Phase 1 Heritage Impact Assessment Report:

Proposed Eskom Dutywa-Gatyana 132kV Power Line and Construction of Gatyana Substation, Mbhashe Local Municipality, Amathole District Municipality, Eastern Cape Province, South Africa

Prepared for

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Management Summary

eThembeni Cultural Heritage was appointed by Arcus GIBB Engineering and Science to undertake a Phase 1 Heritage Impact Assessment (HIA) of a electrical transmission line in the Eastern Cape Province, in terms of the National Environmental Management Act 107 of 1998 as amended, in compliance with Section 38 of the National Heritage Resources Act 25 of 1999, as amended. This report represents compliance with a full Phase 1 HIA.

Heritage resource descriptions, significance and development impacts
We observed no visually sensitive categories of heritage resource within the proposed development corridor. However, we did notice various abandoned homesteads around and between existing villages that may include ancestral graves.

The Lower Beaufort Group bedrocks in the study region are generally deeply weathered and mantled in unfossiliferous superficial sediments (*e.g.* soils, alluvium). Furthermore, their original fossil content has probably been compromised by thermal metamorphism (baking) during dolerite intrusion. Hitherto major vertebrate fossil finds are unknown from the study area, although recent impact studies in the region suggest this may be partially due to insufficient palaeontological research. Substantial sectors of the power line route traverse Karoo dolerite outcrops of no palaeontological significance. Alluvial sediments near Dutywa are of low palaeontological sensitivity.

Recommended mitigation
A heritage practitioner should complete a 'walk-through' of the final selected power line route and all other activity areas (access roads, construction camps, materials' storage areas, etc.) prior to the start of any construction activities and assess direct impacts on discrete resources such as archaeological sites. Mitigation can usually be achieved by micro-adjustment of tower positions, the exclusion of sensitive areas, basic recording and/or obtaining a permit for alteration, destruction or removal from SAHRA.

Tower placements should be negotiated with residents to ensure that no ancestral graves are affected.

Significant impacts on local fossil heritage are not anticipated during the operational phase of the transmission line development. Should substantial fossil remains be exposed during construction, however, such as vertebrate bones and teeth, plant-rich fossil lenses or dense fossil burrow assemblages, the Environmental Control Officer should safeguard these, preferably *in situ*, and alert SAHRA as soon as possible so that appropriate action (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist (refer to Section 9).

Recommended monitoring
None at present.

Conclusion
We recommend that the development proceed with the proposed heritage mitigation and have submitted this report to SAHRA in fulfilment of the requirements of the NHRA. Relevant staff members may be contacted at the SAHRA Cape Town head office (Mariagrazia Galimberti telephone 021 462 4502; MGALIMBERTI@sahra.org.za).

If permission is granted for development to proceed, the client is reminded that the NHRA requires that a developer cease all work immediately and follow the protocol contained in Section 9 of this report should any heritage resources, as defined in the Act, be discovered during the course of development activities.

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1 Introduction

eThembeni Cultural Heritage was appointed by Arcus GIBB Engineering and Science to undertake a Phase 1 Heritage Impact Assessment (HIA) of a electrical transmission line in the Eastern Cape Province, in terms of the National Environmental Management Act 107 of 1998 as amended (NEMA), in compliance with Section 38 of the National Heritage Resources Act 25 of 1999, as amended (NHRA) (refer to Appendix A).

South Africa's heritage resources are both rich and widely diverse, encompassing sites from all periods of human history. Resources may be tangible, such as buildings and archaeological artefacts, or intangible, such as landscapes and living heritage. Their significance is based upon their aesthetic, architectural, historical, scientific, social, spiritual, linguistic, economic or technological values; their representivity of a particular time period; their rarity; and their sphere of influence.

The integrity and significance of heritage resources can be jeopardized by natural (e.g. erosion) and human (e.g. development) activities. In the case of human activities, a range of legislation exists to ensure the timeous identification and effective management of heritage resources for present and future generations.

This report represents compliance with a full Phase 1 HIA for the proposed development, including a specialist palaeontological study.

2 Terms of reference

An HIA must address the following key aspects:

- the identification and mapping of all heritage resources in the area affected;
- an assessment of the significance of such resources in terms of heritage assessment criteria set out in regulations;
- an assessment of the impact of the development on heritage resources;
- an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
- the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
- if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
- plans for mitigation of any adverse effects during and after completion of the proposed development.

