PALAEONTOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED DEVELOPMENT OF A CLUSTER OF RENEWABLE ENERGY FACILITIES BETWEEN SOMERSET EAST AND GRAHAMSTOWN IN THE EASTERN CAPE

(Savannah Ref No: SE2602)

Prepared for:

Savannah Environmental (Pty) Ltd

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Johannesburg, 2157

Prepared by

Banzai Environmental (Pty) Ltd

25 November 2020

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;

- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd

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SIGNATURE: 

The heritage impact assessment report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

Table 1: NEMA Table

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 3 – refer to **Appendix A**	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 6 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 11	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1;10 & 12	
(e) a description of the methodology adopted in preparing the report or carrying out the	Section 8 Approach	-

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
specialised process inclusive of equipment and modelling used	and Methodology	
(f) details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1;10 & 12	
(g) An identification of any areas to be avoided, including buffers	Section 1 & 12	No buffers or areas of sensitivity identified
(h) 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;	Section 6 – Geological and Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 8.1 – Assumptions and Limitation	-
(j) 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 1 and 12	
(k) Any mitigation measures for inclusion in the EMPr	N/A	
(l) Any conditions for inclusion in the environmental authorisation	N/A	Non required
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 13	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 & 12	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities 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	Section 1 and 12	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process was handled as part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) process.
(p) A summary and copies of any comments that were received during any consultation process	N/A	Not applicable. To date, no comments regarding heritage resources that require

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
		input from a specialist have been raised.
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by Savannah (Pty) Ltd to conduct the **Palaeontological Impact Assessment** (PIA) to assess the six wind energy facilities (WEF) and associated grid connection infrastructure, within the Eastern Cape Province. The proposed development is in the Cookhouse Renewable Energy Development Zone (REDZ) and the Eastern Corridor of the Strategic Transmission Corridors. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Impact Assessment is necessary to detect if fossil material is present in the planned development. This study is thus required to evaluate the effect of the development on the palaeontological resources.

The cluster of projects is divided into two sections, namely the Western Section and the Eastern Section, with the Western Section situated near Somerset East and the Eastern Section near Grahamstown. The western section comprises of seven (7) of the nine projects and the eastern section the remaining two (2) projects. The proposed development is divided in an eastern and western block. It must be noted that the two (2) Solar farms were not assessed in this Basic Assessment

The **Eastern Block** of the WEF and associated grid connection infrastructure, is underlain by the Dwyka and Witteberg Group (Witpoort and Weltevrede Formations) of the Cape Supergroup. According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Dwyka Group is Low and that of the Witteberg Group is High (Almond et al, 2013; SAHRIS website). The **Western Block** of the WEF and associated grid connection infrastructure is underlain by the Dwyka Group; the Fort Brown Formation of the Ecca Group (Karoo Supergroup), Adelaide Subgroup (Koonap and Middleton Formations) of the Beaufort Group (Karoo Supergroup) and the Witteberg Group of the Cape Supergroup, Karoo Dolerite (Karoo Supergroup), and Quaternary deposits. According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Dwyka Group is Low, the Collingham Formation, Rippon Formation, Fort Brown Formation of the Ecca Group is Moderate, while the Prince Albert Formation has a High and the Whitehill Formation of the Ecca has a Very High Palaeontological Sensitivity. The Adelaide Subgroup has a Very High Palaeontological Sensitivity, Dolerite is igneous in origin and thus has an Insignificant Paleontological Sensitivity while that of Quaternary deposits is Low but locally High in terms of the sensitivity (Almond et al, 2013; SAHRIS website).

A 3-day site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 20 November to 23 November 2020. No visible evidence of fossiliferous outcrops was found. For this reason, an overall low palaeontological sensitivity is allocated to the development footprint. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the WEF and associated grid connection infrastructure, will be of a low significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological reserves of the area. Thus, the construction of the development may be authorised in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.

However, if fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO or site manager in charge of these developments. Fossil discoveries ought to be protected and the ECO/site manager must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that suitable mitigation (recording and collection) can be carried out.

Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).

It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

Impact Summary

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Loss of fossil heritage Frontier Wind Farm	Destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study	-56	Negative medium impact	+6	Negative low impact
Loss of fossil heritage Wind Garden Wind Farm	Destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study	-56	Negative medium impact	+6	Negative low impact
Loss of fossil heritage Aeoulus Wind Farm	Destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study	-56	Negative medium impact	+6	Negative low impact
Loss of fossil heritage Hamlett Wind Farm	Destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study	-56	Negative medium impact	+6	Negative low impact
Ripponn Wind Farm		-56	Negative medium impact	+6	Negative low impact

Loss of fossil heritage Redding Wind Farm	Destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study	-56	Negative medium impact	+6	Negative low impact
Loss of fossil heritage REDZ 3 Power Corridor 400MTS	Destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study	-56	Negative medium impact	+6	Negative low impact
REDZ 3Power Corridor 400MTS		-56	Negative medium impact	+6	

It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological reserves of the area. Thus, the construction of the development may be authorised in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.

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1 INTRODUCTION

Information provided by Savannah Environmental.

A cluster of renewable energy facilities is proposed to be developed on various project sites located between Somerset East and Grahamstown within the Cookhouse Renewable Energy Development Zone (REDZ), as well as the Eastern Strategic Transmission Corridor. The cluster consists of nine (9) projects which includes six (6) wind farms, two (2) solar energy facilities and one (1) Main Transmission Substation (MTS). A suitable project site for each development has been identified by the project development companies (refer to the attached locality map and table for details) (Figure 1).

The entire extent of the projects is located within the Sarah Baartman District Municipality. The western section is located within the Blue Crane Route Local Municipality and the eastern section within the Makana Local Municipality.

Four of the six wind energy facilities are proposed to be located directly adjacent to one another in one large contiguous area. This area is situated south of Somerset East and Cookhouse, north-west of Riebeek East and Alicedale, and north-east of Kirkwood. Each of the four wind energy facilities will have a contracted capacity of up to 320MW. The four project sites vary in size and include areas of ~15 061ha, ~10 239ha, ~11 141ha and ~10 882ha respectively.

Two of the six wind energy facilities are proposed to be located to the north-west of Grahamstown, to the south-east of Riebeek East and north-east of Alicedale. Each of the wind energy facilities will have a contracted capacity of up to 320MW. One contiguous area with an extent of ~14 063ha has been identified for the development of these two wind energy facilities. It is understood that this area is still to be divided into two separate areas for the two wind energy facilities.

A grid connection solution for the six wind energy facilities will need to be developed in order to enable the evacuation of the generated electricity to the national grid. This grid connection solution will comprise of specific grid connection infrastructure which consists of a 400kV substation. As requested by WIND RELIC, this proposal includes the following:

1. BA process to be undertaken for a wind energy facility within a project site with a total extent approximately 15 061ha. The contracted capacity will be up to 320MW.

2. BA process to be undertaken for a wind energy facility within a project site with a total extent approximately 10 239ha. The contracted capacity will be up to 320MW.

3. BA process to be undertaken for a wind energy facility within a project site with a total extent approximately 11 141ha. The contracted capacity will be up to 320MW.

4. BA process to be undertaken for a wind energy facility within a project site with a total extent approximately 10 882ha. The contracted capacity will be up to 320MW.

5. BA process to be undertaken for a wind energy facility within a project site with an extent of up to 14063ha. The final extent of the project site is yet to be confirmed. The contracted capacity will be up to 320MW.

6. BA process to be undertaken for a wind energy facility within a project site with an extent of up to 14063ha. The final extent of the project site is yet to be confirmed. The contracted capacity will be up to 320MW.

7. BA process to be undertaken for a solar energy facility with a contracted capacity of up to 300MW.

8. BA process to be undertaken for a solar energy facility with a contracted capacity of up to 300MW.

Savannah Environmental has been appointed as the independent consultants to undertake Environmental Impact Assessment processes for the projects. The procedure to be followed in applying for environmental authorisation for a large-scale project in a REDZ as well as grid infrastructure within a Strategic Transmission Corridor was formally gazetted on 16 February 2018 (in GN113 and GN114). As such, these renewable energy projects and the proposed MTS, are subject to a Basic Assessment (BA) as gazetted, as well as a shortened timeframe of 57 days for the processing of an Application for Environmental Authorisation following submission of the final BA Report.

The identified project sites form the basis of investigation for the Basic Assessment (BA) processes. The preferred sites for the projects comprise properties which are privately owned and available for the proposed projects through agreement with the landowners and are deemed technically feasible by the project developer for such development to take place. The cluster of projects is divided into two areas, known as the Western Section and the Eastern Section, with the Western Section located near Somerset East and the Eastern Section near Grahamstown. The western section contains seven (7) of the nine projects and the eastern section the remaining two (2) projects.

The projects are proposed in specific response to national government policy dictating energy development within the project sites, namely the Integrated Resource Plan (IRP), which includes the requirement for diversification of the country's energy mix to include renewable energy. Furthermore, Government has prioritised post COVID-19 turnaround

plans in terms of renewable energies within the Just Energy Transition (JET), coupled with key development objectives of the various spheres of government from a National, Provincial and Local level. These policies share the same ideals, such as:

» The utilisation, application and investment in renewable energy resources in South Africa is considered to be an essential means of reducing the carbon footprint of the country,

» Diversifying the national economy,

» Reducing poverty, and

» Providing critical additional energy to that of Eskom

The project sites identified for development are deemed desirable for development based on the wind resource (measured through wind masts deployed on site since 2011), solar resource and available grid connection capacity which connects the Eastern Cape Province to Mpumalanga Province. As the area has been identified as a REDZ, it is earmarked for fast track development of renewable energy. The mix of wind and solar will ensure the optimization of a supply of steady state baseload type power, as well as play a significant role in the Just Energy Transition ("JET") by supplying low cost energy to the national grid. At the same time, it will contribute to a JET fund to assist in transitioning jobs from the fossil fuel sector in Mpumalanga to renewable energy. The high-quality wind resource, proximity to the transmission infrastructure and scale of the portfolio may also play a possible role in contributing to the hydrogen economy in South Africa, with Europe as a possible export market.

The cluster is expected to have a meaningful contribution to job creation and development in the region (specifically in the local towns like Makhanda, Bedford, Cookhouse, Alicedale, Somerset East and Adelaide), and ensure optimisation of electricity supply.

The table below provides the project specific details for each of the six wind farm projects contained within the cluster.

Table 2: Project specific details for each of the six wind farm projects within the cluster.

Project Name	**Hamlett Wind Farm**	**Ripponn Wind Farm**	**Redding Wind Farm**	**Aeoulus Wind Farm**	**Wind Garden Wind Farm**	**Fronteer Wind Farm**
Applicant	Hamlett (Pty) Ltd	Ripponn (Pty) Ltd	Redding Wind (Pty) Ltd	Aeoulus (Pty) Ltd	Wind Garden (Pty)	Ltd Fronteer (Pty) Ltd
Section	Western	Western	Western	Western	Eastern	Eastern
Affected properties (i.e. project site)	• Farm Vaalkop No 164 • Remainder of Portion 1 (Midlevale) of Farm Van Aardts Kraal No 163 • Portion 1 of Farm Jaskraal No 160 • Remainder of Farm Riet Fontein A No 159 • Portion 1 of Farm Riet Fontein A No 159	Remaining Extent of Farm No 381 • Remaining Extent of Farm Wilton No 409 • Portion 7 of Farm No 381 • Remaining Extent of Farm Hartebeest Kuil No 220 • Portion 1 of Farm Hartebeest Kuil No 220 • Portion 2 of Farm Haartebeestkuil	• Farm No 369 • Portion 2 of Farm Shepherds Rest No 272 • Remainder of Farm Varkens Kuil No 269 • Portion 3 (Vlak Leegte) of Farm Driefontein No 259 • Portion 1 (Opmeet Fontein) of farm Gras Fonteyn No 258 • Remainder of Farm Draai Van	• • Remainder of Farm Brand Rug No 268 • Remainder of Farm Varkens Kuil No 269 • Remainder of Portion 3 of Farm Commadagga No 266 • Portion 1 of Farm Vaalkdrans No 299 • Portion 1 Glen Roy of Farm	Remaining Extent of Farm Brackkloof No 183 • Portion 5 of Farm Hilton No 182 • Portion 8 of Farm Hilton No 182 • Portion 4 of Farm Vandermerweskraal No 132 • Portion 1 of Farm Thursford No183	• • Remainder of Farm Table Hill Farm No 187 • Portion 2 of Table Hill Farm No 187 • Portion 3 of the Farm Table Hill Farm No 187 • Remainder of the Farm Hounshow No 131 • Portion 1 of Farm Draai Farm No 184

	• Remainder of Farm Jaskraal No 160 • Remainder of Farm Nieuwe Grond A No 129 • Remainder of Farm Wilton No 409 • Portion 2 of Farm Middleton No 219 • Remainder of Farm Bloemhof No 166 • Farm Wilde Honden Kloof No 216 • Portion 1 of Farm Bloemhof No 166	No 220 • Portion 2 of Farm No 230 • Remaining Extent of Portion 4 (Pruim Plaas) of Farm Draai Hoek No 221	Klein Visrivier 254 • Portion 1 of Farm Bothas Hoop 358m • Remainder of 271 of Farm Request 271 • Portion 2 of Farm Request 271 • Portion 1 of Farm Request 271 • Portion 9 of Farm Britzkraal No 253 • Portion 8 (a Portion of Portion 7) of Farm Britzkraal No 253	Varkens Kuil No 269 • Portion 3 Glen Roy a portion of Portion 1 of Farm Modderfontein No 302 • Portion 2 Spitzkop of Farm Varkens Kuil No 269		• Portion 1 of Farm No 132 • Portion 1 of Farm Burnt Kraal No 189 • Portion 1 of Farm Table Hill No 187
Contracted Capacity	Up to 333MW Up	to 324MW	Up to 576MW	Up to 297MW	Up to 264MW	Up to 213MW
No of turbines	Up to 37	Up to 36	Up to 64	Up to 33	Up to 47	Up to 38

Turbine hub height	Up to 166m	Up to 166m	Up to 166m	Up to 166	Up to 120m	Up to 120m
Turbine tip height	Up to 246m	Up to 246m	Up to 246m	Up to 246m	Up to 200m	Up to 200m
Rotor diameter	Up to 160m	Up to 160m	Up to 160m	Up to 160m	Up to 160m	Up to 160m

Table 3: Infrastructure

Project Name	***Hamlett Wind Farm***	***Ripponn Wind Farm***	***Redding Wind Farm***	***Aeoulus Wind Farm***	***Wind Garden Wind Farm***	**Fronteer Wind Farm**
On-site substation size and capacity	132/33kV collector substation of 100mX100m	132/33kV collector substation of 100mX100m	132/33kV collector substation of 100mX100m	132/33kV collector substation of 100mX100m	132/33kV collector substation of 100mX100m	132/33kV collector substation of 100mX100m
Access Roads (internal and main)	4.5m in width and of a gravel nature	4.5m in width and of a gravel nature	4.5m in width and of a gravel nature	4.5m in width and of a gravel nature	4.5m in width and of a gravel nature	4.5m in width and of a gravel nature
Other associated infrastructure	A 132kV switching station; a 132/33kV on-site collector substation; a 132kV overhead single-or double circuit loop-in loop -out power line; concrete turbine foundations and turbine hardstands; temporary laydown areas which will accommodate storage and assembly areas; cabling between the turbines, to be laid underground where practical; a temporary concrete batching plant; staff accommodation; and					

	Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitor's centre

Table 4: Main Transmission Substation

Project Name	**REDZ 3Power Corridor 400MTS**
Section	Western
Applicant	Wind Relic (Pty) Ltd
Affected properties (i.e. project site)	• Farm 434 • Portion 3 of Farm Driefontein 259
Capacity	400KV
Footprint	600mX600m
Access Roads (internal and main)	4.5m in width and of a gravel nature

For the assessment of the MTS the developer has identified a larger area within which the MTS will be placed in order to cater for the avoidance of sensitive environmental features. This larger area will have an extent of approximately 400ha. The siting of the 400 kV MTS forms part of Eskom's planning for the area for new proposed substations - Poseidon B and C. It is the developer's intention to supply the electricity generated from the facilities to private off-takers in the region, with key customer focus areas primarily being within the industrial, mining and commercial sectors where there is a need to shift towards cleaner and more sustainable sources of energy. The expected load requirements for each of the potential customers are in excess of 1 000 GWh per annum. The generated electricity will be evacuated through use of the national electricity grid and through a wheeling agreement with Eskom for the use of the existing grid connection infrastructure in the area.

