



# NGT ESH

Environment | Socio-Economics | Heritage

**PROJECT TITLE:**

THE EAST COAST GAS 400 KV POWER LINES, LOCATED IN RICHARDS BAY, WITHIN  
THE UMHLATHUZE LOCAL MUNICIPALITY IN THE KING CETSHWAYO DISTRICT  
MUNICIPALITY IN THE KWAZULU-NATAL PROVINCE.

**PROJECT REFERENCE:**

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Palaeontological Impact Assessment for the East Coast  
Gas 400 KV power line, located in Richards Bay, within  
the Umhlathuze Local Municipality in the King Cetshwayo  
District Municipality, Kwazulu-Natal Province

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## DECLARATION OF INDEPENDENCE

Marion Bamford has compiled this report on behalf of NGT ESH. 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.

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## **EXECUTIVE SUMMARY**

NGT was appointed by EkoInfo to conduct a PIA for the proposed East Coast Gas 400 KV powerlines, located in Richards Bay, in ULM within KCDM, in the KZN, South Africa. NGT appointed its subsidiary (NGT ESH) responsible for implementation of environmental, socio-economic, heritage and sustainability project to manage the HIA and PIA studies.

A PIA was requested for the proposed East Coast Gas 400 KV powerlines in the Richards Bay and Empangeni environs, KwaZulu Natal, South Africa. To comply with the South African Heritage Resources Agency in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999), a desktop PIA was completed for the proposed project.

### **Conclusions:**

The proposed powerline routes lie on shales of the Pietermaritzburg Formation of the Ecca Group in the western part of the west-east sector and this has a small of chance of impacting on invertebrate trace fossils if they are present here. The proposed north-south section lies on Quaternary sands and these are not fossiliferous. The ancient granites and gneisses in the area are not fossiliferous. The Jurassic dolerite dykes and overlying Quaternary sands to the west do not preserve fossils.

### **Recommendations:**

For only the western part of the west-east sector a Fossil Chance Find Protocol should be followed once excavations and construction of the powerline poles commences. If any trace fossils are discovered by the responsible person in charge, they should be rescued and put aside for a professional palaeontologist to assess. The north-south sector is not on fossiliferous rocks. As far as the palaeontology is concerned the project may proceed.

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## LIST OF ABBREVIATIONS

*The PIA was developed by NGT ESH on behalf of NGT for EkoInfo on behalf of their client Eskom Holdings SOC Ltd*

ACRONYMS	DESCRIPTION
<b>AUTHORITIES</b>	
ASAPA	Association of South African Professional Archaeologists
FDDM	Fezile Dabi District Municipality
FSPHRA	Free State Provincial Heritage Resources Authority
MLM	Moqhaka Local Municipality
NGT	Nurture, Grow, Treasure
SADC	Southern African Developing Community
SAHRA	South African Heritage Resources Agency
<b>DISCIPLINE</b>	
BAR	Basic Assessment Report
EMPr	Environmental Management Programme
PIA	Palaeontological Impact Assessment
<b>LEGAL</b>	
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act



## TERMS AND DEFINITIONS

### ***Palaeontological***

This means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial.

### ***Development***

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in the change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

- Construction, alteration, demolition, removal or change in use of a place or a structure at a place,
- Carrying out any works on or over or under a place.
- Subdivision or consolidation of land comprising a place, including the structures or airspace of a place.
- Constructing or putting up for display signs or boards; any change to the natural or existing condition or topography of land.
- And any removal or destruction of trees, or removal of vegetation or topsoil.
- The current development is for power transmission line and associated infrastructure and its impact on potential heritage resources within the project area.

## 1. INTRODUCTION

NGT was appointed by EkoInfo to conduct a HIA for the proposed East Coast Gas 400 KV powerlines, located in Richards Bay, in ULM within KCDM, in the KZN, South Africa (*Table 1, Figure 1*). NGT appointed its subsidiary (NGT ESH) responsible for implementation of environmental, socio-economic, heritage and sustainability project to manage the PIA study.

Eskom proposed the construction of four 400kv power lines. These new powerlines will be able to transmit the power generated at the new proposed Combined Cycle Power Plant (CCPP). The aim of the project is to upgrade all applicable 400kV powerlines, install fault limiting reactors at the 132kV side of the transformers at Athene substation as well as loop into Athene- Invubu and Athene – Umfolozi 400 kV lines.