In addition, the HIA should comply with the requirements of NEMA, including providing the assumptions and limitations associated with the study; the details, qualifications and expertise of the person who prepared the report; and a statement of independence.

3 Project description

The Willowvale (Gatyana) area has about 10 700 outstanding electrification connections under the accelerated electrification programme. However, it is anticipated that the 22kV networks supplying this area will have reached the limits of their supply capacity by 2011. There will thus be no capacity to supply the outstanding connections beyond 2011.

In order to address this limitation and to provide spare capacity for future load growth, it is necessary to strengthen the supply to the 22kV network by upgrading the 132kV network in the area. This will provide the needed spare capacity, improve back-feed capabilities and improve the reliability of supply to the Willowvale area

The planned network strengthening entails:

- Construction of 132/22kV 2x20MVA Gatyana substation in the Willowvale area.
- Construction of ±40km of 132kV Chicadee line from Idutywa substation to Gatyana substation.
- Upgrade existing 22kV link lines and build new 22kV link lines.

The project is needed in order to provide capacity for existing and future developments in the area; improve reliability of supply and maintain acceptable voltage levels on this network.

NEMA Section 24(5) stipulates that “listed activities” require environmental authorization. Government Notice No. 544 (June 2010 EIA Regulations) identifies the following listed activities as requiring environmental authorization by means of a Basic Assessment Process:

Activity No. 10 “The construction of facilities or infrastructure for the transmission or distribution of electricity

(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275kV; or

(ii) inside urban areas or industrial complexes with a capacity of 275kV or more”

4 Project location and environmental description

The proposed power line extends from the existing Dutywa substation, located at S32 06 32.0; E28 20 21.0, to the proposed Gatyana substation, located at S32 11 25.0; E28 33 00.0 (Figures 1 and 2).