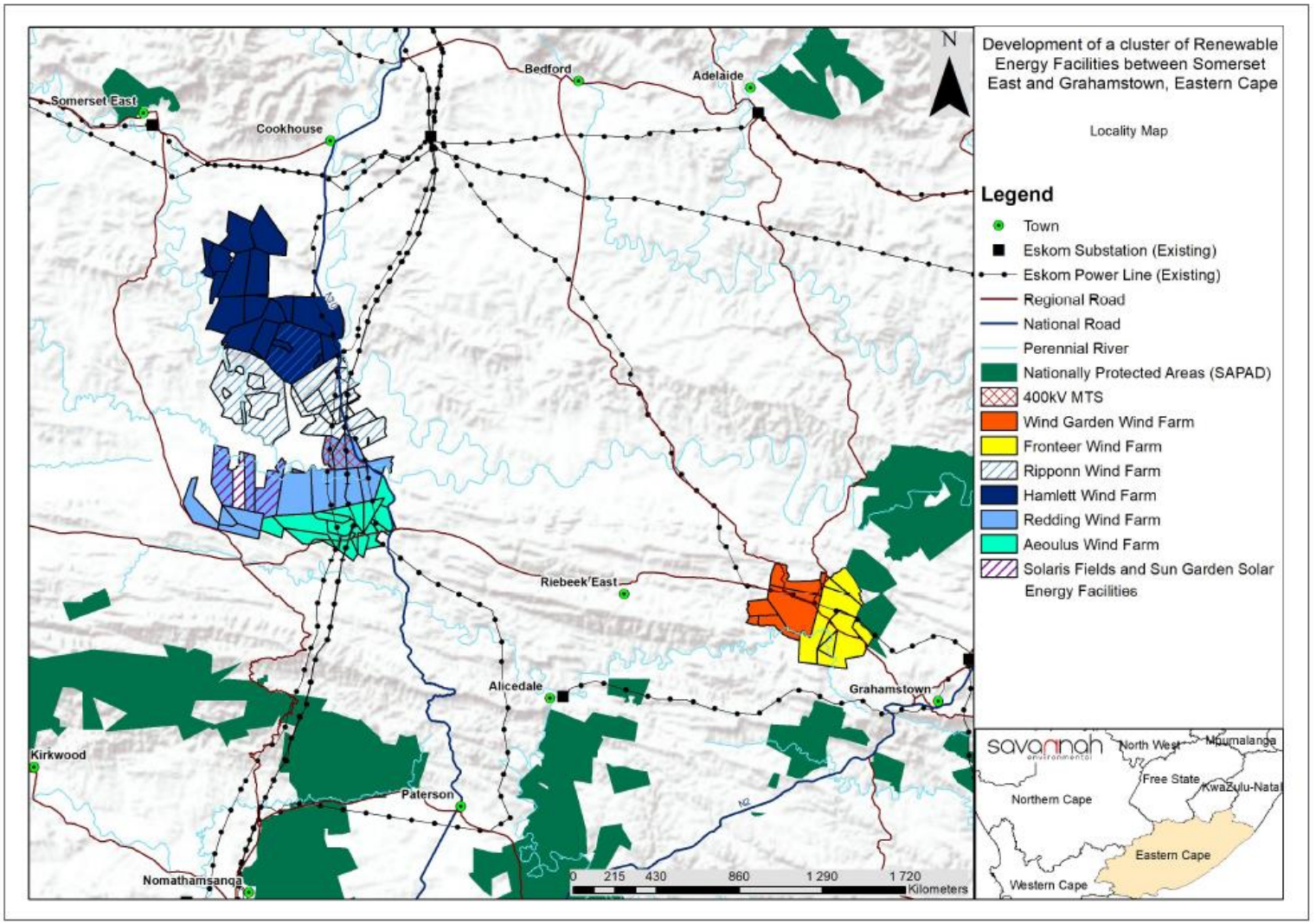


Figure 1: Locality of the renewable energy facilities located between Somerset East and Grahamstown.

The cluster of projects is divided into two sections, namely the Eastern Section near Grahamstown and the Western Section near Somerset East hence the name Eastern and Western Block.

2 PROJECT DESCRIPTIONS

2.1 Eastern Block

2.1.1 Fronteer Wind Farm, Eastern Cape Province

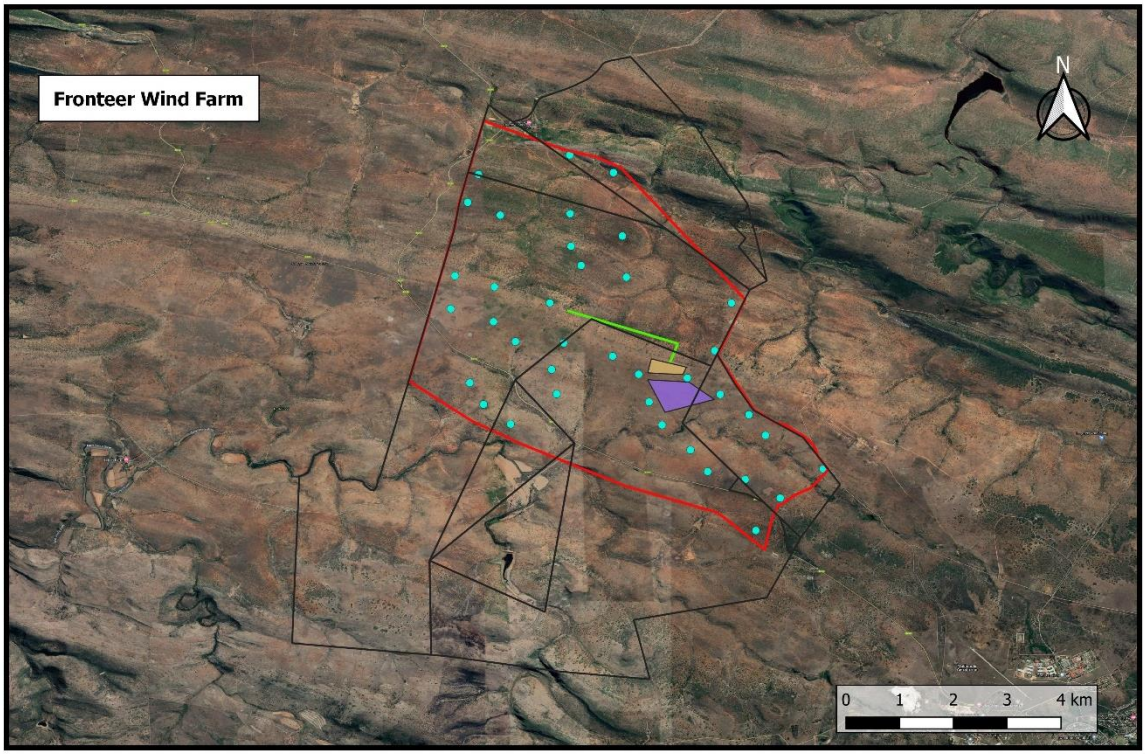


Figure 2: Google Earth Image (2020) of the proposed Fronteer Wind Farm (Eastern Block).

Fronteer (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 12km north-west of Grahamstown (measured from the centre of the site) within the Makana Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province.

A preferred project site with an extent of ~5091ha has been identified by Fronteer (Pty) Ltd as a technically suitable area for the development of the Fronteer Wind Farm with a contracted capacity of up to 213MW that can accommodate up to 38 turbines.

The entire project site is located within the Cookhouse Renewable Energy Development Zone (REDZ). Due to the location of the project site within the REDZ, a Basic Assessment (BA) process will be undertaken in accordance with GN114 as formally gazetted on 16 February 2018. The project site comprises the following eight (8) farm portions:

» Remainder of Farm Table Hill Farm No 187
» Portion 2 of Table Hill Farm No 187
» Portion 3 of the Farm Table Hill Farm No 187
» Remainder of the Farm Hounshow No 131
» Portion 1 of Farm Draai Farm No 184
» Portion 1 of Farm No 132
» Portion 1 of Farm Burnt Kraal No 189
» Portion 1 of Farm Table Hill No 187

The Fronteer Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 213MW:

» Up to 38 wind turbines with a maximum hub height of up to 120m. The tip height of the turbines will be up to 200m;
» A 132kV switching station and a 132/33kV on-site collector substation to be connected via a 132kV overhead power line (twin turn dual circuit). The wind farm will be connected to the national grid through a connection from the 132/33kV collector substation via the 132kV power line which will connect to the 132kV switching station that will loop in and loop out of the existing Poseidon – Albany 132kV line;
» Concrete turbine foundations and turbine hardstands;
» Temporary laydown areas which will accommodate the boom erection, storage and assembly area;
» Cabling between the turbines, to be laid underground where practical;
» Access roads to the site and between project components with a width of approximately 4.5m;
» A temporary concrete batching plant;

» Staff accommodation; and
» Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre.

A development envelope for the placement of the wind energy facility infrastructure (i.e. development footprint) has been identified within the project site and assessed as part of the BA process. The development envelope is ~2689ha in extent and the much smaller development footprint of ~49.4ha will be placed and sited within the development envelope.

2.1.2 Wind Garden Wind Farm, Eastern Cape Province

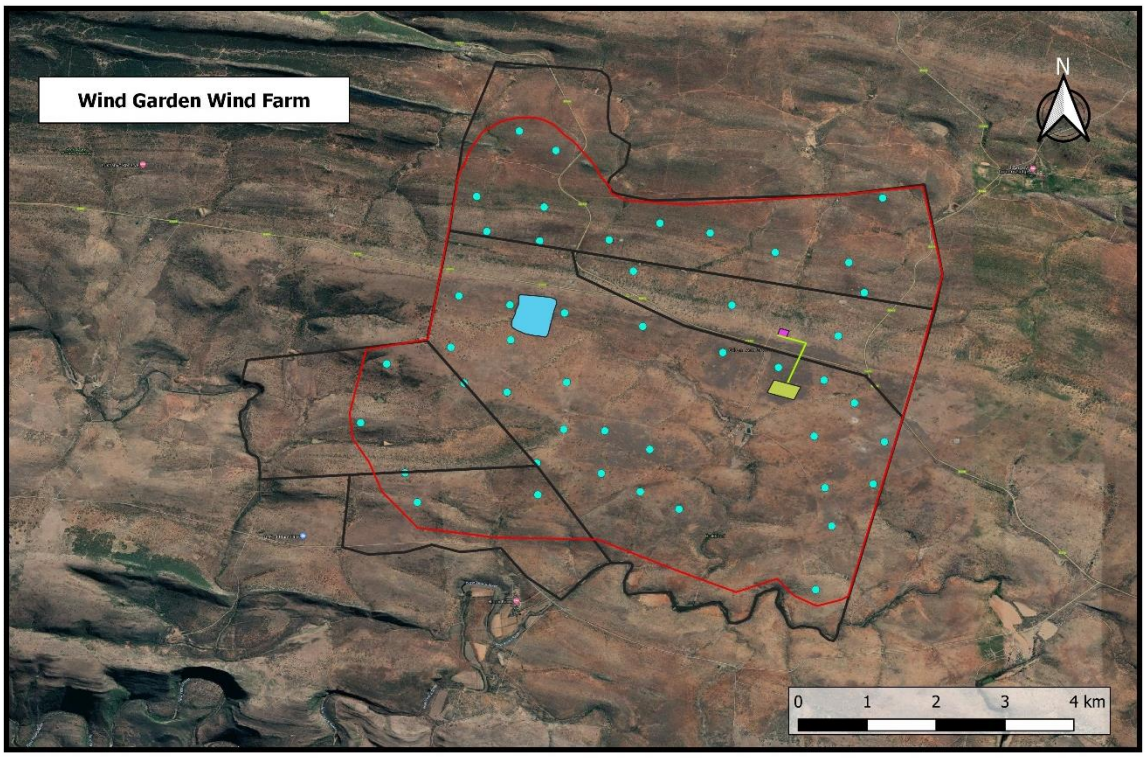


Figure 3: Google Earth Image (2020) of the Proposed Wind Garden Wind Farm (Eastern Block).

Wind Garden (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 17km north-west of

Grahamstown (measured from the centre of the site) within the Makana Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province.

A preferred project site with an extent of ~4336ha has been identified by Wind Garden (Pty) Ltd as a technically suitable area for the development of the Wind Garden Wind Farm with a contracted capacity of up to 264MW that can accommodate up to 47 turbines. The entire project site is located within the Cookhouse Renewable Energy Development Zone (REDZ). Due to the location of the project site within the REDZ, a Basic Assessment (BA) process will be undertaken in accordance with GN114 as formally gazetted on 16 February 2018. The project site comprises the following five (5) farm portions:

» Remaining Extent of Farm Brackkloof No 183

» Portion 5 of Farm Hilton No 182

» Portion 8 of Farm Hilton No 182

» Portion 4 of Farm Vandermerweskraal No 132

» Portion 1 of Farm Thursford No183

The Wind Garden Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 264MW:

» Up to 47 wind turbines with a maximum hub height of up to 120m. The tip height of the turbines will be up to 200m;
» A 132kV switching station and a 132/33kV on-site collector substation to be connected via a 132kV overhead power line (twin turn dual circuit). The wind farm will be connected to the national grid through a connection from the 132/33kV collector substation via the 132kV power line which will connect to the 132kV switching station that will loop in and loop out of the existing Poseidon – Albany 132kV line;

» Concrete turbine foundations and turbine hardstands;
» Temporary laydown areas which will accommodate the boom erection, storage and assembly area;
» Cabling between the turbines, to be laid underground where practical;
» Access roads to the site and between project components with a width of approximately 4,5m;
» A temporary concrete batching plant;
» Staff accommodation; and
» Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre.