A desktop PIA is presented here for the above project in order to comply with the SAHRA in terms of Section 38(8) of the NHRA, 1999 (Act No. 25 of 1999) (*Table 2*).

*Table 1: Site Location and Property Information*

Location	
<b>Town</b>	Richards bay
<b>Responsible Local Authority</b>	Umhlathuze Local Municipality
<b>Ward</b>	2 26 12
<b>Magisterial District</b>	King Cetshwayo District Municipality
<b>Region</b>	KwaZulu-Natal
<b>Country</b>	South Africa
<b>Site centre GPS coordinates</b>	<ul style="list-style-type: none"> <li>• 28° 43' 55.02" S</li> <li>• 31° 59' 58.64" E</li> </ul>

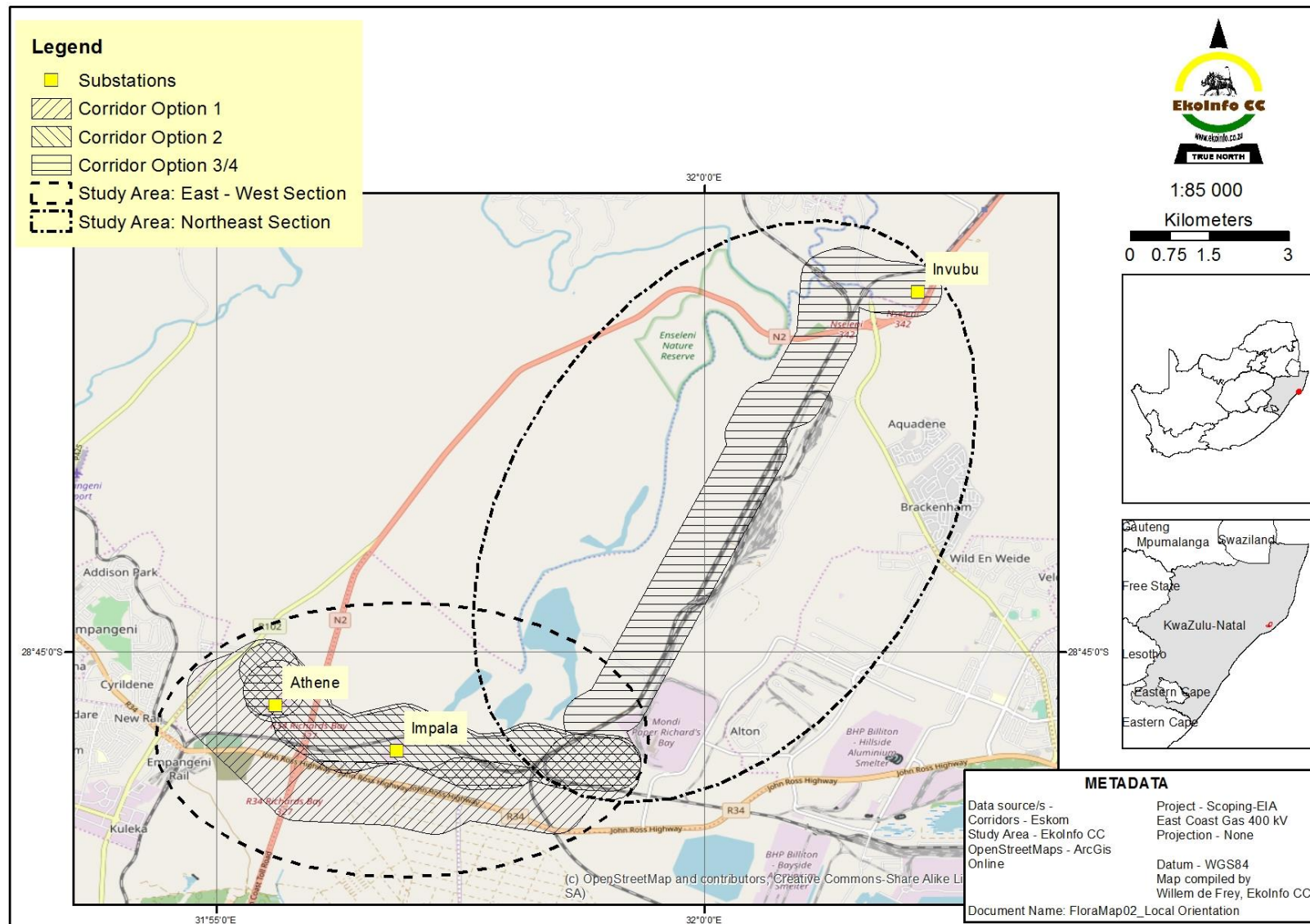


Figure 1: Map showing more details on the four options for the proposed powerline (Supplied by EkolInfo).

