

**Palaeontological Impact Assessment for the proposed  
Umdloti Beach Far South Sewage Infrastructure  
Project in Umdloti Beach, Ward 58, eThekwini  
Municipality, KwaZulu Natal**

**Desktop Study**

**For**

**1World Consultants (Pty) Ltd**

**05 June 2018**

**Prof Marion Bamford**

Palaeobotanist

P Bag 652, WITS 2050

Johannesburg, South Africa

[Marion.bamford@wits.ac.za](mailto: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 year PIA studies

## Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by 1World Consultants, Durban, 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: .....

A handwritten signature in blue ink, appearing to read 'M Bamford', is written above a horizontal line.

## Executive Summary

The desktop Palaeontological Impact Assessment for the Umdloti Beach Far South Sewage Infrastructure Project in Umdloti Beach, Ward 58, eThekweni Municipality, KwaZulu Natal is presented here.

The rocks and sediments that would be affected are the Maputaland Group with the basal Uloa Formation that is composed of calcified coquina and shelly conglomerates, the Port Durnford Formation that has mammal bones and peats preserving a rich palynological record, and non-fossiliferous sand dunes and aeolianites. Since there is a moderate chance of finding fossils of shells, fish, mammal bones, wood or pollen it is recommended that either a professional palaeontologist/geologist or a well-informed environmental control officer be present when excavations commence. The responsible person should photograph and record the position of any fossils before collecting them (with an AMAFA permit). The fossils should be deposited in a recognized local museum. Given that the pump station, access road pipeline footprint will be very narrow and are likely to cross cut the potentially fossiliferous strata rescue is recommended rather than preservation in situ. Moreover, the environment is physically unstable and people live close by so it would be difficult to preserve and protect any exposed fossils.

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## 1. Background

An application has been made for the Umdloti Beach Far South Sewage Infrastructure Project in Umdloti Beach, Ward 58, eThekweni Municipality. The sewer line access road will be 140m long and will intersect stabilized sand dunes.

The following infrastructure have also been proposed within the undeveloped area therefore requiring a paleontological desktop study;

- Pump station (25m<sup>2</sup> in area);
- Access road (140m long, 5m wide); and
- Portion of the sewer reticulation and rising main.

This report complies with the requirements of the NEMA and environmental impact assessment (EIA) regulations (GNR 982 of 2014). The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

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

<b>A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:</b>	<b>Relevant section in report</b>
Details of the specialist who prepared the report (CV in Appendix A)	Prof Marion Bamford
The expertise of that person to compile a specialist report including a curriculum vitae	Palaeontologist (PhD Wits 1990)
A declaration that the person is independent in a form as may be specified by the competent authority	Page 2
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 Seasons make no difference to fossils
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	See table 2
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 6,
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	n/a
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 and	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	Rescue
A description of any consultation process that was undertaken during the course of carrying out the study	Section 3
A summary and copies if any comments that were received during any consultation	n/a

process	
Any other information requested by the competent authority.	n/a

## 2. Methods and Terms of Reference

1. In order to determine the likelihood of fossils occurring in the affected area geological maps, literature, palaeontological databases and published and unpublished records must be consulted.
2. If fossils are likely to occur then a site visit must be made by a qualified palaeontologist to locate and assess the fossils and their importance.
3. Unique or rare fossils should either be collected (with the relevant South African Heritage Resources Agency (SAHRA) permit) and removed to a suitable storage and curation facility, for example a Museum or University palaeontology department or protected on site.
4. Common fossils can be sacrificed if they are of minimal or no scientific importance but a representative collection could be made if deemed necessary.

The published geological and palaeontological literature, unpublished records of fossil sites, catalogues and reports housed in the Evolutionary Studies Institute, University of the Witwatersrand, and SAHRA databases were consulted to determine if there are any records of fossils from the sites and the likelihood of any fossils occurring there.



Figure 1: Locality of the proposed Umdloti Beach Far South Sewage Infrastructure Project in Umdloti Beach, Ward 58, eThekweni Municipality. The pump station, access road and rising main will be in the southernmost part that is uninhabited.

### **3. Consultation Process**

No consultations were carried out during the desktop study. Apart from reviewing interested and/or affected party (IAP) comments received by the EIA consultant during the EIA process, no other consultation took place as part of the paleontological study.