A development envelope for the placement of the wind energy facility infrastructure (i.e. development footprint) has been identified within the project site and assessed as part of the BA process. The development envelope is ~3400ha in extent and the much smaller development footprint of ~66.6ha will be placed and sited within the development envelope.

2.2 Western Block

2.2.1 Aeoulus Wind Farm, Eastern Cape Province

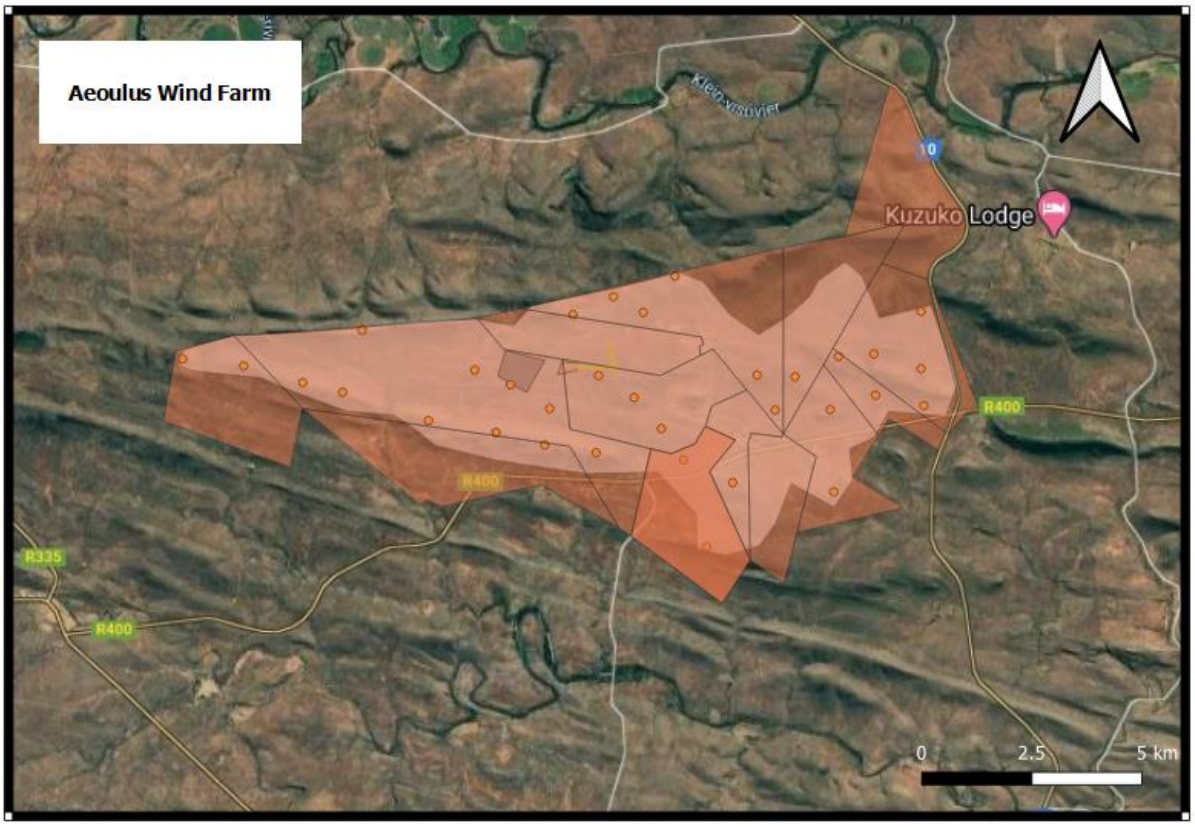


Figure 4: Google Earth Image (2020) of the Proposed Aeoulus Wind Farm (Eastern Block).

Aeoulus (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 53km south-east of Somerset East, 44km south-west of Cookhouse and 32km north-west of Riebeek East (measured from the centre of the site) within the Blue Crane Route Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province.

A preferred project site with an extent of ~5 330ha has been identified by Aeoulus (Pty) Ltd as a technically suitable area for the development of the Aeoulus Wind Farm with a contracted capacity of up to 297MW that can accommodate up to 33 turbines. The entire project site is located within the Cookhouse Renewable Energy Development Zone (REDZ). Due to the location of the project site within the REDZ, a Basic

Assessment (BA) process will be undertaken in accordance with GN114 as formally gazetted on 16 February 2018. The project site comprises the following seven (7) farm portions:

» Remainder of Farm Brand Rug No 268
» Remainder of Farm Varkens Kuil No 269
» Remainder of Portion 3 of Farm Commadagga No 266
» Portion 1 of Farm Vaalkdrans No 299
» Portion 1 Glen Roy of Farm Varkens Kuil No 269
» Portion 3 Glen Roy a portion of Portion 1 of Farm Modderfontein No 302
» Portion 2 Spitzkop of Farm Varkens Kuil No 269

The Aeoulus Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 297MW:

» Up to 33 wind turbines with a maximum hub height of up to 166m. The tip height of the turbines will be up to 246m;
» A 132/33kV on-site collector substation to be connected to a proposed 400kV Main Transmission Substation (MTS) located to the north via a new 132kV overhead power line (twin turn dual circuit line). The development of the proposed 400kV Main Transmission Substation will be assessed as part of the separate BA process in order to obtain Environmental Authorisation;
» Concrete turbine foundations and turbine hardstands;
» Temporary laydown areas which will accommodate the boom erection, storage and assembly area;
» Cabling between the turbines, to be laid underground where practical;
» Access roads to the site and between project components with a width of approximately 4,5m;
» A temporary concrete batching plant;
» Staff accommodation; and
» Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre.

A development envelope for the placement of the wind energy facility infrastructure (i.e. development footprint) has been identified within the project site and assessed as part of the BA process. The development envelope is ~3857ha in extent and the much smaller development footprint of ~45.4ha will be placed and sited within the development envelope.

2.2.2 Hamlett Wind Farm, Eastern Cape Province

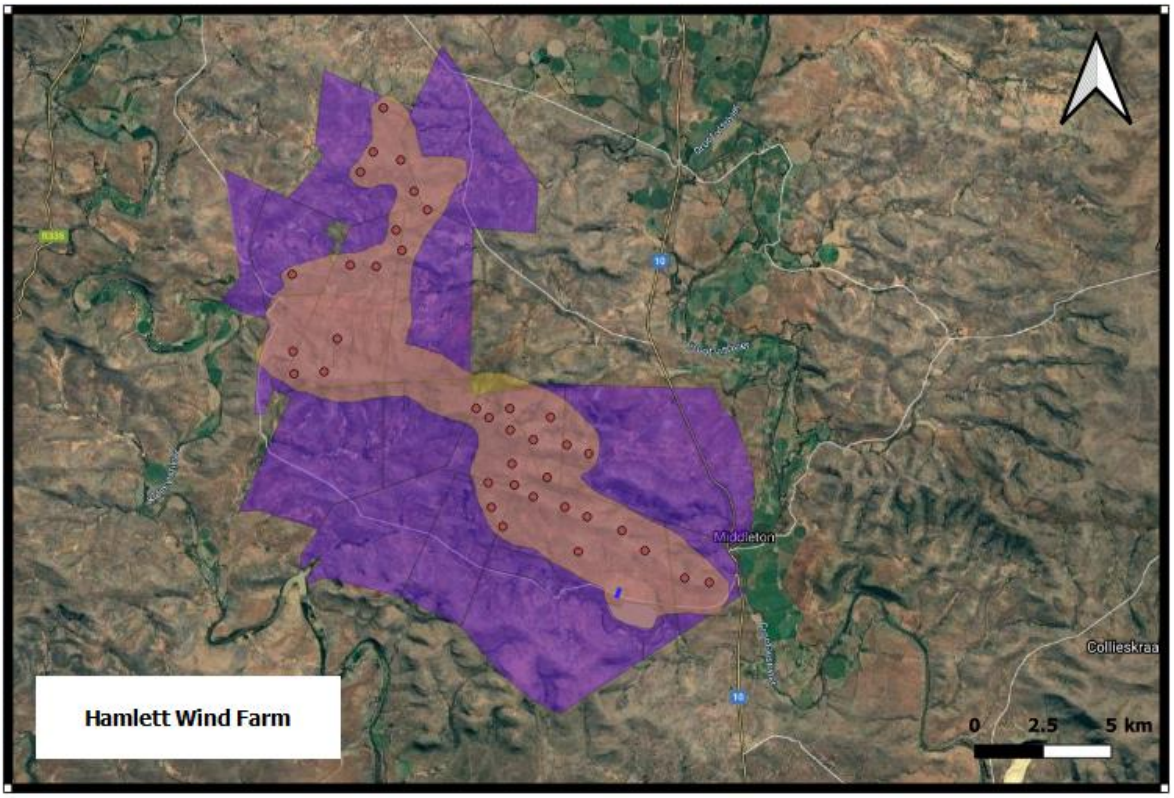


Figure 5: Google Earth Image (2020) of the Proposed Hamlett Wind Farm (Eastern Block).

Hamlett (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 27km south-east of Somerset East and 20km south-west of Cookhouse (measured from the centre of the site) within the Blue Crane Route Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province.

A preferred project site with an extent of ~14 329ha has been identified by Hamlett (Pty) Ltd as a technically suitable area for the development of the Hamlett Wind Farm with a contracted capacity of up to 333MW that can accommodate up to 37 turbines. The entire project site is located within the Cookhouse Renewable Energy Development Zone (REDZ). Due to the location of the project site within the REDZ, a Basic Assessment (BA) process will be undertaken in accordance with GN114 as formally gazetted on 16 February 2018. The project site comprises the following twelve (12) farm portions:

» Farm Vaalkop No 164
» Remainder of Portion 1 (Middlevale) of Farm Van Aardts Kraal No 163
» Portion 1 of Farm Jaskraal No 160
» Remainder of Farm Riet Fontein A No 159
» Portion 1 of Farm Riet Fontein A No 159
» Remainder of Farm Jaskraal No 160
» Remainder of Farm Nieuwe Grond A No 129
» Remainder of Farm Wilton No 409
» Portion 2 of Farm Middleton No 219
» Remainder of Farm Bloemhof No 166
» Farm Wilde Honden Kloof No 216
» Portion 1 of the Farm Bloemhof 166

The Hamlett Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 333MW:

» Up to 37 wind turbines with a maximum hub height of up to 166m. The tip height of the turbines will be up to 246m;
» A 132/33kV on-site collector substation to be connected to a proposed 400kV Main Transmission Substation (MTS) located to the south via a new 132kV overhead power line (twin turn dual circuit line). The development of the proposed 400kV Main Transmission Substation will be assessed as part of the separate BA process in order to obtain Environmental Authorisation;
» Concrete turbine foundations and turbine hardstands;

» Temporary laydown areas which will accommodate the boom erection, storage and assembly area;
» Cabling between the turbines, to be laid underground where practical;
» Access roads to the site and between project components with a width of approximately 4,5m;
» A temporary concrete batching plant;
» Staff accommodation; and
» Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre.

A development envelope for the placement of the wind energy facility infrastructure (i.e. development footprint) has been identified within the project site and assessed as part of the BA process. The development envelope is ~5973ha in extent and the much smaller development footprint of ~48.6ha will be placed and sited within the development envelope.

2.2.3 Redding Wind Farm, Eastern Cape Province

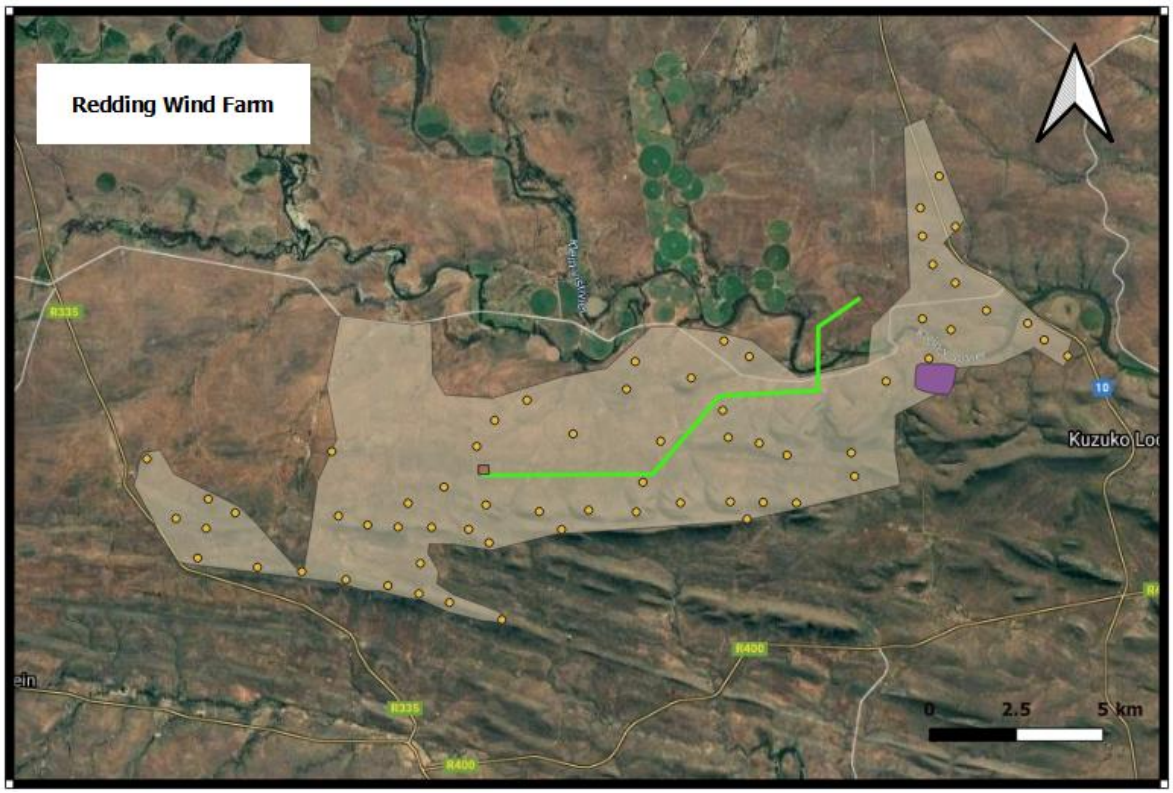


Figure 6: Google Earth Image (2020) of the Redding Wind Farm (Eastern Block).

