

**PALAEONTOLOGICAL IMPACT ASSESSMENT (PIA)  
(supplementary letter) for the proposed  
Waihoek WEF EA Amendment Application, near  
Utrecht, within the Emadlangeni Local  
Municipality, KwaZulu Natal Province.**

**FOR**

**Coastal and Environmental Services**

**By**

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## EXECUTIVE SUMMARY

Dr Gideon Groenewald was appointed to undertake a Phase 1 Palaeontological Impact Assessment, assessing the potential palaeontological impact of the proposed amendment of the layout for the Waaihoek Wind Energy Facility near Utrecht, Kwa-Zulu Natal Province. The purpose of this Palaeontological Impact Assessment is to identify exposed and potential palaeontological heritage on the sites of the proposed changes to the development, to assess the impact the development may have on this resource, and to make recommendations as to how this impact might be mitigated.

### 1.1. Legal Requirements

This report forms part of the Part II Amendment for the proposed development of a wind farm and complies with the requirements for the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Palaeontological Impact Assessment is required to assess any potential impacts to palaeontological heritage within the development footprint of the proposed Waaihoek Wind Energy Facility.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens; and
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

The development site for the proposed Waaihoek Wind Energy Facility is underlain by the Permian Vryheid and Volksrust Formations of the Ecca Group as well as a thick dolerite sill.

Outcrops of the Vryheid and Volksrust Formations are restricted to specific areas on the escarpment and in road cuttings. Extensive areas are underlain by dolerite.

It is recommended that:

- The PEA and CEO be made aware of the possibility of finding fossils in the Vryheid and Volksrust Formation sediments during excavation of the foundations for the turbines and other infrastructure.
- A professional palaeontologist be appointed to monitor possible palaeontological finds during excavation of turbine foundations and infrastructure where turbine positions and infrastructure fall on Vryheid and Volksrust Formation sediments.
- No further action is needed in all areas underlain by dolerite.

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## **2. INTRODUCTION**

Dr Gideon Groenewald was appointed to undertake a Phase 1 Palaeontological Impact Assessment, assessing the potential palaeontological impact of the proposed amendment of the layout for the Waaihoek Wind Energy Facility near Utrecht, Kwa-Zulu Natal Province. The purpose of this Palaeontological Impact Assessment is to identify exposed and potential palaeontological heritage on the sites of the proposed changes to the development, to assess the impact the development may have on this resource, and to make recommendations as to how this impact might be mitigated.

### **2.1. Legal Requirements**

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Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens; and
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

## **3. AIMS AND METHODOLOGY**

This Phase 1 investigation only refers to possible changes to the recommendations of the Phase 1 PIA report of March 2014 (Groenewald, 2014, internal report).

The likely impact of the proposed development on local fossil heritage was determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the minimal extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 below.

The aim of this supplementary letter is to report on a site visit by Dr Gideon Groenewald, an experienced field worker, on 4 August 2021 and is only a supplementary comment on an existing report. The table referred to (Table 1) is however an upgraded version of the table used in the report of 2014 and gives a more definitive explanation of the colours used to indicate sensitivity for Palaeontological Heritage on site.

**Table 1 Explanation of sensitivity classes used in this study as well as limitations for each colour code used**

<b>PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS</b>	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008, 2009) (Groenewald et al., 2014).	
<b>RED</b>	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
<b>ORANGE</b>	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
<b>GREEN</b>	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example, areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) recommended.
<b>BLUE</b>	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in larger alluvium deposits. Minimum requirement is a Phase 1 site inspection and/ or a "Chance Find Protocol" Report. Collection of a representative sample of potential fossiliferous material is recommended.

<b>GREY</b>	<p>Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during emplacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. Minimum requirement is a Phase 1 field investigation and/or a “Chance Find Protocol” Report.</p>
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When rock units of moderate to high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures should be incorporated into the Environmental Management Plan.