### **4. Geology and Palaeontology**

#### Project location and geological setting

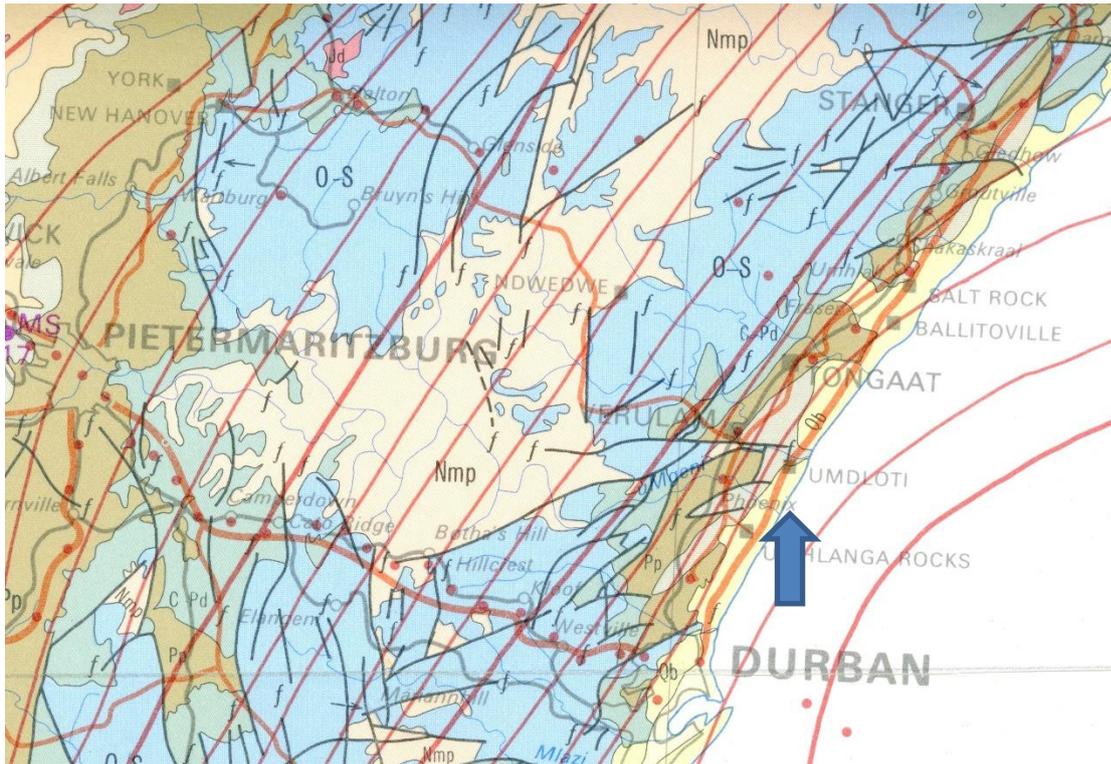


Figure 2: Geological map of the area just north of Durban along the Natal coast. The approximate location of the proposed project is indicated with the arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 2: Explanation of symbols for the geological map and approximate ages (Cornell, et al., 2006; Marshall, 2006; Roberts et al., 1995). SG = Supergroup; Fm = Formation. The shaded symbols represent the geological units that are most relevant to the project.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Aeolian sands	Last 2.5 Ma
Qb	Bluff, Berea, Port Durnford Fms	Aeolianite, sand, clay, limestone	Plio-Pleistocene
Tu	Uloa Fm, Maputaland Group	Siltstone, limestone, calcrenites	Mid Mio-Pliocene
Pp	Pietermaritzberg Fm, Ecca Group, Karoo Supergroup	shale	middle Permian 286-269 Ma
O-S	Natal Group	Quartzitic sandstone, arkose, shale	Ordovician-Silurian ca 480-420 Ma
Nmp	Mapumulo Group	Gneiss, granulite	1200 – 1030 Ma

## Geology

The oldest rocks in the area are the gneisses of the Mapumulo Group that are between 1200 and 1030 Ma (Cornell et al., 2006). Natal Group quartzitic sandstones, arkoses and shales (>450 Ma; Marshall, 2006) are overlain by younger sediments and will not be considered further.

