 4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:
Based on the nature of the project, the alluvial sands only will be removed and the ground would not be penetrated. Since there is no chance of finding fossils in either the hard rock or loose surface sands there would be no impact on the fossil heritage. There is no chance of finding fossils so a phase 2 or site visit is NOT recommended. Taking account of the defined criteria, the potential impact to fossil heritage resources is zero.

**TABLE 3A: 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 3B: IMPACT ASSESSMENT**

| **PART B: ASSESSMENT** | | |
|---|---|---|
| **SEVERITY/NATURE** | **H** | - |
| | **M** | - |
| | **L** | There is no chance of any fossils being found here |
| | **L+** | - |
| | **M+** | |
| | **H+** | - |
| **DURATION** | **L** | - |
| | **M** | - |
| | **H** | Where manifest, the impact will be permanent. |
| **SPATIAL SCALE** | **L** | The spatial scale is extremely small. |
| | **M** | - |
| | **H** | - |
| **PROBABILITY** | **H** | **-** |
| | **M** | |
| | **L** | There is no chance of finding fossils in the surrounding rocks or in the sand. |

# 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 gneisses, schists, granites, amphibolites and sands are typical for the country and do not contain any microfossils, fossil plant, insect, invertebrate and vertebrate material.

# 6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely any fossils would be identified in the proposed site. No further palaeontological assessment is required. As far as the palaeontology is concerned the project may continue.

# 7. References

Almond, J., Pether, J. 2009. Palaeontological Heritage of the Northern Cape. SAHRA Palaeotechnical Report. 143 pp.

Cornell, D.H., Thomas, R.J., Moen, H.F.G., Reid, D.L., Moore, J.M., Gibson, R.L., 2006. The Namaqua-Natal Province. 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 325-379.

Partridge, T.C., Botha, G.A., Haddon, I.G., 2006. Cenozoic deposits of the interior. 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 585-604.

**Appendix A** – Details of specialist

# 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- |
| Telephone | : | +27 11 717 6690 |
| Fax | : | +27 11 717 6694 |
| Cell | : | 082 555 6937 |
| E-mail | : | marion.bamford@wits.ac.za ; 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)