### **3.1. Scope and Limitations of the Phase 1 Investigation**

The scope of a phase 1 Investigation includes:

- an analysis of the area’s stratigraphy, age and depositional setting of fossil-bearing units;
- a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports;
- data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and
- where feasible, location and examination of any fossil collections from the study area (e.g. museums).
- do an on-site investigation to assess the identified palaeontological sensitive areas within the development footprint/study area rather than formal palaeontological collection. The investigation should focus on the sites where bedrock excavations would definitely require palaeontological monitoring.

The results of the field investigation are then used to predict the potential of buried fossil heritage within the development footprint. In some investigations this involves the examination of similar accessible bedrock exposures, such as road cuttings and quarries, along roads that run parallel to or across the development footprint.

## **4. PROPOSED DEVELOPMENT DESCRIPTION**

South Africa Mainstream Renewable Power Developments (Pty) Ltd. (Mainstream) is applying for an amendment to the planning of a Wind Energy Facility (WEF), and this report must be read in conjunction with the report by the same author, dated March 2014.

## 5. GEOLOGY OF THE AREA

Extensive parts of the study area are underlain by a prominent Jurassic aged Dolerite Sill, with smaller areas underlain by sedimentary rocks of the Permian aged Vryheid and Volksrust Formations of the Ecca Group, Karoo Supergroup.

### 5.1. Vryheid Formation (Pv)

In the study area the Vryheid Formation consists mainly of interbedded coarse-grained sandstone and mudstone, interpreted as deltaic deposits. The Vryheid Formation contains numerous coal seams that are of economic importance (Johnson et al, 2006).

### 5.2. Volksrust Formation (Pvo)

The Volksrust Formation consists of a monotonous sequence of grey mudstone and it is interpreted as a deeper water deposit (Johnson et al, 2006; Groenewald, 1996).

### 5.3. Dolerite

A very prominent dolerite sill underlies a large part of the study area and represents magma intrusions into the Karoo Supergroup sediments during the Jurassic volcanic episode that occurred during the breakup of Gondwanaland.

The geology is discussed in the report of March 2014 and it is not necessary to repeat the information for this “supplementary letter”.

The potential palaeontology of a rock unit relates directly to the geology of the area. The desktop survey includes the comparison of relevant referenced geological maps and locality maps and/or waypoints provided for the development project.

### 5.4. Vryheid Formation (Pv)

The Ecca Group is not known to contain body fossils of vertebrates, but trace and plant fossils have been described from the group. Fossils include plant fossils of the *Glossopteris* assemblage and trace fossils (Johnson et al, 2006). The Vryheid Formation is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. Plant fossils described by Bamford (2011) from the Vryheid Formation are; *Azaniodendron fertile*, *Cyclodendron leslij*, *Sphenophyllum hammanskraalensis*, *Annularia sp.*, *Raniganjia sp.*, *Asterotheca spp.*, *Liknopetalon enigmata*, *Glossopteris > 20 species*, *Hirsutum 4 spp.*, *Scutum 4 spp.*, *Ottokaria 3 spp.*, *Estcourtia sp.*, *Arberia 4 spp.*, *Lidgettonia sp.*, *Noeggerathiopsis sp.* and *Podocarpidites sp.*

### 5.5. Volksrust Formation (Pvo)

The Volksrust Formation contains assemblages of trace fossils and the bivalve *Megadesmus* has been described from the Formation (Bamford 2011).

### 5.6. Karoo Dolerite (Jd)

Due to the igneous character of these rocks they do not contain fossils.

## 6. PRELIMINARY ASSESSMENT RESULTS

The palaeontological sensitivity was predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity can be described as significant due to the potential abundance of Permian trace and plant fossils known to occur within the Vryheid and Volksrust Formations.