*Table 2: 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	Appendix B
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
A declaration that the person is independent in a form as may be specified by the competent authority	Page <b>Error! Bookmark not defined.</b>
An indication of the scope of, and the purpose for which, the report was prepared	Section <b>Error! Reference source not found.</b>
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 0 <b>Error! Reference source not found.</b>
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 0
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	Section 8
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

## **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*).
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected.

## **3. GEOLOGY AND PALAEONTOLOGY**

### **3.1. Project location and geological context**

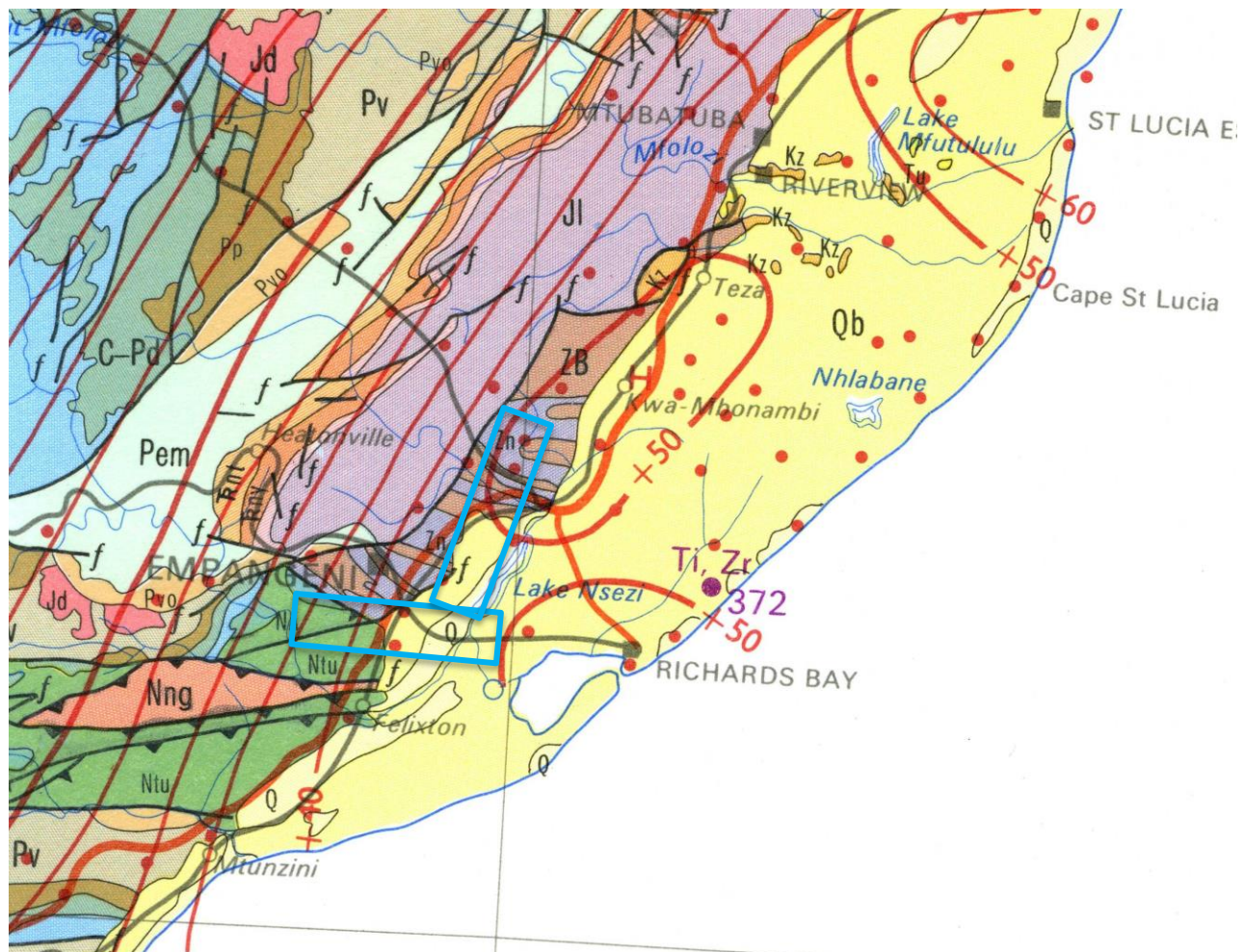
The oldest rocks in the area are small outcrops of granites and gneisses of the basement rocks and also some younger schists and amphibolites of the Tugela Group. These are igneous, and metamorphosed in the case of the latter, and will not be considered any further as they are too old and of the wrong kind to preserve fossils.