Redding Wind (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 46km south-east of Somerset East, 40km south-west of Cookhouse and 37km north-west of Riebeek East (measured from the centre of the site) within the Blue Crane Route Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province.

A preferred project site with an extent of ~13 115ha has been identified by Redding (Pty) Ltd as a technically suitable area for the development of the Redding Wind Farm with a contracted capacity of up to 576MW that can accommodate up to 64 turbines. The entire project site is located within the Cookhouse Renewable Energy Development Zone (REDZ). Due to the location of the project site within the REDZ, a Basic Assessment (BA) process will be undertaken in accordance with GN114 as formally gazetted on 16 February 2018. The project site comprises the following twelve (12) farm portions:

» Farm No 369
» Portion 2 of Farm Shepherds Rest No 272
» Remainder of Farm Varkens Kuil No 269
» Portion 3 (Vlak Leegte) of Farm Driefontein No 259
» Portion 1 (Opmeet Fontein) of farm Gras Fonteyn No 258
» Remainder of Farm Draai Van Klein Visrivier 254
» Portion 1 of Farm Bothas Hoop 358m
» Remainder of 271 of Farm Request 271
» Portion 2 of Farm Request 271
» Portion 1 of Farm Request 271
» Portion 9 of Farm Britzkraal No 253
» Portion 8 (a Portion of Portion 7) of Farm Britzkraal No 253

The Redding Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 576MW:

- Up to 64 wind turbines with a maximum hub height of up to 166m. The tip height of the turbines will be up to 246m;
- A 132/33kV on-site collector substation to be connected to a proposed 400kV Main Transmission Substation (MTS) located to the north via a new 132kV overhead power line (twin turn dual circuit line). The development of the proposed 400kV Main Transmission Substation will be assessed as part of the separate BA process in order to obtain Environmental Authorisation;
- Concrete turbine foundations and turbine hardstands;
- Temporary laydown areas which will accommodate the boom erection, storage and assembly area;
- Cabling between the turbines, to be laid underground where practical;
- Access roads to the site and between project components with a width of approximately 4,5m;
- A temporary concrete batching plant;
- Staff accommodation; and
- Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre.

A development envelope for the placement of the wind energy facility infrastructure (i.e. development footprint) has been identified within the project site and assessed as part of the BA process. The development envelope is ~7963ha in extent and the much smaller development footprint of ~88.2ha will be placed and sited within the development envelope.

2.2.4 Ripponn Wind Farm, Eastern Cape Province

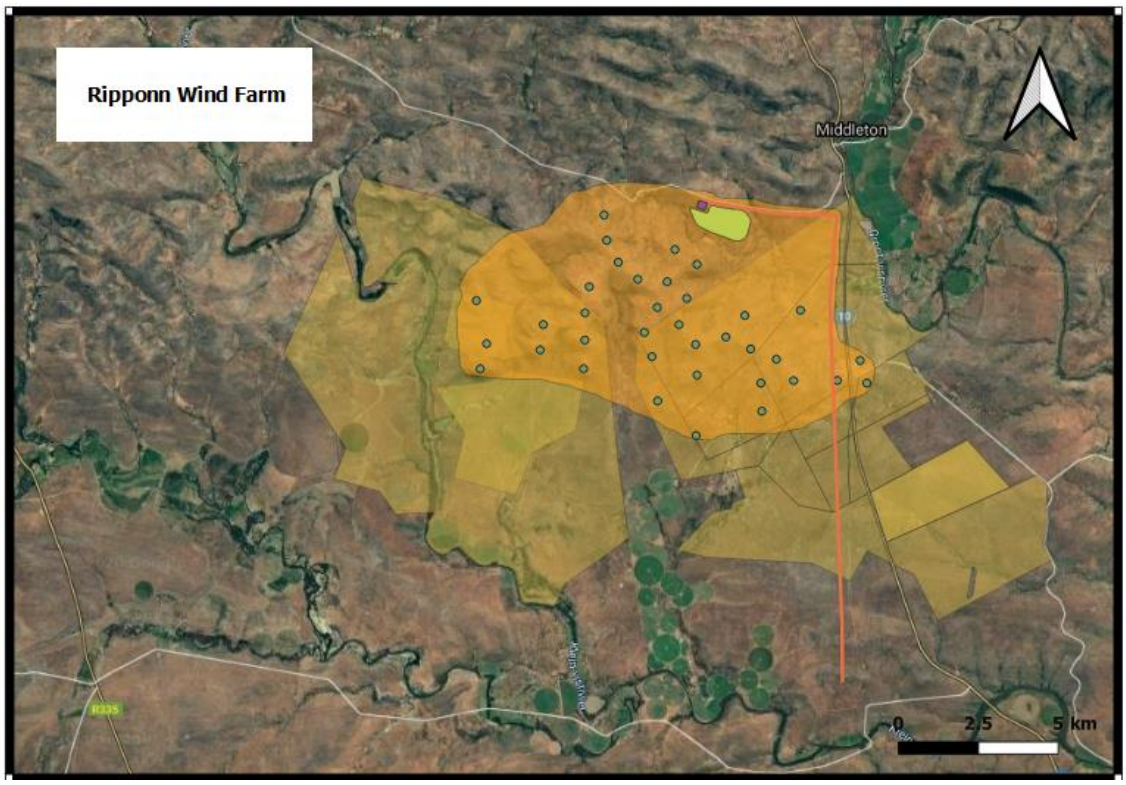


Figure 7: Google Earth Image (2020) of the Rippon Wind Farm (Eastern Block).

Ripponn (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 36km south-east of Somerset East and 28km south-west of Cookhouse (measured from the centre of the site) within the Blue Crane Route Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province.

A preferred project site with an extent of ~12 838ha has been identified by Ripponn (Pty) Ltd as a technically suitable area for the development of the Ripponn Wind Farm with a contracted capacity of up to 324MW that can accommodate up to 36 turbines. The entire project site is located within the Cookhouse Renewable Energy Development Zone (REDZ). Due to the location of the project site within the REDZ, a Basic Assessment (BA) process will be undertaken in accordance with GN114 as formally gazetted on 16 February 2018. The project site comprises the following eight (8) farm portions:

» Remaining Extent of Farm No 381
» Remaining Extent of Farm Wilton No 409
» Portion 7 of Farm No 381
» Remaining Extent of Farm Hartebeest Kuil No 220
» Portion 1 of Farm Hartebeest Kuil No 220
» Portion 2 of Farm Haartebeestkuil No 220
» Portion 2 of Farm No 230
» Remaining Extent of Portion 4 (Pruim Plaas) of Farm Draai Hoek No 221

The Ripponn Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 324MW:

» Up to 36 wind turbines with a maximum hub height of up to 166m. The tip height of the turbines will be up to 246m;
» A 132/33kV on-site collector substation to be connected to a proposed 400kV Main Transmission Substation (MTS) located to the south via a new 132kV overhead power line (twin turn dual circuit line). The development of the proposed 400kV Main Transmission Substation will be assessed as part of the separate BA process in order to obtain Environmental Authorisation;
» Concrete turbine foundations and turbine hardstands;
» Temporary laydown areas which will accommodate the boom erection, storage and assembly area;
» Cabling between the turbines, to be laid underground where practical;
» Access roads to the site and between project components with a width of approximately 4,5m;
» A temporary concrete batching plant;
» Staff accommodation; and
» Operation and Maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre.

A development envelope for the placement of the wind energy facility infrastructure (i.e. development footprint) has been identified within the project site and assessed as part of the BA process. The development envelope is ~5400ha in extent and the

much smaller development footprint of ~30.8ha will be placed and sited within the development envelope.

2.2.5 REDZ 3 Power Corridor 400MTS, Eastern Cape Province

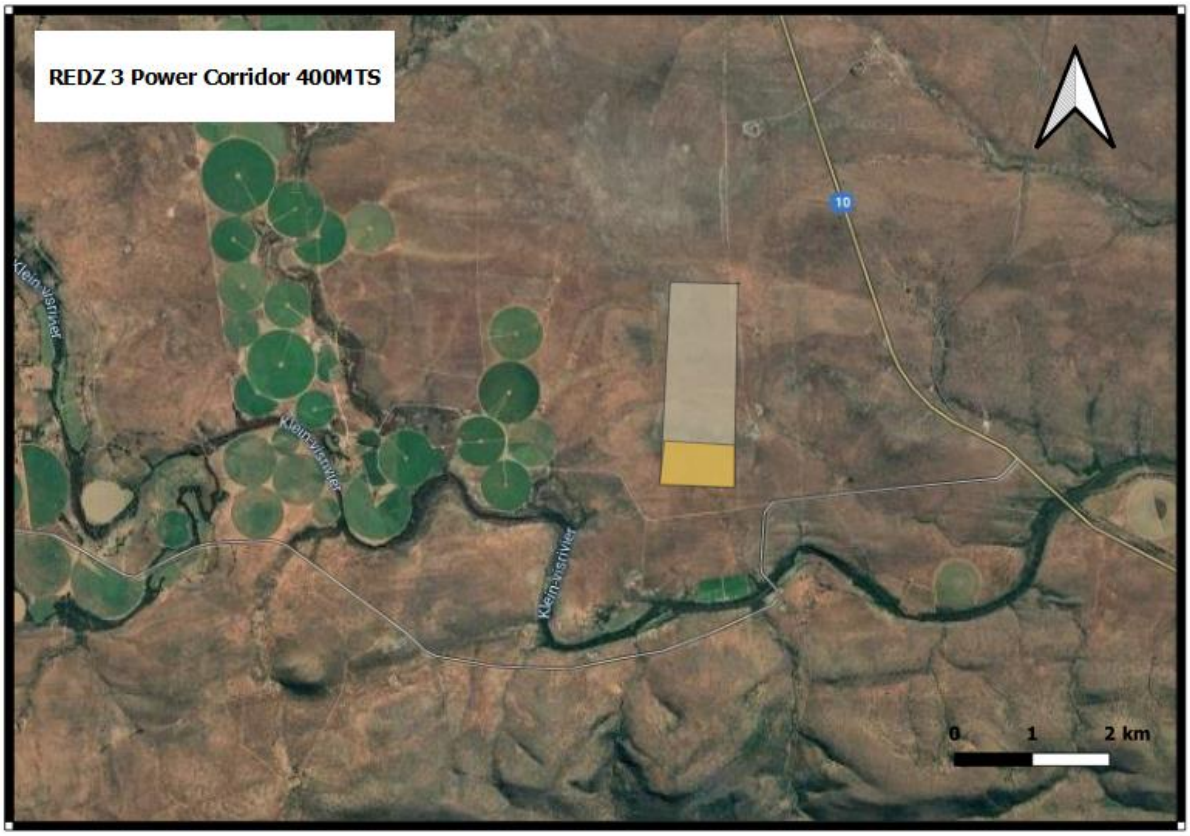


Figure 8: Google Earth Image (2020) of the REDZ 3 Power Corridor 400MTS (Eastern Block).

Wind Relic (Pty) Ltd is proposing the development of a 400kV Main Transmission Substation (MTS) on a site located approximately 36km south of Cookhouse and 35km north-west of Riebeek East (measured from the centre of the site) within the Blue Crane Route Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province.

A preferred project site with an extent of ~1 683ha has been identified by Wind Relic (Pty) Ltd as a technically suitable area for the development of the MTS with a capacity of 400kV. The entire project site is located within Strategic Transmission Corridor.

Due to the location of the project site within a Corridor, a Basic Assessment (BA) process will be undertaken in accordance with GN113 as formally gazetted on 16 February 2018. The project site comprises the following two (2) farm portions:

» Farm 434
» Portion 3 of Farm Driefontein 259

The REDZ 3 Power Corridor 400MTS project site is proposed to accommodate the MTS as well as access roads with a width of 4.5m and gravel of nature.

A development envelope for the placement of the MTS (i.e. development footprint) has been identified within the project site and assessed as part of the BA process. The development envelope is ~168ha in extent and the much smaller development footprint of 600mx600m will be placed and sited within the development envelope.

3 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This study has been conducted by Mrs Elize Butler. She has conducted approximately 300 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than twenty-five years. She has experience in locating, collecting, and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

4 LEGISLATION

4.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This PDIA forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length
- the construction of a bridge or similar structure exceeding 50 m in length
- any development or other activity which will change the character of a site
- exceeding 5 000 m^2 in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m^2 in extent

- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

5 OBJECTIVE

The objective of a Palaeontological Impact Assessment (PIA) is to determine the impact of the development on potential palaeontological material at the site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the PIA are: 1) to **identify** the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to estimate the **palaeontological importance** of the formations 3) to determine the **impact** on fossil heritage; and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage.

The terms of reference of a PIA are as follows:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;
- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study,
- Description and location of the proposed development and provide geological and topographical maps
- Provide palaeontological and geological history of the affected area.

- Identification of sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;

- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:

    a. **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.

    b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.

    c. Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.

- Fair assessment of alternatives (infrastructure alternatives have been provided):

- Recommend mitigation measures to minimise the impact of the proposed development; and

- Implications of specialist findings for the proposed development (such as permits, licenses etc).

6 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The geology of the proposed Eastern Block Wind Farms is indicated on the 1: 250 000 3326 Grahams Town (1976) Geological Map (Council for Geosciences) (**Error! Reference source not found.**-10) while the Western Block is indicated on the 1: 250 000 3224 Graaff-Reinet (1993) and 3324 Port Elizabeth (1990) Geological Maps (Figure 11-15).

The **Eastern Block** (Figure 7-8) is underlain by the:

- Dwyka Group
- Witteberg Group of the Cape Supergroup
- Witpoort Formation, Witteberg Group of the Cape Supergroup
- Weltevrede Formation, Witteberg Group of the Cape Supergroup

According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Dwyka Group is Low and that of the Witteberg Group is High Sensitivity (Almond *et al*, 2013; SAHRIS website).

The **Western Block** of the Renewable Energy Wind Farms (Figure 9-15) is underlain by the:

- Dwyka Group
- Collingham Formation, Whitehill Formation, Prince Albert Formation, Rippon Formation, Fort Brown Formation (Ecca Group, Karoo Supergroup),
- Koonap Formation, Middleton Formation and Balfour Formation (Adelaide Subgroup, Beaufort Group, Karoo Supergroup),
- Dolerite

According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Dwyka Group is Low, the Collingham Formation, Rippon Formation, Fort Brown Formation of the Ecca Group is Moderate, while the Prince Albert Formation has a High and the Whitehill Formation of the Ecca has a Very High Palaeontological Sensitivity. The Adelaide Subgroup has a Very high Palaeontological Sensitivity while Dolerite is igneous in origin and thus has an Insignificant Paleontological Sensitivity (Almond *et al*, 2013; SAHRIS website).