## 7. FIELD INVESTIGATION

Gideon Groenewald, an experienced fieldworker, visited the site of the proposed Waaihoek Wind Farm on 3 August 2021 to 5 August 2021. The topography of the area forms part of the escarpment and consists of hills and cliffs in regions where outcrops of Vryheid Formation sandstone and mudstone are intruded by a thick dolerite sill. The larger part of the study area is underlain by deeply weathered dolerite.

A survey of a representative sample of turbine points was done where a total of 17 observation sites were visited, to groundproof expected geological information. Turbine points that convincingly fell on dolerite outcrop from both the desktop study and field observations from a distance were not individually visited due to time constraints and the fact that dolerite will not yield fossils.

The data from the field visits to the turbine sites is contained in Table 2 below.

**Table 2 Photographic record of observations at proposed tower localities**

Observation number	GPS Coordinates	Geology	Palaeontological significance	Photo
P1	27.665723° S 30.380920° E	Dolerite	No Fossils expected. No fossils observed.	
P2	27.669722° S 30.383611° E	Dolerite	General view of study area with sandstone of Vryheid Formation in the hillside	

<p>T35</p> <p>T36</p>	<p>27.706699° S 30.419043° E</p> <p>27.703575° S 30.426490° E</p>	<p>Dolerite</p>	<p>No Fossils expected. No fossils observed</p>	
<p>T37</p>	<p>27.700299° S 30.424249° E</p>	<p>Vryheid</p>	<p>Fossils expected, no fossils observed but must be monitored during excavations</p>	
<p>T39</p>	<p>27.704632° S 30.412487° E</p>	<p>Dolerite</p>	<p>No Fossils expected. No fossils observed</p>	
<p>T34</p>	<p>27.711609° S 30.424492° E</p>	<p>Dolerite</p>	<p>No Fossils expected. No fossils observed</p>	

T33	27.701671° S 30.434892° E	Vryheid	No Outcrop, fossils expected, no fossils observed. Monitoring during excavation.	
T17	27.705449° S 30.438112° E	Dolerite	No Fossils expected. No fossils observed	
T11 T20 T22 T31 T41	27.696800° S 30.446044° E  27.699027° S 30.441646° E  27.693001° S 30.446280°  27.689582° S 30.443857° E  27.695498° S 30.439551° E	Dolerite	No Fossils expected. No fossils observed.	
T40	27.716930° S 30.425315° E	Vryheid	No Outcrop, fossils expected, no fossils observed. Monitoring during excavation	

P5	27.702867° S 30.443263° E	Dolerite	No Fossils expected. No fossils observed	
P6	27.704804° S 30.444892° E	Dolerite	No Fossils expected. No fossils observed	
T1 T5 T9	27.708456° S 30.460134°  27.716255° S 30.438996° E  27.714049° S 30.443942° E	Dolerite	No Fossils expected. No fossils observed	
T6	27.714443° S 30.454037° E	Dolerite	No Fossils expected. No fossils observed	

T4	27.719497° S 30.445973° E	Dolerite	No Fossils expected. No fossils observed	
T2 T38	27.717572° S 30.456680° E  27.720089° S 30.453472° E	Dolerite	No Fossils expected. No fossils observed	
P9	27.717196° S 30.454203° E	Dolerite	No Fossils expected. No fossils observed	
P10	27.720100° S 30.455470° E	Dolerite and Volksrust shale at spring site	Trace fossils expected, no fossils observed but monitoring at excavations compulsory	

T8 T25	27.723608° S 30.447192° E  27.728468° S 30.441610° E	Vryheid and Volksrust	No Outcrop, fossils expected, no fossils observed. Monitoring of excavations compulsory	
T15	27.731950° S 30.453775° E	Dolerite	No Fossils expected. No fossils observed	
T3 T42	27.736714° S 30.434227° E  27.732745° S 30.433887° E	Dolerite	No Fossils expected. No fossils observed	
T10 T13 T28	27.739168° S 30.461868° E  27.741544° S 30.457431° E  27.743888° S 30.462607° E	Dolerite	No Fossils expected. No fossils observed	