The rest of the rocks are members of the Karoo Supergroup with Dwyka Group tillites, diamictites and mudstones to the west and not within the footprint of the project. These are the oldest Karoo rocks and are upper Carboniferous to early Permian in age. Running more or less north-south are younger Karoo rocks, namely the Pietermaritzburg Formation Shales, Vryheid and Volksrust Formations of the Ecca Group. To the north the Beaufort Group Emakwezini Formation is exposed. The Karoo rocks are part of the Letaba Formation of the Lebombo Group that are Jurassic in age and comprise lavas that were intruded around the time of the Drakensburg lavas and are associated with the breakup of Gondwana.



To the west and all along the coast, including the surroundings of Richards Bay, are the much younger Maputaland Group sands that are Quaternary in age. In this area the Berea, Bluff and Port Durnford Formation sands dominate, particularly along the coast.

According to the general geological map, the proposed routes for the Richards Bay powerlines are on Quaternary sands for option 3 (green) along the north-south section (red oval in *Figure 1*); and the rest of the options and sections (west-east along the R34 road; purple oval in *Figure 1*) are on Pietermaritzburg shales in the westernmost part, with Berea Formation in the central section and Quaternary sands for the eastern section (*Figures 2 and Table 3*).



*Figure 2: Geological map of the area around Empangeni and Richards Bay. The location of the proposed pipelines is indicated within the blue rectangles. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000*

*Table 3: Explanation of symbols for the geological map and approximate ages (Barbolini et al., 2016; Cornell et al., 2006; Johnson et al., 2006; McCarthy, 2006). SG = Supergroup; Fm = Formation; Ma = million year; ka = thousand years.*

Symbol	Group/Formation	Lithology	Approximate Age
Qb	Berea, Bluff and Port Durnford Fm; Maputaland Group	Alluvium, sand, calcrete	Middle to late Pleistocene ca <700ka
Jl	Letaba Fm, Lebombo Group, Karoo Igneous Province	Picritic (olivine-rich) lavas	Jurassic
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pem	Emakwezini Fm, Beaufort Group, Karoo SG.	Blue-grey mudrocks and fine-grained sandstone	Late Permian
Pvo	Volsrust Fm, Ecca Group, Karoo SG	Mudstones, siltstones, shales,	(late Permian) Guadalupian, Capitanian to Lopingian, Wuchiapingian; Ca 266 – 256 Ma
Pv	Vryheid Fm, Ecca Group. Karoo SG	Sandstone, siltstones, shale, coal	(Mid late Permian), Guadalupian, Wordian; Ca 269-266 Ma
Pp	Pietermaritzburg Fm, Ecca Group, Karoo SG	Shales	Early Permian,
C-Pd	Dwyka Group, Karoo SG	Diamictite, shale	Late Carboniferous to Early Permian; ca 300 Ma
Ntu	Tugela Group	Amphibolite, gneiss, schist	1209 – 1105 Ma
Nng	Ngoye Granite Gneiss	Granite, gneiss	
ZB	Unnamed potassic granite	Granite	>3200 Ma

### 3.2. Palaeontological context

The Dwyka Group mudstones only are known to preserve fossils of the very early *Glossopteris* flora but these rocks are not within the project footprint. The Pietermaritzburg Formation shales represent the receding glacial ice sheets and deep to shallow water deposits so although they are the correct age for the *Glossopteris* flora, only trace fossils of invertebrate tracks and worm burrows have been recorded from this formation (Johnson et al., 2006). Good fossil assemblages have been reported from the Vryheid Formation (Ecca Group) and younger Emakwezini Formation (Beaufort Group), whereas the intervening Volksrust Formation does not preserve fossil assemblages.

Quaternary sands and the red “Berea-type” sands are aeolian or alluvial and do not preserve fossils, but the sands, muds and peats of the Port Durnford Formation have yielded fossil mammals and pollen samples from near Port Durnford (Oschadleus et al., 1996). Vryheid Formation fossil plants are locally common in the formation, but their distribution is scattered and hard to predict. Fossil vertebrates are extremely rare from this time period as very few had evolved. Coals and impression fossils of the *Glossopteris* flora are abundant in some parts of the Vryheid Formation and include *Glossopteris* leaves, roots, fructifications, sphenophytes, lycopods and ferns and silicified wood (Plumstead, 1969; Anderson and Anderson, 1985, Bamford, 2004).