6.1 Dwyka Group

The Permo-Carboniferous Dwyka Group is the oldest deposit in the Karoo Supergroup and spans the Late Carboniferous to Early Permian. The Dwyka Group overlies the

glaciated Precambrian bedrocks in the north and unconformably and paraconformably the Cape Supergroup in the south. In the east, it overlies the Natal Group and Msikaba Formation unconformably. Glacial pavements underlying the Dwyka Group has well-developed striations (specifically in the north) (Johnson et al, 2006). The Dwyka Group is believed to be deposited in a marine basin (Visser, 1989). South Africa was covered by an ice sheet during the Dwyka. These deposits were thus deposited in a cold, glacially dominated environment. This Group consists mainly of gravelly sediments with mudstones with scraped and facetted pebbles and subordinate vorved shales. Dark grey tillite was deposited by retreating glaciers (Visser et al, 1987) and thus the Dwyka is known for its rich assemblage of dropstones of various sizes.

The Permo-Carboniferous Dwyka Group is known for its trackways (trace fossils) that was formed by fish and arthropods, while fossilized faeces have also been recovered. Body fossils consist of gastropods, invertebrates and marine fish. Fossil plants from this group include a rich diversity of conifers, cordaitaleans, glossopterids, ginkgoaleans, horsetails, lycopods, pollens and spores ferns (Almond and Pether, 2008).

6.2 Cape Supergroup

The Cape Supergroup is about 10 km thick and represents approximately 170 million years of Earth's history from the Early Ordovician to the Early Carboniferous. This Supergroup is divided into three subdivisions namely the Table Mountain, Bokkeveld and Witteberg Groups. These Groups are lithologically distinctive and form the southern mountain ranges of the Eastern Cape and Western Cape Provinces. The Witteberg Group decreases in thickness from the eastern part to the southwestern part of the basin. This Group consists basically of micaceous mudrock and quartzitic sandstone which occur in almost equal proportions.

The Weltevrede Subgroup forms the basal unit of the Cape supergroup and is Devonian in age. The Witpoort Formation forms the top unit of the Weltevrede Subgroup.

6.3 The Ecca Group

Period	Supergroup	Group	Formation West of 24⁰ E	Formation East of 24⁰ E	Formation Free State / KwaZulu Natal
Permian	Karoo Supergroup	Ecca Group	Waterford Formation	Waterford Formation	Volksrust Formation
			Tierberg / Fort Brown Formation	Fort Brown Formation	
			Laingsburg / Rippon Formation	Rippon Formation	Vryheid Formation
			Collingham Formation	Collingham Formation	Pietermaritzburg Formation
			Whitehill Formation	Whitehill Formation	
			Prince Albert Formation	Prince Albert Formation	Mbizane Formation

Ecca Group consists of the following Formations (from youngest to oldest Formation):

- The **Prince Albert Formation** is confined to the south-western half of the Karoo Basin. The northern facies are characterised by the predominance of greyish to olive-green, micaceous shale and grey, silty shale, as well as a pronounced transition from the underlying glacial deposits. Dark-grey to black carbonaceous shale and fine- to medium-grained feldspathic arenite and wacke are also present. The southern facies is characterised by the predominance of dark-grey, pyrite-bearing, splintery shale, siltstone and the presence of dark-coloured chert and phosphatic nodules and lenses.

- The mudrocks of the **Whitehill Formation** consist of shale that is very thinly laminated and contains up to 14% carbonaceous material. The Whitehill Formation

loses its distinctive lithological character towards the northeast with its lower part containing siltstone and very fine-grained sandstone.

- Outcrops of the **Collingham Formation** are confined to the southern and western margins of the Main Karoo Basin. The formation is generally between 30 and 70m thick and comprises a rhythmic alternation of thin, continuous beds (average 5cm) of hard, dark grey, siliceous mudrocks and very thin beds (average 2cm) of softer yellowish tuff (K-bentonite). In the western part of the area, minor sandstone and siltstone units occur in the upper half of the formation, while the distinctive Matjiesfontein Chert Bed (0.2-0.6m thick) is present in the lower half.

- The **Ripon Formation** consists of poorly sorted, fine- to very fine-grained lithofeldspathic sandstone alternating with dark grey clastic rhythmite and mudrock.

- The **Fort Brown Formation** consists of rhythmite and mudrock with minor sandstone intercalations and displays an overall coarsening-upward tendency. At certain localities, one or more fairly prominent sandstone units occur some distance below the upper contact. Individual sand/silt and silt/clay layers comprising rhythmite units of similar thickness, ranging from a few millimetres to a few centimetres, are laterally persistent.

The fossil assemblage of the **Ecca Group** is trace fossils. This trace fossil assemblage of the non-marine Mermia Ichnofacies, is dominated by the ichnogenera Umfolozia (arthropod trackways) and Undichna (fish swimming trail) as well as mesosaurid reptiles, palaeoniscoid fish, small eocarid crustaceans, insects, trace fossils (king crab trackways. shark coprolites), palynomorphs (organic-walled spores and pollens), petrified wood (mainly of primitive gymnosperms, silicified or calcified), sparse vascular plant remains (Glossopteris leaves, lycopods etc).

6.3.1 Adelaide Subgroup

Period	Supergroup	Group	Subgroup	Formation West of 24º E	Formation East of 24º E
Middle Permian - Middle Triassic	Karoo Supergroup	Beaufort Group	Adelaide Subgroup		Balfour Formation
				Teekloof Formation	Middleton Formation
				Abrahamskraal Formation	Koonop Formation

The proposed development is underlain by a series of Karoo sandstones, mudstones and shales, deposited under fluvial environments of the Adelaide Subgroup that forms part of the Beaufort Group. The Beaufort Group is the third of the main subdivisions of the Karoo Supergroup. The Beaufort group overlays the Ecca Group and consists essentially of sandstones and shales, deposited in the Karoo Basin from the Middle Permian to the early part of the Middle Triassic periods and was deposited on land through alluvial processes. The Beaufort Group covers a total land surface area of approximately 200 000 km^2 in South Africa and is the first fully continental sequence in the Karoo Supergroup, and is divided into the Adelaide subgroup and the overlying Tarkastad subgroup. The Adelaide subgroup rocks are deposited under a humid climate that allowed for the establishment of wet floodplains with high water tables and are interpreted to be fluvio-lacustrine sediments.

In the south-eastern portion of the Karoo Basin, the Adelaide Subgroup consists of the Koonap, Middleton and Balfour Formations. West of 24° the Adelaide Subgroup is represented by the Abrahamskraal and Teekloof Formations and in the north the Group is represented by the Normandien Formation. The Adelaide Subgroup is approximately 5 000 m thick in the southeast, but this decreases to about 800m in the centre of the basin which decreases to about 100 to 200m in the north. The Koonop Formation is about 1 300 m, Middleton 1 600 m and the Balfour Formation approximately 200 m thick. The Abrahamskraal Formation is about 2 500 m thick and the Teekloof Formation 1 000 m. The Normandien Formation is only about 320 m thick.

The Adelaide Subgroup contains alternating greyish-red, bluish-grey, or greenish-grey mudrocks in the southern and central parts of the Karoo Basin with very fine to medium-grained, grey lithofeldspathic sandstones. In the northern Normandien formation the basin consists of coarse to very coarse sandstones and granulostones. Coarsening–upward cycles are present in the lower part of the Normandien Formation while the mudrocks and sandstone units usually form fining-upward cycles. These cycles are positioned on erosion surfaces which is overlain by a thin intraformational mud-pellet conglomerate and vary in thickness from a few meters to tens of meters. Singular sandstone units could vary from 6m to 60m in the south thinning northwards but thick sandstone units are also present in the northern Normandien Formation.

Thicker sandstones of the Adelaide are usually multi-storey and usually have cut-and-fill features. The sandstones are characterized internally by horizontal lamination together with parting lineation and less frequent trough cross-bedding as well as current ripple lamination. The bases of the sandstone units are extensive beds, while ripple lamination is usually confined to thin sandstones towards the top of the thicker units.

The mudrocks of the Adelaide Subgroup usually have massive and blocky weathering apart from in the Normandien and Daggaboersnek Member. Sometimes desiccation cracks and impressions of raindrops are present. In the mudstones of the Beaufort Group calcareous nodules and concretions occur throughout.

The Lower Adelaide Subgroup consists of the following formations:

Koonap Formation: Transitional brackish lacustrine to fluvial. Greenish-grey sandstones grading upwards into fine-grained siltstones and mudstones.

Middleton Formation: Semi-arid climate supported a lush flora and fauna that thrived along meander belts and semi-permanent lakes. Cyclic deposits of lenticular sandstone bodies grading into greenish-grey mudstone. The thickest formation in this succession, constituting 37% of the Beaufort Group and 47% of the Adelaide Subgroup. The formation has lenses of red mudstone which are likely to have been deposited in a

sub-aerial fluvial environment.The Middleton Formation is known for its Glossopteris fossils plant assemblages. At their peak development during the Permian these plants inhabited a diversity of ecological niches, which includes riverine forests which were dominated by conifers, cycadeoids and ginkos. Diverse assemblages of insects are also recorded from this Formation. This Formation is represented by a rich assemblage of vertebrates found in the *Pristerognathus, Tropidostoma* and *Cistecephalus* Assemblage Zones of the Karoo Basin, (Rubidge et al, 1995; MacRae, 1999; McCarthy and Rubidge, 2005). The *Eodicynodon* and *Tapinocephalus* Assemblage Zones are present in the Kroonap Formation. The *Eodicynodon* AZ is characterised by *Eodicynodon* and *Tapinocaninus* fossils. The *Tapinocephaus* AZ has a rich diversity of Therapids, dinocephalia, while fish, amphibia and plant fossils are also present.

Balfour Formation: The upper part of the Adelaide Subgroup and part of what was called lower to middle Beaufort. The Balfour Formation has an abundant assemblage of vertebrates. Fossils of the Balfour Formation includes vertebrates from the *Daptocecphalus* and *Lystrosaurus* Assemblage Zones (AZ) (Rubidge et al, 1995; MacRae, 1999; McCarthy and Rubidge, 2005; Johnson et al, 2009). Several important trace fossil assemblages, comprising vertebrate tracks and casts of vertebrate burrows have also been described from this Formation (Groenewald, 1996; Johnson *et al*., 2009).

6.4 Karoo Dolerite Suite

The Karoo Dolerite Suite is a volcanic suite which consists of igneous rocks and is thus unfossiliferous. This Suite was formed approximately 183 million years ago in the Early Jurassic. It is characterised by a superficial feeder system to the flood basalt eruptions and is best developed in the Karoo Basin. Flood basalts usually do not form noticeable volcanic structures but with a succession of eruptions form a suite of fissures of sub-horizontal lava flows that may vary in thickness from a couple of meters to thousands of meters. The Karoo Dolerite Suite is a widespread system of igneous bodies (dykes, sills) that encroached into the sediments of the Main Karoo Basin. Karoo lavas preserved today are erosional remnants of a more extensive lava cap that covered much of southern Africa.

6.5 Quaternary Superficial Deposits

The Quaternary superficial deposits are the youngest geological deposits formed during the most recent period of geological time (approximately 2.6 million years ago

to present). The rocks and sediments can be found at or near the surface of the Earth. Pre-Quaternary deposits are referred to as bedrock. Most of the superficial deposits are unconsolidated sediments and consist of gravel, sand, silt, and clay, and they form relatively thin, often discontinuous patches of sediments or larger spreads onshore. These sediments may include stream, channel and floodplain deposits, beach sand, talus gravels and glacial drift sediments.

The Quaternary deposits are of most importance due to the palaeoclimatic changes that are reflected in the different geological formations (Hunter et al., 2006). During the climate fluctuations in the Cenozoic Era most geomorphologic features in southern Africa where formed (Maud, 2012). Barnosky (2005) indicated that various warming and cooling events occurred in the Cenozoic but states that climatic changes during the Quaternary Period, specifically the last 1.8 Ma, were the most drastic climate changes relative to all climate variations in the past. Climate variations that occurred in the Quaternary Period were both drier and wetter than the present and resulted in changes in river flow patterns, sedimentation processes and vegetation variation (Tooth et al., 2004).

Quaternary fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. These fossil assemblages may in some cases occur in extensive alluvial and colluvial deposits cut by dongas. In the past palaeontologists did not focus on Caenozoic superficial deposits although they sometimes comprise of significant fossil deposits. These fossil assemblages resemble modern animals and may comprise of mammalian teeth, bones and horn corns, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells are also known from Quaternary deposits. Plant material such as foliage, wood, pollens and peats are recovered as well as trace fossils like vertebrate tracks, burrows, termitaria (termite heaps/ mounds) and rhizoliths (root casts).