<p>T12</p> <p>T18</p> <p>T19</p> <p>T21</p>	<p>27.740097° S 30.446426° E</p> <p>27.745864° S 30.451370° E</p> <p>27.745505° S 30.445427° E</p> <p>27.740118° S 30.452054° E</p>	<p>Dolerite</p>	<p>No Fossils expected. No fossils observed</p>	
<p>P14</p>	<p>27.739681° S 30.451795° E</p>	<p>Dolerite</p>	<p>No Fossils expected. No fossils observed</p>	
<p>P15</p>	<p>27.742026° S 30.450592° E</p>	<p>Dolerite</p>	<p>No Fossils expected. No fossils observed</p>	
<p>P16</p>	<p>27.744047° S 30.450381° E</p>	<p>Dolerite</p>	<p>No Fossils expected. No fossils observed</p>	

T14	27.744302° S 30.473314° E	Dolerite	No Fossils expected. No fossils observed	
T16	27.753323° S 30.464553° E			
T23	27.751075° S 30.468318° E			
T24	27.749840° S 30.492733° E			
T27	27.757618° S 30.486913° E			
T29	S27 44 45.2 E30 27 53.6	Dolerite	No Fossils expected. No fossils observed	
T30				
T32				
T43				

No fossils were observed at any of the visited turbine sites. This is either due to lack of exposure of Vryheid or Volksrust Formations or the presence of Dolerite. It is however important to note that where outcrops of the Vryheid and Volksrust Formations are present, fossils were observed. Exposures on the farm Paardepoot yielded well preserved trace fossils on mudstone bedding planes and stromatolites associated with carbonate concretions.

## 8. PALAEOLOGICAL SIGNIFICANCE AND RATING

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the field investigation.

The palaeontological significance and rating as discussed in the comprehensive report of March 2014 (Groenewald, Phase 1 PIA report, 2014: Internal report at Mainstream) is upheld and the recommendations for further mitigation for Palaeontological Heritage is upheld.

## 9. PALAEOLOGICAL IMPACT AND MITIGATION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the field investigation. The field investigation confirms that the area is underlain by a prominent an extensive dolerite sill, with smaller areas underlain by Vryheid and Volksrust Formations of the Ecca Group.

The recommended mitigation for Palaeontological Heritage as reported in 2014 is therefor confirmed for this future development of the Waaihoek WEF.

## 10. CONCLUSION

The development site for the proposed Waaihoek Wind Energy Facility is underlain by the Permian Vryheid and Volksrust Formations of the Ecca Group as well as a thick dolerite sill.

Outcrops of the Vryheid and Volksrust Formations are restricted to specific areas on the escarpment and in road cuttings. Extensive areas are underlain by dolerite.

It is recommended that:

- The PEA and CEO be made aware of the possibility of finding fossils in the Vryheid and Volksrust Formation sediments during excavation of the foundations for the turbines and other infrastructure.
- A professional palaeontologist be appointed to monitor possible palaeontological finds during excavation of turbine foundations and infrastructure where turbine positions and infrastructure fall on Vryheid and Volksrust Formation sediments.
- No further action is needed in all areas underlain by dolerite.

## 11. REFERENCES

**Bamford M. 2011.** Desktop study Palaeontology Ermelo to Empangeni – Eskom powerline. Internal report Bernard Price Institute for Palaeontological Research, University of the Witwatersrand.

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**Rubidge, B.S. (Ed.). 1995.** Biostratigraphy of the Beaufort Group (Karoo Supergroup). SACS Biostratigraphic Series, vol. 1.

## **12. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR**

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

## **13. DECLARATION OF INDEPENDENCE**

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

A handwritten signature in black ink, appearing to read 'G. Groenewald', written in a cursive style.

**Dr Gideon Groenewald**  
**Geologist**