Jurassic dolerite dykes are common in the region as a whole but do not contain fossils as these would have been badly affected or destroyed by the intruding volcanic material. From the SAHRIS palaeo-sensitivity map below (*Figure 4*), the project area is indicated as highly sensitive (orange) to moderately sensitive (green), thus a desktop study is presented here. The Pietermaritzburg Formation shales only rarely preserve trace fossils of invertebrate burrows or trackways. This is relevant for the western section (all options) of the proposed route only.

The Port Durnford Formation may have very localised peats and associated fossils. This is relevant for the central section of west-east route (all options). The north-south section, green or Option 3, is not located on paleontologically sensitive rocks.



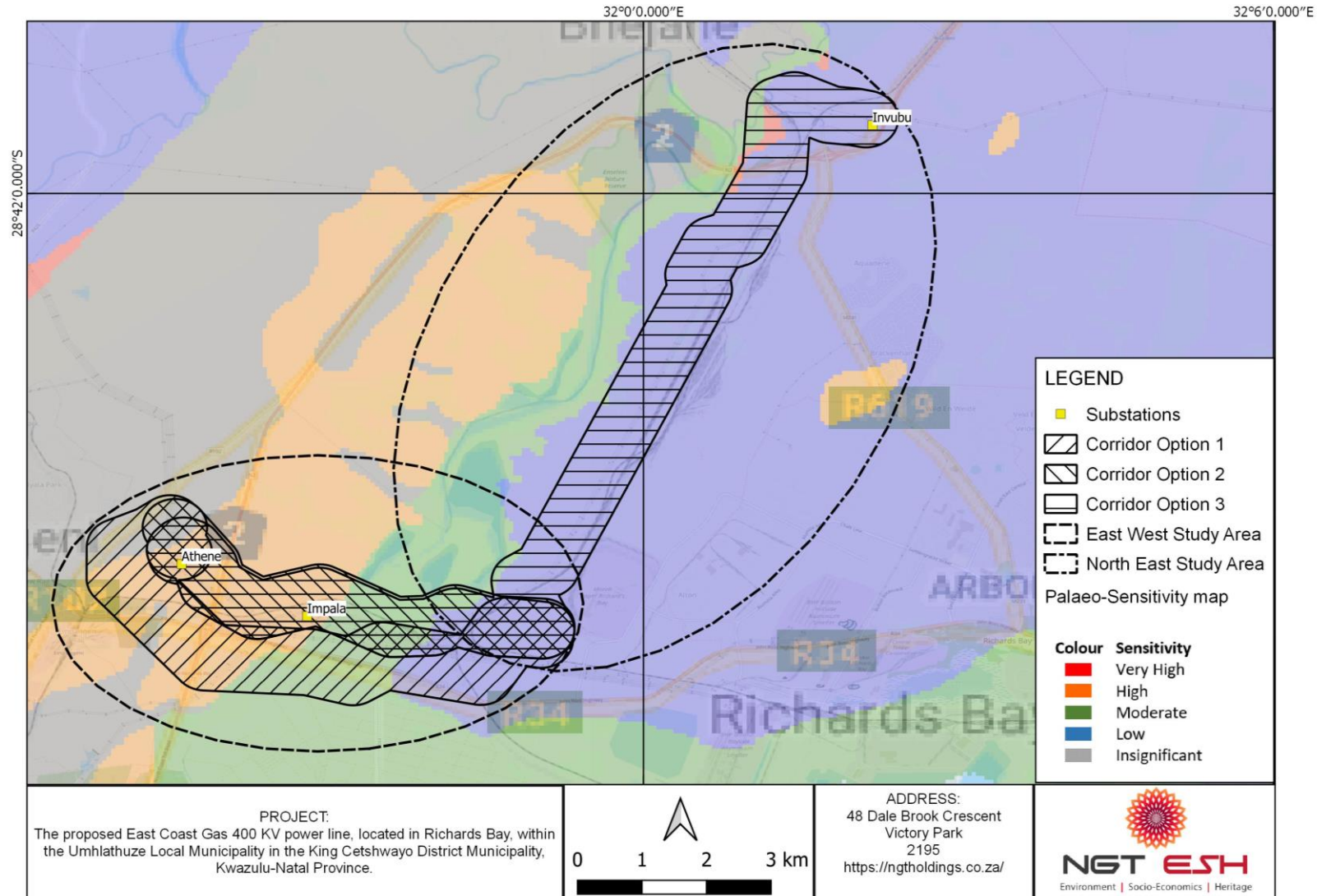


Figure 3: Paleo-Sensitivity layer of the East West (in purple circle) and North East (in red circle) project areas proposed for the East Coast Gas 400 KV power line, located near Richards Bay.