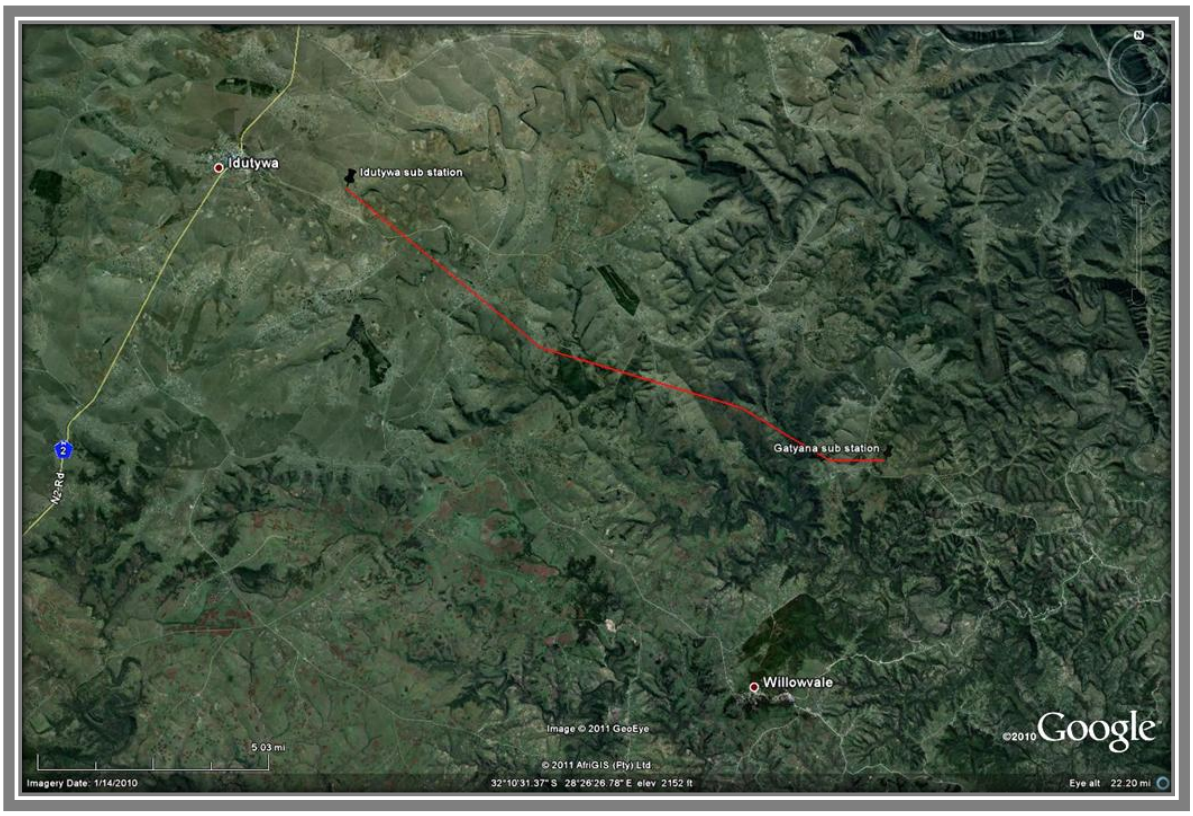

Figure 1 Locality map of the project relative to Dutywa and Willowvale in the Eastern Cape Province.

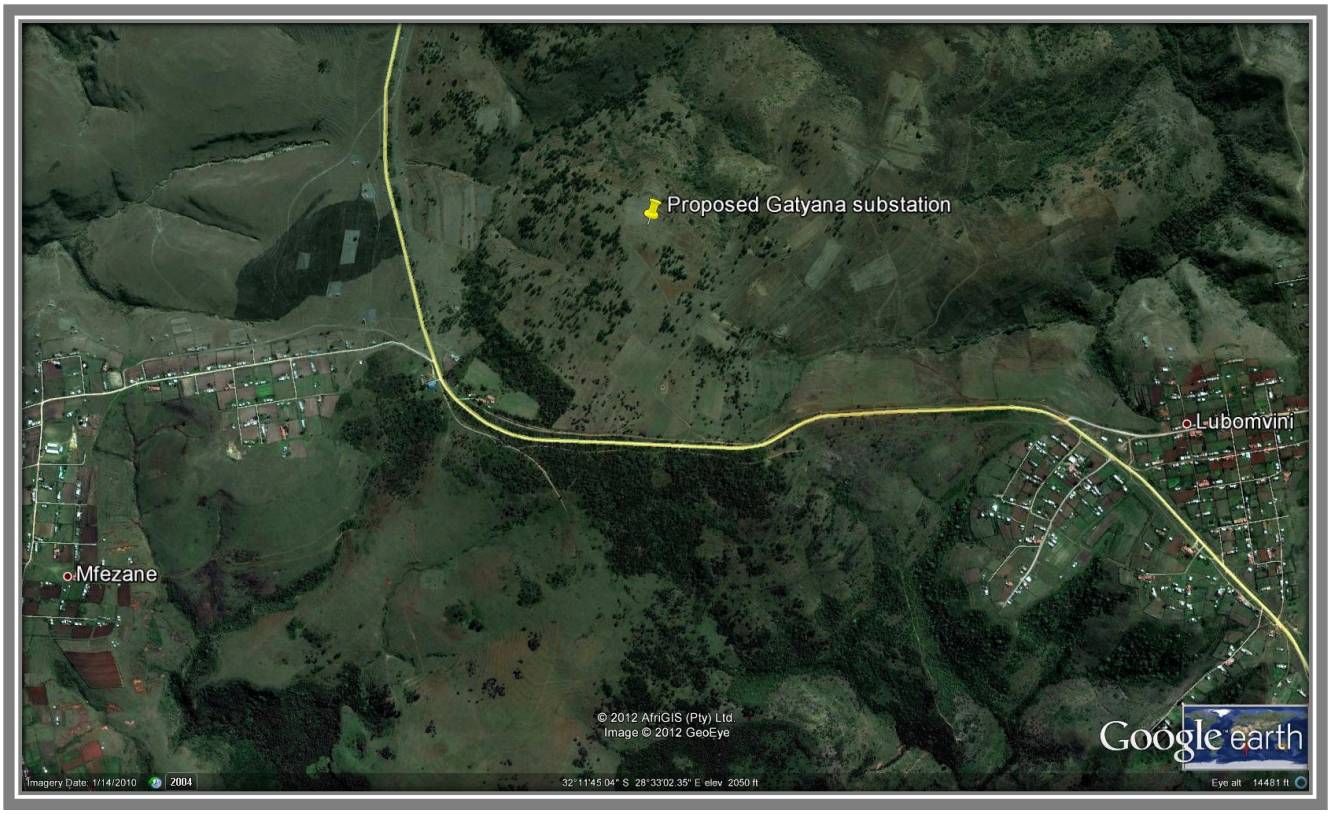

Figure 2 Locality map of the proposed Gatyana substation.