Inland from the coast are shales and mudrocks of the Pietermaritzburg Formation that record relatively shallow water on an unstable shelf during a major post-glacial transgression (Johnson et al., 2006).

The rocks of interest are the overlying Maputaland Group that represent coastal deposits. At the base are the coquina and conglomerates of the Uloa Formation, then the Umkwelane Formation aeolianites with "Berea-type" rubrified sand (Roberts et al., 2006). Above that are possible dune sands and the fossiliferous Port Durnford Formation's muds, peats and sands. This sequence is mid Miocene to Pleistocene in age.

## Palaeontology

The gneisses and granulites are volcanic in origin and also too old to preserve fossils. No fossils are recorded in the Natal Group as it comprises a series of reworked aeolian sands and faulting (Marshall, 2006). In contrast, the Pietermaritzburg Formation contains invertebrate trace fossils in some areas (Johnson et al., 2006).

The basal layer of the Maputaland Group, the Uloa Formation, is composed of calcified coquina and shelly conglomerates representing the littoral zone of the palaeoshoreline (Roberts et al., 2006). The Port Durnford Formation is also potentially fossiliferous with mammal bones, and peats preserving a rich palynological record having been recorded from several sites along the coast between Durban and Lake St Lucia (Anderson, 1907; McCarthy and Orr, 1978; Scott et al., 1992; Oschadleus et al., 1996).

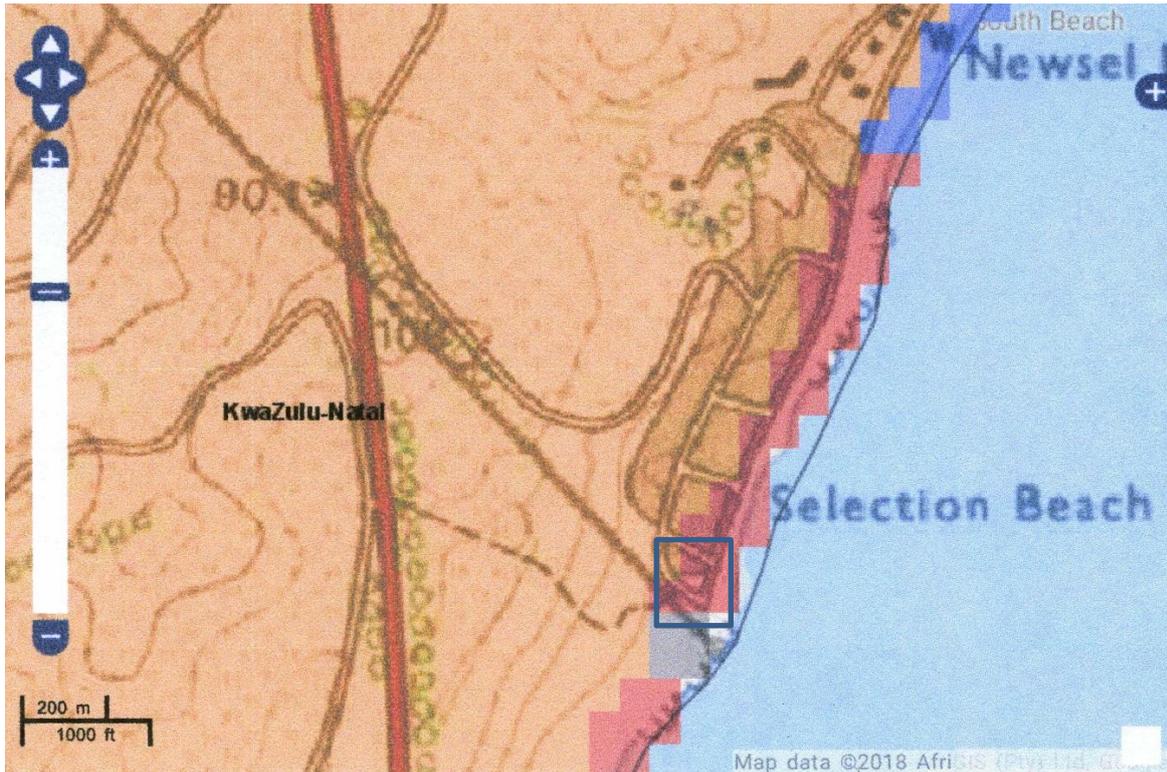


Figure 3: SAHRIS palaeosensitivity map. The site is within the blue rectangle. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

## 5. Impact assessment

From the heritage impact assessment it was deduced that the project area is situated in an area of high to very high fossil sensitivity. Due to the highly disturbed nature along the streets where the pipeline reticulation will be placed, it is recommended that no further study of these areas be undertaken. However, it is recommended that a desktop palaeontological study is undertaken of the area where the pump station and the access road are to be located in order to determine whether sensitive fossil finds will be impacted by the proposed development.