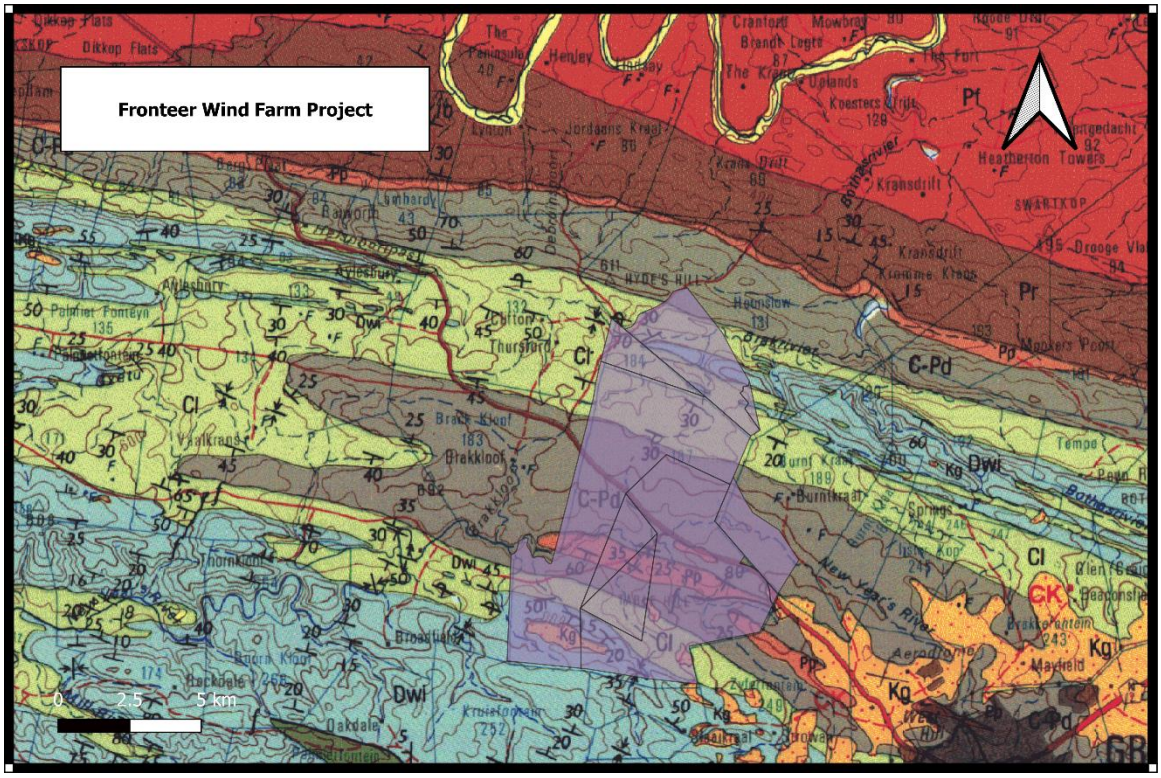


Figure 9. Extract of the 1:250 000 3326 Grahamstown Geological Map (Council of Geosciences [Pretoria]) indicating the Eastern Block (Fronteer) Wind Farms

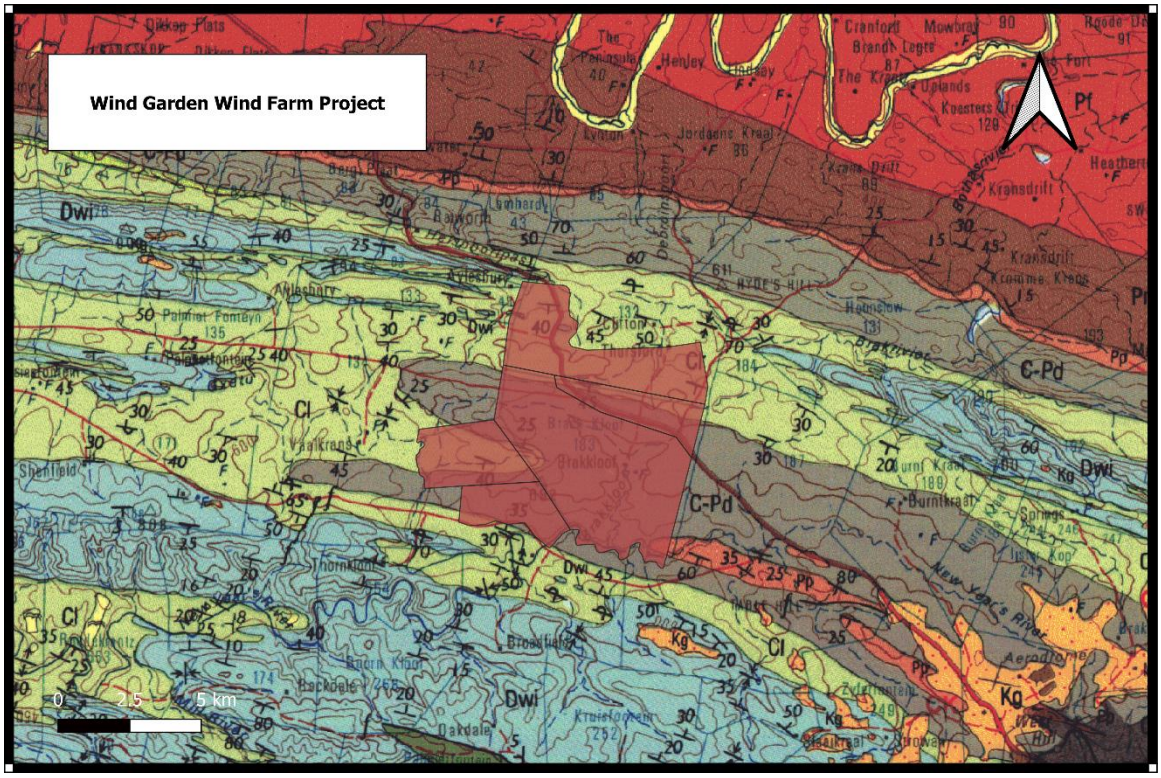


Figure 10: Extract of the 1:250 000 3326 Grahamstown Geological Map (Council of Geosciences [Pretoria]) indicating the Eastern Block (Wind Garden) Wind Farms.

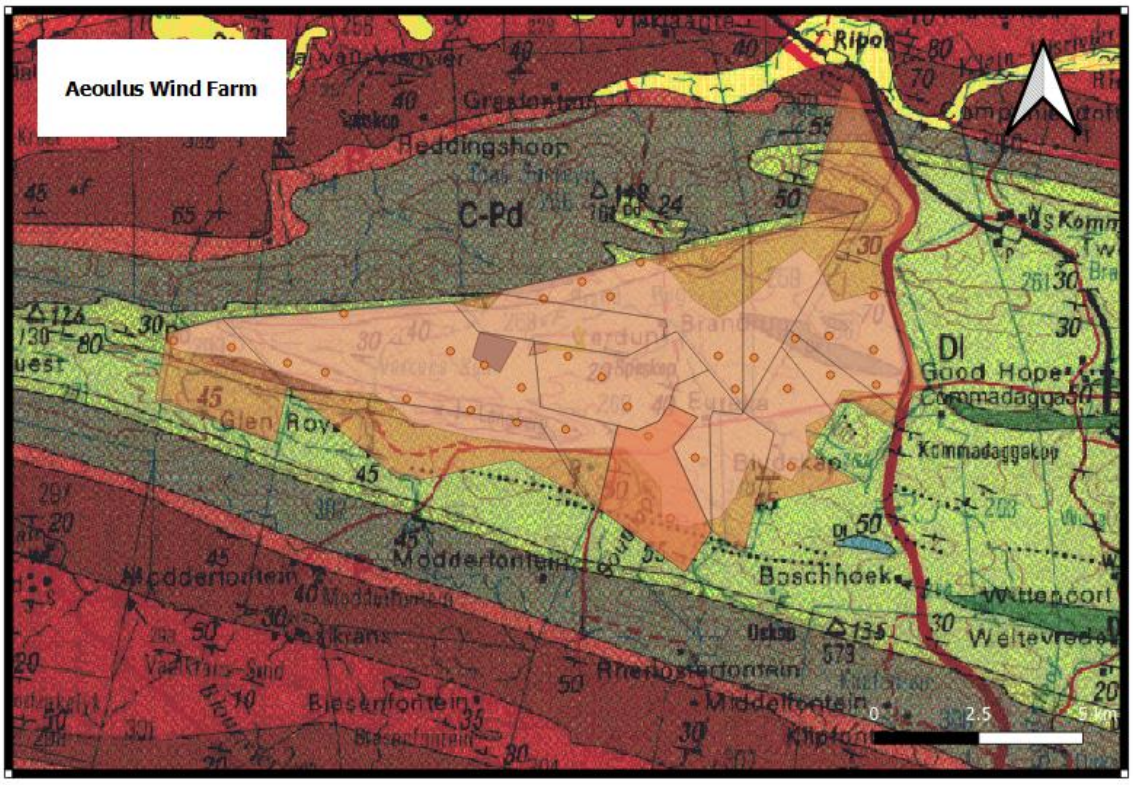


Figure 11: Extract of the 1:250 000 3324 Port Elizabeth Geological Map (Council of Geosciences [Pretoria]) indicating the Western Block (Aeoulus) Wind Farms.

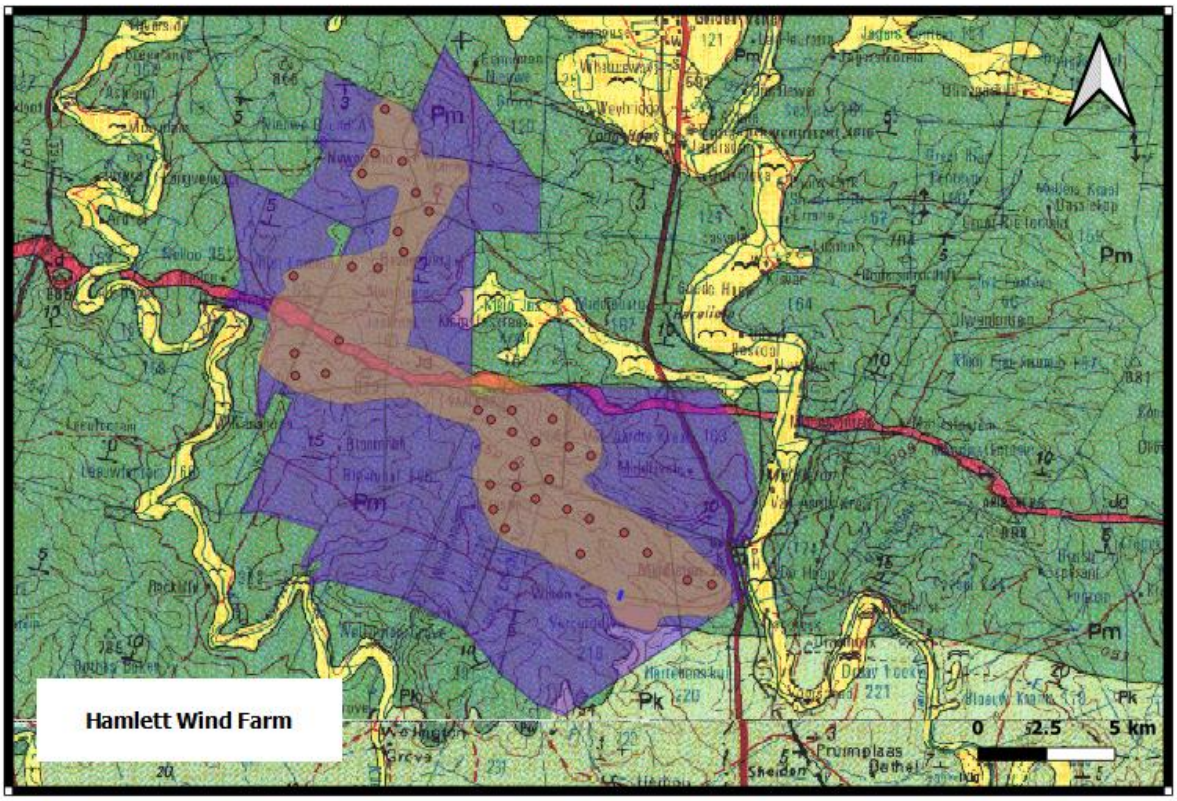


Figure 12: Extract of the 1:250 000 3324 Port Elizabeth Geological Map (Council of Geosciences [Pretoria]) indicating the Western Block (Hamlett) Wind Farms.

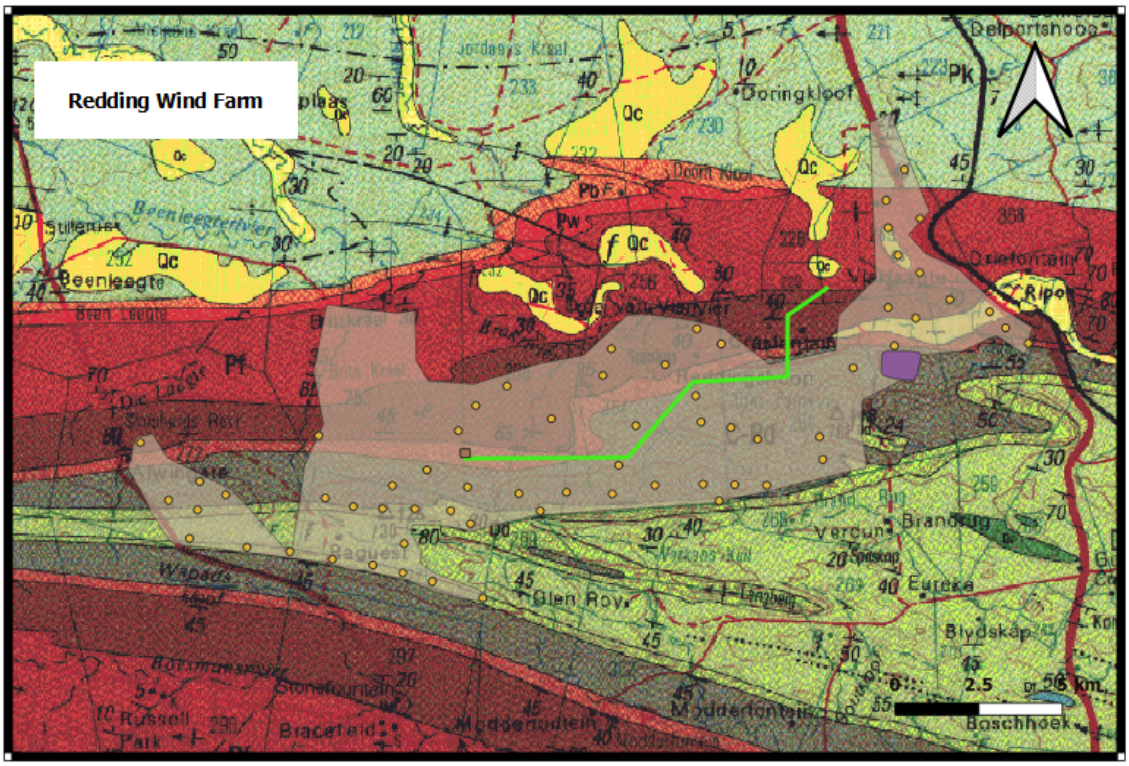


Figure 13: Extract of the 1:250 000 3324 Port Elizabeth Geological Map (Council of Geosciences [Pretoria]) indicating the Western Block (Redding) Wind Farms.