Unlike the mineral rich provinces in the rest of South Africa, the Eastern Cape it not well endowed with large, valuable mineral deposits[1]. This is largely a function of the geology of the province. In particular the age of the rocks and strata are much younger than in provinces to the north. Not-withstanding, several mineral deposits are located in the province, but these remain largely undeveloped and unexploited. Most of these are not precious metal deposits, rather they are industrial mineral related. Mineral deposits that show promise are: stone quarrying (for export), industrial minerals related to the building industry, such as sand, aggregate, limestone and heavy mineral sands.

Coal is formed when peat, or some other accumulation of partially decayed vegetable matter, is compacted and slightly heated during burial. Coal is currently the principal energy source in this country and likely to remain so for the foreseeable future. At present there are no industrial applications for the low grade coal in the province.

Four coal seams are recognized in the Molteno Formation, which is the coal-bearing horizon in the Eastern Cape Province. All seams cap upward-fining fluvial sequences and they are named (from the base) the Indwe, Guba, Molteno and Gubenxa seams. Dolerite intrusives are common, forming ~30% of the surface area in the Molteno - Dordrecht -Indwe region. Dykes are typically 5-10 m in width and rarely exceed 10 km along strike; dips are vertical to sub-vertical. Dolerite sills and sheets are extensive and may approach 200 m in thickness, causing updoming of the strata in some localities.

Dykes of dolerite (called black granite in the trade) produce an attractive, fine-grained dark dimension stone when fresh and unjointed. Coastal dolerite dykes are generally deeply weathered whereas those occurring in the more arid interior are more suitable for dimension stone and aggregate applications. An extensive drilling program showed the dolerite sill at Willowvale extends over some 15 km² and is at least 100m thick. Dormant dimension stone quarries at Willowvale and Kentani (and in other parts of South Africa) have piles of slightly sub-standard dimension stone blocks and off-cuts that, with the correct handling and cutting equipment, could be used to produce stone suitable for monumental purposes instead of importing from other provinces.

Dutywa receives about 535mm of rain per year, with most rainfall occurring during summer. It receives the lowest rainfall (7mm) in June and the highest (77mm) in March. The average midday temperatures for Dutywa range from 18.3°C in July to 25°C in February. The region is the coldest during July when the mercury drops to 5.1°C on average during the night. Willowvale receives about 800mm of rain per year, with most rainfall occurring during midsummer[2]. It receives the lowest rainfall (10mm) in June and the highest (107mm) in November. The average midday temperatures for Willowvale range from 20°C in July to 25.7°C in February. The region is the coldest during July when the mercury drops to 7.7°C on average during the night.

5 Methodology and approach

The methodology used for HIAs of transmission lines is unlike that for projects where impacts primarily involve physical landscape disturbance. The greatest change invoked by transmission lines is typically above the ground surface; therefore the emphasis of the HIA is on resources that are sensitive to visual change. Such resources are usually places, structures and landscapes that are or could be publicly celebrated as heritage. Accordingly, the purpose of this HIA is to identify a preferred transmission line corridor based on the occurrence of, and potential impact on visually sensitive categories of heritage resource.

[1] http://www.geoscience.org.za/
[2] http://www.saexplorer.co.za/south-africa/climate/willowvale_climate.asp

eThembeni staff members drove along the proposed power line route option on 26 and 27 March 2012. The significance of and potential impact on heritage resources were evaluated using the criteria in Appendix C. During the assessment of the potential impacts of the project on heritage resources, the following factors were taken into consideration:

- The constraints of fieldwork and a desktop study of a 100 metre wide servitude over the length of the entire corridor.
- The constraints of identifying an exact route using maps at a scale of 1:50 000.
- Electronic databases of visually sensitive heritage resources do not exist for the study area, and paper versions are extremely limited.
- In open landscape during daylight hours, 400kV transmission lines on self-supporting towers are visible (but not necessarily intrusive) from a distance of 2 to 5km. Guidelines for the development of wind energy facilities in the Western Cape[3] have suggested that a buffer zone of 1km be established around significant visually sensitive heritage resources to minimise the change to the 'sense of place'. The point at which a transmission line may be perceived as intrusive or offensive is subjective.
- The presence of an existing transmission line in an area serves as a mitigatory factor rather than a cumulative negative impact, in terms of establishing new transmission lines in the same area (within a distance of 1km of the existing line). Electrical infrastructure is therefore best confined to an existing area or corridor of vertical visual disturbance, rather than introducing new infrastructure to an undisturbed landscape.
- Transmission power line routes should be chosen to minimise the requirements for new infrastructure such as access roads, which have the greatest permanent direct and indirect impact on the landscape[4]. This factor supports the previous observation in that new transmission lines located close to existing lines can share access and maintenance roads.
- The linear nature of the project where tower positions can be altered (within limits) to avoid direct impacts on heritage resources such as archaeological and palaeontological sites that may have high heritage significance due to their scientific values, but are generally not publicly celebrated as resources sensitive to visual change.
- A heritage practitioner should complete a 'walk-through' of the final selected power line corridor and all other activity areas (access roads, construction camps, materials' storage areas, etc.) prior to the start of any construction activities and assess direct impacts on discrete resources such as archaeological and palaeontological sites. Mitigation can usually be achieved by micro-adjustment of tower positions, the exclusion of sensitive areas, basic recording and/or obtaining a permit for alteration, destruction or removal from SAHRA.

A guideline issued by the Western Cape Department of Environment and Cultural Affairs and Sport (2001) on the application of the EIA Regulations to structures associated with communication networks[5] explicitly recognises that:

- The power supply services as well as access routes can have greater impacts on biophysical elements than the communication structure itself (noted above); and
- Masts and access routes can have significant visual impacts which can be out of character with the surrounding area.

This guideline document supports the following decision-making principles that are relevant to this HIA:

- Structures associated with communication networks that are proposed where they will be out of character or disruptive of the sense of place will be discouraged or completely avoided.

[3] Developed by Department of Environmental Affairs and Development Planning, 2006.
[4] Guideline on the application of the EIA Regulations to structures associated with communication networks. Developed by the Western Cape Department of Environment and Cultural Affairs and Sport, September 2001
[5] Developed by the Western Cape Department of Environment and Cultural Affairs and Sport, September 2001.

- Structures associated with communication networks, which are proposed where they will break the skyline on a scenic landscape, will be discouraged or completely avoided.
- Structures associated with communication networks, which are proposed along scenic tourist routes will be discouraged or completely avoided.
- Structures associated with communication networks, which are proposed in a sensitive environment as listed in Annexure A (see below) of the guideline document will be strongly discouraged or completely avoided.
- Structures associated with communication networks which are proposed in any area, property, adjacent to sites of cultural or social importance such as historical sites proclaimed in terms of the NHRA, graveyards, public open spaces and visual corridors or gateways will be strongly discouraged or completely avoided.

Annexure A of the guideline provides a list of potentially sensitive environmental features/areas that includes the following:

- Properties subject to any statutory conservation status or similar, including, but not restricted to, World Heritage Sites, National Parks, Provincial, Local Authority or Private nature reserves, Wilderness Areas, State Forests, Protected Natural Environments, or adjoining properties in so far as the activity or structure may affect the ecosystem function or aesthetic value of those conservation areas. This therefore includes locations for communication structures where such structures may be visible from sites of conservation significance (i.e. statutory conservation status).
- Natural Heritage Sites or adjoining properties in so far as the activity or structure may affect the ecosystem function or aesthetic value of those sites. This therefore includes locations for communication structures where such structures may be visible from Natural Heritage Sites.
- Any area, property or adjacent property that is of cultural or social importance e.g. historical sites, as proclaimed by the NHRA, graveyards, public open spaces and visual corridors or gateways.
- Any areas identified as areas of natural or conservation significance in statutory or non-statutory land use or development planning documents (structure plans, integrated development frameworks etc.) and/or maps, including the core areas of biosphere reserves or in close proximity thereto.
- Routes of tourism or scenic significance or locations visible from such routes.