#### 4. IMPACT ASSESSMENT AND RATINGS

Table 4: Impact assessment definitions and criteria.

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

Table 5: Impact assessment results for this project

<b>PART B: Assessment</b>		
<b>SEVERITY/NATURE</b>	<b>H</b>	-
	<b>M</b>	-
	<b>L</b>	North-south section: extremely unlikely that any fossils occur. West-east section – western part – small chance of finding invertebrate trace fossils; eastern part – extremely small chance of finding any fossils.
	<b>L+</b>	-
	<b>M+</b>	-
	<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>	North-south section: no fossils West-east section: Since only the possible fossils within the area would be invertebrate trace fossils, the spatial scale will be localised within the site boundary, i.e. the foot print of each new pole or pylon.
	<b>M</b>	-
	<b>H</b>	-
<b>PROBABILITY</b>	<b>H</b>	-
	<b>M</b>	-
	<b>L</b>	North-south section – no fossils West-east section - it is very unlikely that any fossils would be found in the surface soils or on shaley outcrops but they might occur below ground. Therefore a Fossil Chance Find protocol should be followed once excavations for the new powerline poles commence.

Based on the nature of the project, surface activities would not impact upon the fossil heritage even if preserved, because the area has already been disturbed by agricultural activities and urban development. The geological structures suggest that the basal rocks are much too old and of the wrong type to contain fossils. Only the shales of the Pietermaritzburg Formation could contain invertebrate trace fossils, and these might occur below the surface. Since there is a very small chance that fossils may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is very low.

## **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 basal tuffs, conglomerates, granites, sandstones, shales and sands are typical for the country and do not contain any fossil plants or vertebrates, except for the shales of the Pietermaritzburg Formation, Ecca Group. Trace fossils such as invertebrate burrows or trackways have been recorded from this formation in other parts of the Karoo Basin so there is a very small possibility that they occur in this area too.

## **6. RECOMMENDATION**

Based on experience and the lack of any previously recorded fossils from the area, it is unlikely that any fossils would be preserved in the overlying disturbed and weathered soils. There is a small chance that fossils may occur below ground in the shales of the Pietermaritzburg Formation so a Chance Find Protocol (Appendix A) should be added to the EMPr. If fossils are found once excavations for the powerline poles and infrastructure have commenced then they should be rescued, and a palaeontologist called to assess and collect a representative sample. Thereafter the palaeontology heritage will not be impacted on any further. No distinction or preference can be made for the four proposed routes

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## 8. APPENDIX A - CHANCE FIND PROTOCOL

**Monitoring Programme for Palaeontology – to commence once the excavations for the powerline poles begins.**

1. The following procedure is only required if fossils are seen on the surface and when drilling, digging or excavations commence.
2. When drilling, construction or excavations begins the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (burrows, shells, plants, insects) should be put aside in a suitably protected place. This way the mining activities will not be interrupted.
3. Photographs of similar fossil invertebrates' burrows or trackways must be provided to the developer to assist in recognizing the fossils in the shales and mudstones. This information will be built into the EMPr's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer/miners then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered, then the site inspections by the palaeontologist will not be necessary. Annual reports by the palaeontologist must be sent to SAHRA.
8. If no fossils are found and the excavations have finished, then no further monitoring is required.

## 9. APPENDIX B – DETAILS OF SPECIALIST

### Curriculum vitae (short) - Marion Bamford PhD

January 2019

#### 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  
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 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

*The PIA was developed by NGT ESH on behalf of NGT for EkoInfo on behalf of their client Eskom Holdings SOC Ltd*

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	6	1
Masters	8	1
PhD	10	2
Postdoctoral fellows	9	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

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- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klippoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells

#### **xi) Research Output**

Publications by M K Bamford up to June 2018 peer-reviewed journals or scholarly books: over 125 articles published; 5 submitted/in press; 8 book chapters.

Scopus h index = 26; Google scholar h index = 30;

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)