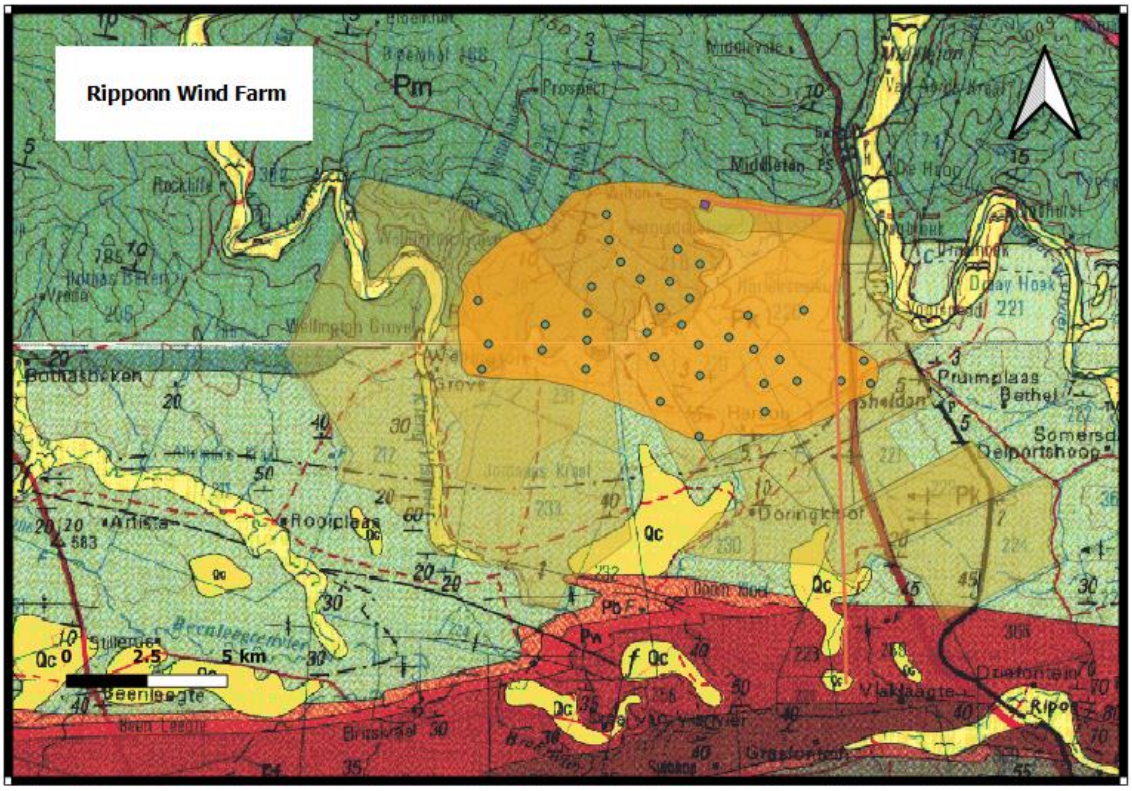


Figure 14: Extract of the 1:250 000 3224 Graaff-Reinet (1993) and 3324 Port Elizabeth (1990) Geological Maps indicating the Western Block (Rippon) Wind Farms.

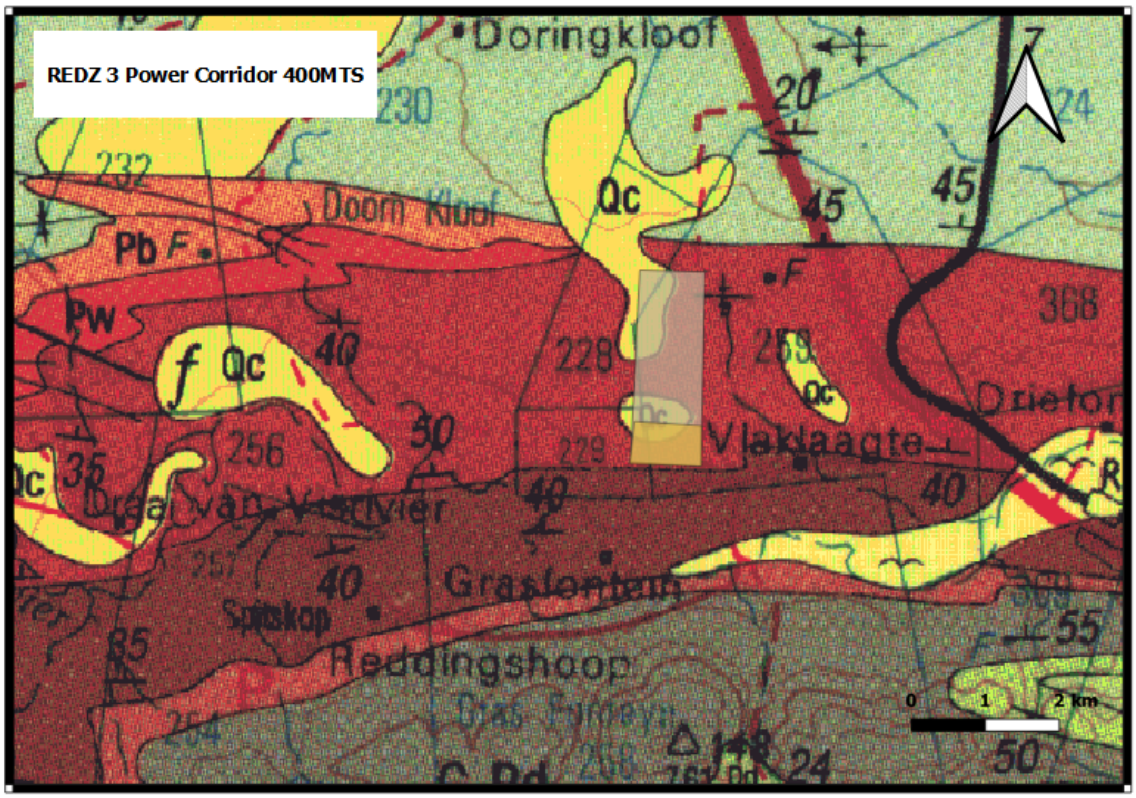
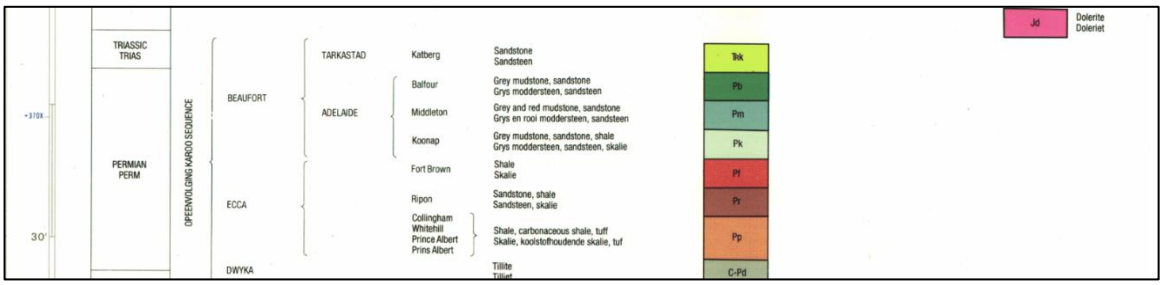


Figure 15: Extract of the 1:250 000 3324 Port Elizabeth Geological Map (Council of Geosciences [Pretoria]) indicating the REDZ 3 Power Corridor 400 MTS.



Legend

Qc-Quaternary-Calcrete

Jd-Dolerite

Pb- Balfour Formation (Adelaide Subgroup, Beaufort Group, Karoo Supergroup); Sandstone and Grey mudstone

Pm- Middleton Formation (Adelaide Subgroup, Beaufort Group, Karoo Supergroup); Sandstone; Grey and red mudstone

Pk- Koonap Formation (Adelaide Subgroup, Beaufort Group, Karoo Supergroup); sandstone, shale and grey mudstone

Pf- Fort Brown Formation (Ecca Group, Karoo Supergroup); Shale

Pr-Rippon Formation (Ecca Group, Karoo Supergroup); sandstone and shale

Pp- Collingham Formation, Whitehill Formation, Prince Albert Formation (Ecca Group, Karoo Supergroup)

C-Pd- Dwyka, Tillite

Figure 16: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed Wind Energy Clusters.

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

According to the SAHRIS Palaeosensitivity map (Figure 16) there is a chance of finding fossils in this area. See table above.

7 GEOGRAPHICAL LOCATION OF THE SITE

The proposed Wind Energy Farms lies in the Cookhouse REDZ. The development is situated about 100 km northeast of Port Elizabeth and is approximately 2200 m^2 in extent. The development spans the N10 to the east and west and from Grahamstown to Somerset East.

The cluster of projects is divided into two sections, namely the Western Section and the Eastern Section, with the Western Section situated near Somerset East and the Eastern Section near Grahamstown. The western section comprises of seven (7) of the nine projects and the eastern section the remaining two (2) projects. The proposed development is divided in an eastern and western block. (Table 2-4)

8 METHODS

The aim of a desktop study is to evaluate the possible risk to palaeontological heritage in the proposed development. This include all trace fossils as well as all fossils in the proposed footprint. All possible information is consulted to compile a desktop study, and this includes the following: all Palaeontological Impact Assessment reports in the same area; aerial photos and Google Earth images, topographical as well as geological maps.

8.1 Assumptions and Limitations

The focal point of geological maps is the geology of the area and the sheet explanations of the Geological Maps were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have never been reviewed by palaeontologists and data is generally based on aerial photographs alone. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accuratetely documented.

Comparable Assemblage Zones in other areas is also used to provide information on the existence of fossils in an area which has not documented in the past. When using similar Assemblage Zones and geological formations for Desktop studies it is generally **assumed** that exposed fossil heritage is present within the footprint. A field-assessment will thus improve the accuracy of the desktop assessment.

9 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984)
- A Google Earth map with polygons of the proposed development was obtained from Savannah.
- The geology of the proposed development is indicated on the 1: 250 000 3326 Grahams Town (1976), 3224 Graaff-Reinet (1993) and 3324 Port Elizabeth (1990) Geological Maps (Council for Geosciences)

10 SITE VISIT

A 3-day site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 20 November to 23 November 2020. No visible evidence of fossiliferous outcrops was found but well-preserved fossils may thus be found during excavations and care must be taken to preserve them- see protocol for finds.

Figure 17:Fronteer Turbine 6:
Low vegetation with sandy patches. No outcrops. GPS: -33.234532; 26.437121

Figure 18: Fronteer BoP.
Low vegetation and no outcrops GPS: -33.238171; 26.445647

Figure 19: Fronteer Turbine 15: Low vegetation and sandy patches without any outcrop.
GPS: -33.229503; 26.426310

Figure 20: View over Wind Garden Sub-collector. Low vegetation and sandy patches. No outcrops.
GPS: -33.220568; 26.384666

Figure 21: Wind Garden Turbine 126_N. No fossiliferous outcrops
GPS: -33.229502; 26.370164

Figure 22: View over Wind Garden BoP.
GPS: -33.2207835; 26.353171

Figure 23: Wind Garden Turbine 9. Low vegetation with sandy patches. No outcrops.
GPS:-33.235676; 26.446495

Figure 24: View over Aeolus Wind Farm Turbine 35. Low vegetation without any fossiliferous outcrops at the site

GPS -33.145278; 25.860833

Figure 25: Aeolus Wind Farm 132 KV New Sub-Collector. Aloes and grassy vegetation. No fossiliferous outcrops. GPS: -33.140278; 25.801944

Figure 26: Aeolus Wind Farm BoP. Grassy vegetation and aloe sp.
GPS:-33.140556; 26.792222

Figure 27: Aeolus Wind Farm Turbine WED 56. Low vegetation with isolated trees. GPS:-33.142500; 25.793056

Figure 28: Aeolus Wind Farm Turbine 49. Aloes with grassy vegetation and Quaternary sandy patches. No fossiliferous outcrops.
GPS -33.15766; 25.830322

Figure 29: Redding Wind Farm Turbines WEC 28_N. Low grassy vegetation with Quaternary sandy patches. No fossiliferous outcrops. GPS: -33.095727; 25.774536

Figure 30: View over Redding Wind Farm Turbines WEC23 location: Grassy vegetation with few Aloe sp.
GPS -33.098523; 25.779332

Figure 31: View towards Redding Wind Farm Turbine WEC36: Low vegetation with sandy Quaternary deposits. GPS -33.115556; 25.712500

Figure 32: Rippon Wind Energy Farm: Quaternary deposits with trees. Vegetation is low.

GPS-32.999444; 25.41389

Figure 33: Rippon Wind Energy Farm WEB23. Low vegetation with no outcrops just loose sandstones. GPS -32.995278; 25.768056

Figure 34: Rippon Wind Energy Farm Turbine32. Prominent loose sandstone is present. GPS -33.007500; 25.773056

Figure 35: Hamlett Wind Energy Farm Collector substation area. Low vegetation and quaternary deposits. GPS -32.963889; 25.775556

11 IMPACT ASSESSMENT METHODOLOGY

11.1 Basic Assessment Report

The Specialist report must include:

» an indication of the methodology used in determining the significance of potential environmental impacts
» a description of all environmental issues that were identified during the environmental impact assessment process

» an assessment of the significance of direct, indirect and cumulative impacts in terms of the following criteria:
  * the *nature* of the impact, which shall include a description of what causes the effect, what will be affected and how it will be affected
  * the *extent* of the impact, indicating whether the impact will be local (limited to the immediate area or site of development), regional, national or international
  * the *duration* of the impact, indicating whether the lifetime of the impact will be of a short-term duration (0–5 years), medium-term (5–15 years), long-term (> 15 years, where the impact will cease after the operational life of the activity) or permanent
  * the *probability* of the impact, describing the likelihood of the impact actually occurring, indicated as improbable (low likelihood), probable (distinct possibility), highly probable (most likely), or definite (impact will occur regardless of any preventative measures)
  * the *severity/beneficial scale*, indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit, with no real alternative to achieving this benefit), severe/beneficial (long-term impact that could be mitigated/long-term benefit), moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit), slight or have no effect
  * the *significance*, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high
  * the *status*, which will be described as either positive, negative or neutral
  * the *degree* to which the impact can be reversed
  * the *degree* to which the impact may cause irreplaceable loss of resources
  * the *degree* to which the impact can be *mitigated*
» a description and comparative assessment of all alternatives identified during the environmental impact assessment process
» recommendations regarding practical mitigation measures for potentially significant impacts, *for inclusion in the Environmental Management Programme (EMPr)*
» an indication of the extent to which the issue could be addressed by the adoption of mitigation measures
» a description of any assumptions, uncertainties and gaps in knowledge
» an environmental impact statement which contains:
  * a summary of the key findings of the environmental impact assessment;
  * an assessment of the positive and negative implications of the proposed activity.

The specialist report must also be in-line with the gazetted protocols which came into effect on 08 May 2020, where relevant.

In terms of **Appendix 6 of 2014 EIA Regulations**, as amended;

» A specialist report prepared in terms of these Regulations must contain—
  details of—
  (i) the specialist who prepared the report; and
  (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;
» a declaration that the specialist is independent in a form as may be specified by the competent authority;
» an indication of the scope of, and the purpose for which, the report was prepared;
» the date and season of the site investigation and the relevance of the season to the outcome of the assessment;
» a description of the methodology adopted in preparing the report or carrying out the specialised process;
» the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;
» an identification of any areas to be avoided, including buffers;
» 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;
» a description of any assumptions made and any uncertainties or gaps in knowledge;
» a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;
» any mitigation measures for inclusion in the EMPr;
» any conditions for inclusion in the environmental authorisation;
» any monitoring requirements for inclusion in the EMPr or environmental authorisation;
» a reasoned opinion—
  (i) as to whether the proposed activity or portions thereof should be authorised; and
  (ii) 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;
» a description of any consultation process that was undertaken during the course of preparing the specialist report;
» a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and
» any other information requested by the competent authority.