Using the criteria in the table below, the impact of the proposed sewage infrastructure at Umdloti Beach has been assessed.

**TABLE 3: CRITERIA FOR ASSESSING IMPACTS**

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE	H	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.

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

<b>PART B: ASSESSMENT</b>		
<b>SEVERITY/NATURE</b>	<b>H</b>	-
	<b>M</b>	-
	<b>L</b>	.
	<b>L+</b>	-
	<b>M+</b>	The footprint of the proposed sewage infrastructure is small but it is likely to intersect fossiliferous strata
	<b>H+</b>	-
<b>DURATION</b>	<b>L</b>	-
	<b>M</b>	-
	<b>H</b>	Where manifest, the impact will be permanent.
<b>SPATIAL SCALE</b>	<b>L</b>	
	<b>M</b>	The proposed sewage infrastructure is small but there is a chance that it will intersect fossiliferous strata
	<b>H</b>	-
<b>PROBABILITY</b>	<b>H</b>	-
	<b>M</b>	There is a chance of finding fossils as the beds along this section of coastline are fossiliferous although no fossils have been reported from this site
	<b>L</b>	-

## 6. 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 calcified coquina, conglomerates, aeolianites, sand dunes and sands are typical for the country, and could contain fossil shells, fish, mammal bones, lignified or silicified woods and pollen because such fossils have been

recorded from other exposures along the coast north of Durban. The proposed pipeline is likely to penetrate some or part of these fossiliferous deposits.

## 7. Recommendation

It is likely that some fossils occur along the route of the proposed pipeline, however, it is not possible to determine precisely what fossils could be found until the construction and excavations begin. It is recommended that either a professional palaeontologist/geologist or a well-informed environmental control officer be present when excavations commence. The responsible person should photograph and record the position of any fossils before collecting them (with an AMAFA permit). The fossils should be deposited in a recognized local museum. Given that the pump station, access road and pipeline footprint will be very narrow and likely to cross cut the potentially fossiliferous strata rescue is recommended rather than preservation in situ. Moreover, the environment is physically unstable and people live close by so it would be difficult to preserve and protect any exposed fossils.

## 8. References

Anderson, W., 1907. On the discovery in Zululand of marine fossiliferous rocks of Tertiary age containing mammalian remains. Report of the Geological Survey, Natal Zululand 3, 119-127.

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.

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.

Marshall, G.G.A., 2006. The Natal Group. 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 433-441.

McCarthy, M.J., Orr, W.N., 1978. A Rhinoceros tooth from basal strata of the Port Durnford Formation, Zululand, South Africa: the relocation of Anderson's mammalian fossil site. Annals of the Natal Museum 23, 485-496.

Oschadleus, H.D., Vogel, J.C., Scott, L., 1996. Radiometric date for the Port Durnford peat and development of yellow-wood forest along the South African coast. South African Journal of Science 92, 43-45.

Roberts, D.L., Botha, G.A., Maud, R.R., Pether, J., 2006. Coastal Cenozoic deposits. 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 605-628.

Scott, L., Cooremans, B., Maud, R.R., 1992. Preliminary palynological evaluation of the Port Durnford Formation at Port Durnford, Natal, South Africa. South African Journal of Science 88, 470-474.

## **Appendix A** – Details of specialist

### **Curriculum vitae (short) - Marion Bamford PhD June 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](mailto:marion.bamford@wits.ac.za) ; [marionbamford12@gmail.com](mailto: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

**vii) 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

**viii) 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.

**ix) 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

## **x) 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
- Klipootjie and Finaalspan 2017 for Delta BEC

## **xi) 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.

## **xii) 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)