11.2 Assessment of Impacts

Direct, indirect and cumulative impacts associated with the projects must be assessed in terms of the following criteria:

» The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
» The **duration**, wherein it will be indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5;
» The **magnitude**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
» the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
» the **status**, which will be described as either positive, negative or neutral.
» the degree to which the impact can be reversed.
» the degree to which the impact may cause irreplaceable loss of resources.
» the *degree* to which the impact can be *mitigated.*

The **significance** is calculated by combining the criteria in the following formula:

S=(E+D+M)P

S = Significance weighting
E = Extent
D = Duration
M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

» < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
» 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Assessment of impacts must be summarised in the following table format. The rating values as per the above criteria must also be included.

11.3 IMPACT ASSESSMENTS

An assessment of the impact significance of the Matla Power Station Reverse Osmosis Plant, Mpumalanga are resented here:

11.3.1 Nature of the impact

The excavations and site clearance of the Wind Energy Facilities will involve extensive excavations into the superficial sediment cover as well as into the underlying bedrock. These excavations will change the existing topography and may destroy and seal-in fossils at or below the ground surface. These fossils will then be unavailable for research.

11.3.2 Sensitive areas

The **Eastern Block** of the WEF and associated grid connection infrastructure, is underlain by the Dwyka and Witteberg Group (Witpoort and Weltevrede Formations) of the Cape Supergroup. According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Dwyka Group is Low and that of the Witteberg Group is High (Almond *et al*, 2013; SAHRIS website). The **Western Block** of the WEF and associated grid connection infrastructure is underlain by the Dwyka Group; the Fort Brown Formation of the Ecca Group (Karoo Supergroup), Adelaide Subgroup (Koonap and Middleton Formations) of the Beaufort Group (Karoo Supergroup) and the Witteberg Group of the Cape Supergroup, Karoo Dolerite (Karoo Supergroup), and Quaternary deposits. According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Dwyka Group is

Low, the Collingham Formation, Rippon Formation, Fort Brown Formation of the Ecca Group is Moderate, while the Prince Albert Formation has a High and the Whitehill Formation of the Ecca has a Very High Palaeontological Sensitivity. The Adelaide Subgroup has a Very high Palaeontological Sensitivity while Dolerite is igneous in origin and thus has an Insignificant Paleontological Sensitivity (Almond *et al*, 2013; SAHRIS website).

11.3.3 Geographical extent of impact

The impact on fossil heritage will be restricted to the construction phase when new excavations into potentially fossiliferous bedrock take place. The extent of the area of potential impact is thus restricted to the project site and therefore categorised as **local**. (1)

11.3.4 Duration of impact

The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures (if fossils are present in the development) the damage or destruction of any palaeontological materials will be **permanent.** (5)

11.3.5 Potential significance of the impact

If the project proceeds without care that fossils could be present in the proposed development the damage to any fossils will be **permanent and irreversible**. Fossils occurring in the development are potentially culturally and scientifically significant and any negative impact on them would be of **high significance**.

11.3.6 Severity / benefit scale

The development will be **beneficial l**ocally, regional and national as well.

A **secondary advantage** of the construction of the project would be that fossils could be uncovered during excavations and made available for scientific research.

11.3.7 Intensity

During the construction phase probable significant impacts on fossils are high.

11.3.8 Probability of the impact occurring

Since the Palaeontological Sensitivity are very high the probability of significant impacts on fossil heritage during the construction phase are high.

11.3.9 Damage mitigation, reversal and potential irreversible loss

Mitigation

If fossil material is present in the proposed footprint any negative impact may be mitigated by collecting and description of well-preserved fossils. This should take place after vegetation clearance but *before* the ground is levelled for construction. Excavation of fossil heritage will require a permit from SAHRA, and the material must be housed in a permitted institution.

11.3.10 Degree to which the impact can be mitigated

Mitigation of the damage and destruction of fossil heritage within the planned footprint would entail the collection and describing of fossils. These actions would take place after initial vegetation clearance but *before* the ground is levelled for construction.

11.3.11 Degree of irreversible loss

Impacts on fossil heritage are irreversible. A positive impact is possible by well-documented records and palaeontological studies of any fossils exposed during construction while negative impacts can be limited by the application of adequate damage mitigation procedures. If damage mitigation is properly undertaken the impact may be seen as beneficial.

11.3.12 Degree to which the impact may cause irreplaceable loss of Resources

The **Eastern Block** of the WEF and associated grid connection infrastructure, is underlain by the Dwyka and Witteberg Group (Witpoort and Weltevrede Formations) of the Cape Supergroup. According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Dwyka Group is Low and that of the Witteberg Group is High (Almond et al, 2013; SAHRIS website). The **Western Block** of the WEF and associated grid connection infrastructure is underlain by the Dwyka Group; the Fort Brown Formation of the Ecca Group (Karoo Supergroup), Adelaide Subgroup (Koonap and Middleton Formations) of the Beaufort Group (Karoo Supergroup) and the Witteberg Group of the Cape Supergroup, Karoo Dolerite (Karoo Supergroup), and Quaternary deposits. According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Dwyka Group is Low, the Collingham Formation, Rippon Formation, Fort Brown Formation of the Ecca Group is Moderate, while the Prince Albert Formation has a High and the Whitehill Formation of the Ecca has a Very High Palaeontological Sensitivity. The Adelaide Subgroup has a Very high Palaeontological Sensitivity while Dolerite is igneous in origin and thus has an Insignificant Paleontological Sensitivity (Almond *et al*, 2013; SAHRIS website).

Impacts on all Wind Energy Facilities will only occur during the construction phase with no impacts during the Planning and Operational Phases. The impacts on the different facilities will be the same and thus only one Impact Table will be completed.

Impact table summarising the significance of impacts (with and without mitigation)

Nature: The excavations and site clearance of the Wind Energy Facilities will involve extensive excavations into the superficial sediment cover as well as into the underlying bedrock. These excavations will change the existing topography and may destroy and seal-in fossils at or below the ground surface. These fossils will then be unavailable for research Impacts on Palaeontological Heritage are likely to happen only within the construction phase. No impacts are expected to occur during the operation phase.		
	Without mitigation	**With mitigation**
Extent	Development area (1)	Development area (1)
Duration	Permanent (5)	Medium-term (3)
Magnitude	High (8)	Minor (2)
Probability	Highly Probable (4)	Improbable (1)
Significance	**Medium (-56)**	**Low (+6)**
Status (positive or negative)	Negative	Neutral
Reversibility	Irreversible	
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation procedure: See Chance find protocol **Chance Find Procedure** • If a chance find is made the person responsible for the find must immediately **stop working** and all work must cease in the immediate vicinity of the find. • The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the Environmental Officer (EO) (if appointed) or site manager. The EO must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax:		

+27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.

- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

Upon receipt of the preliminary report, the Heritage Agency will inform the EO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the EO (or site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once Heritage Agency has issued the written authorization, the developer may continue with the development.

Residual Impacts:

Loss of fossil heritage

Assessment of Cumulative Impacts

As per DEA's requirements, specialists are required to assess the cumulative impacts. In this regard, please refer to the methodology below that will need to be used for the assessment of Cumulative Impacts.

"Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that

activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities[1].

The role of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). This section should address whether the construction of the proposed development will result in:

» Unacceptable risk
» Unacceptable loss
» Complete or whole-scale changes to the environment or sense of place
» Unacceptable increase in impact

The specialist is required to conclude if the proposed development will result in any unacceptable loss or impact considering all the projects proposed in the area.

11.4 Cumulative impact table:

Nature: Complete or whole-scale changes to the environment or sense of place (example)

Nature: Cumulative impacts on fossil remains preserved at or beneath the ground surface.		
	Overall impact of the proposed project considered in isolation	***Cumulative impact of the project and other projects in the area***
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Medium-term (5)
Magnitude	Minor (2)	Minor (2)
Probability	Highly Probable (1)	Improbable (1)
Significance	**Medium (-8)**	**Low (+8)**
Status (positive or negative)	Negative	Neutral
Reversibility	Irreversible	
Mitigation: Not necessary		

[1] Unless otherwise stated, all definitions are from the 2014 EIA Regulations, GNR 326.

Residual Impacts: Loss of fossil heritage

11.5 Environmental Management Programme

Measures for inclusion in the Environmental Management Programme must be laid out as detailed below:

OBJECTIVE: Prevent the loss of Palaeontological Heritage

Project component/s	Damaging impacts on palaeontological heritage occur during the **construction** phase which will modify the existing topography.
Potential Impact	Destruct, destroy or permanently close-in fossils at or below the ground surface that are then no longer available for research
Activity/risk source	Activities associated with the construction of the Wind Energy Facilities
Mitigation: Target/Objective	Protection of identified fossils uncovered during the construction phase.

Mitigation: Action/control	**Responsibility**	**Timeframe**
List specific action(s) required to meet the mitigation target/objective described above	EO	Construction phase

Performance Indicator	Description of key indicator(s) that track progress/indicate the effectiveness of the management plan.
Monitoring	The **Eastern Block** of the WEF and associated grid connection infrastructure, is underlain by the Dwyka and Witteberg Group (Witpoort and Weltevrede Formations) of the Cape Supergroup. According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Dwyka Group is Low and that of the Witteberg Group is High (Almond et

	al, 2013; SAHRIS website). The **Western Block** of the WEF and associated grid connection infrastructure is underlain by the Dwyka Group; the Fort Brown Formation of the Ecca Group (Karoo Supergroup), Adelaide Subgroup (Koonap and Middleton Formations) of the Beaufort Group (Karoo Supergroup) and the Witteberg Group of the Cape Supergroup, Karoo Dolerite (Karoo Supergroup), and Quaternary deposits. According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Dwyka Group is Low, the Collingham Formation, Rippon Formation, Fort Brown Formation of the Ecca Group is Moderate, while the Prince Albert Formation has a High and the Whitehill Formation of the Ecca has a Very High Palaeontological Sensitivity. The Adelaide Subgroup has a Very high Palaeontological Sensitivity while Dolerite is igneous in origin and thus has an Insignificant Paleontological Sensitivity (Almond *et al*, 2013; SAHRIS website).

11.6 Summary of Impact Tables

The **Eastern Block** of the WEF and associated grid connection infrastructure, is underlain by the Dwyka and Witteberg Group (Witpoort and Weltevrede Formations) of the Cape Supergroup. According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Dwyka Group is Low and that of the Witteberg Group is High (Almond et al, 2013; SAHRIS website). The **Western Block** of the WEF and associated grid connection infrastructure is underlain by the Dwyka Group; the Fort Brown Formation of the Ecca Group (Karoo Supergroup), Adelaide Subgroup (Koonap and Middleton Formations) of the Beaufort Group (Karoo Supergroup) and the Witteberg Group of the Cape Supergroup, Karoo Dolerite (Karoo Supergroup), and Quaternary deposits. According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Dwyka Group is Low, the Collingham Formation, Rippon Formation, Fort Brown Formation of the Ecca Group is Moderate, while the Prince Albert Formation has a High and the Whitehill Formation of the Ecca has a Very High Palaeontological Sensitivity. The Adelaide Subgroup has a Very high Palaeontological Sensitivity while Dolerite is igneous in origin and thus has an Insignificant Paleontological Sensitivity (Almond *et al*, 2013; SAHRIS website).

The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be **permanent**. Impacts on palaeontological heritage during the construction phase could potentially occur but are regarded as having a high possibility. The significance of the impact occurring pre-mitigation will be medium before mitigation and low after mitigation.

12 FINDINGS AND RECOMMENDATIONS

The cluster of projects is divided into two sections, namely the Western Section and the Eastern Section, with the Western Section situated near Somerset East and the Eastern Section near Grahamstown. The western section comprises of seven (7) of the

nine projects and the eastern section the remaining two (2) projects. The proposed development is divided in an eastern and western block.

The **Eastern Block** of the WEF and associated grid connection infrastructure, is underlain by the Dwyka and Witteberg Group (Witpoort and Weltevrede Formations) of the Cape Supergroup. According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Dwyka Group is Low and that of the Witteberg Group is High (Almond et al, 2013; SAHRIS website). The **Western Block** of the WEF and associated grid connection infrastructure is underlain by the Dwyka Group; the Fort Brown Formation of the Ecca Group (Karoo Supergroup), Adelaide Subgroup (Koonap and Middleton Formations) of the Beaufort Group (Karoo Supergroup) and the Witteberg Group of the Cape Supergroup, Karoo Dolerite (Karoo Supergroup), and Quaternary deposits.

According to the PalaeoMap of SAHRIS the Palaeontological Sensitivity of the Dwyka Group is Low, the Collingham Formation, Rippon Formation, Fort Brown Formation of the Ecca Group is Moderate, while the Prince Albert Formation has a High and the Whitehill Formation of the Ecca has a Very High Palaeontological Sensitivity. The Adelaide Subgroup has a Very High Palaeontological Sensitivity, Dolerite is igneous in origin and thus has an Insignificant Paleontological Sensitivity while that of Quaternary deposits is Low but locally High in terms of the sensitivity (Almond et al, 2013; SAHRIS website).

A 3-day site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 20 November to 23 November 2020. No visible evidence of fossiliferous outcrops was found. For this reason, an overall low palaeontological sensitivity is allocated to the development footprint. The scarcity of fossil heritage at the proposed development footprint indicates that the impact of the WEF and associated grid connection infrastructure, will be of a low significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological reserves of the area. Thus, the construction of the development may be authorised in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.

However, if fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO or site manager in charge of these developments. Fossil discoveries ought to be protected and the ECO/site manager must report to SAHRA

(Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that suitable mitigation (recording and collection) can be carried out.

Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).

It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

13 CHANCE FINDS PROTOCOL

A following procedure will only be followed if fossils are uncovered during excavation.

13.1 Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act 25 of 1999) (NHRA).** According to Section 3 of the Act, all Heritage resources include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

13.2 Background

A fossil is the naturally preserved remains (or traces) of plants or animals embedded in rock. These plants and animals lived in the geologic past millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

13.3 Introduction

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Site Officer (ESO) or site manager of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ESO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

13.4 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately **stop working** and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description

of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.

- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO (site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

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Appendix A – Elize Butler CV

CURRICULUM VITAE

ELIZE BUTLER

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	26 years in Palaeontology
EDUCATION:	B.Sc Botany and Zoology, 1988
	University of the Orange Free State
	B.Sc (Hons) Zoology, 1991
	University of the Orange Free State
	Management Course, 1991
	University of the Orange Free State
	M. Sc. *Cum laude* (Zoology), 2009
	University of the Free State

Dissertation title: The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

Registered as a PhD fellow at the Zoology Department of the UFS 2013 to current

Dissertation title: A new gorgonopsian from the uppermost D*aptocephalus Assemblage Zone*, in the Karoo Basin of South Africa

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

Part-time Laboratory assistant	Department of Zoology & Entomology University of the Free State Zoology 1989-1992
Part-time laboratory assistant	Department of Virology University of the Free State Zoology 1992
Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant and Collection Manager	National Museum, Bloemfontein 1998–currently

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