With due consideration of these factors, we evaluated the following visually sensitive categories of heritage resource, and commissioned a specialist palaeontological study, as requested by SAHRA:

- Places to which oral traditions are attached or which are associated with living heritage.
- Historical settlements and townscapes.
- Landscapes and natural features of cultural significance (including places defined as a site, area or region; (groups of) buildings and open spaces).
- Battlefields.

The assumptions and limitations of this HIA are as follows:

- The description of the proposed project, provided by the client, is accurate.
- The public consultation process undertaken as part of the EIA is sufficient and adequate, and does not require repetition as part of the HIA.
- Soil surface visibility was moderate. Heritage resources might be present below the surface or in areas of dense vegetation and we remind the client that the NHRA requires that a developer cease all work immediately and follow the protocol in Section 10 of this report should any heritage resources, as defined in the Act, be discovered during the course of development activities.
- No subsurface investigation (including excavations or sampling) were undertaken, since a permit from SAHRA is required to disturb a heritage resource.

- A key concept in the management of heritage resources is that of non-renewability: damage to or destruction of most resources, including that caused by bona fide research endeavours, cannot be reversed or undone. Accordingly, management recommendations for heritage resources in the context of development are as conservative as possible, according to the precautionary principle.
- Human sciences are necessarily both subjective and objective in nature. eThembeni strives to manage heritage resources to the highest standards in accordance with national and international best practice, but recognise that our opinions might differ from those of other heritage practitioners.
- Staff members involved in this project have no vested interest in it; are qualified to undertake the tasks as described in the terms of reference (refer to Appendix D); and comply at all times with the Codes of Ethics and Conduct of the Association of Southern African Professional Archaeologists.
- eThembeni staff members take no personal or professional responsibility for the misuse of the information contained in this report, although they take all reasonable precautions against such misuse.

6 Observations

The proposed power line route traverses a primarily rural and remote area of the Eastern Cape Province, characterised by deeply incised river valleys. Part of the proposed power line route parallels a well-established gravel road, with other portions traversing river valleys and drainage lines.

Human settlement is concentrated on drainage interfluves, with some encroachment on steeper areas due to population pressure. Settlement tends to create small villages or occupation nodes, rather than randomly scattered homesteads, including eBongweni, Mfezane, Matolweni and Taleni. Such villages were established as a consequence of apartheid policies during the 1950s and 1960s. Residents practice limited subsistence agriculture and livestock grazing, and outward migration of jobseekers and unemployment are high. Ancestral graves usually occur within homestead boundaries (whether occupied or not) and are managed by next-of-kin.

We observed no visually sensitive categories of heritage resource within the proposed development corridor. However, we did notice various abandoned homesteads around and between existing villages that probably date to before the establishment of the aforementioned villages and may include ancestral graves.

The proposed transmission line route and substation site overlie the outcrop area of Lower Beaufort Group (Adelaide Subgroup) sediments that may contain important fossil heritage – notably Late Permian vertebrate, plant and trace fossil remains. However, the Lower Beaufort Group bedrocks in the study region are generally deeply weathered and mantled in unfossiliferous superficial sediments (*e.g.* soils, alluvium). Furthermore, their original fossil content has probably been compromised by thermal metamorphism (baking) during dolerite intrusion. Hitherto major vertebrate fossil finds are unknown from the study area, although recent impact studies in the region suggest this may be partially due to insufficient palaeontological research. Substantial sectors of the power line route traverse Karoo dolerite outcrops of no palaeontological significance. Alluvial sediments near Dutywa are of low palaeontological sensitivity.

7 Recommended mitigation

A heritage practitioner should complete a 'walk-through' of the final selected power line route and all other activity areas (access roads, construction camps, materials' storage areas, etc.) prior to the start of any construction activities and assess direct impacts on discrete resources such as archaeological sites. Mitigation can usually be achieved by micro-adjustment of tower positions, the exclusion of sensitive areas, basic recording and/or obtaining a permit for alteration, destruction or removal from SAHRA.

Tower placements should be negotiated with residents to ensure that no ancestral graves are affected.

Significant impacts on local fossil heritage are not anticipated during the operational phase of the transmission line development. Should substantial fossil remains be exposed during construction, however, such as vertebrate bones and teeth, plant-rich fossil lenses or dense fossil burrow assemblages, the Environmental Control Officer should safeguard these, preferably *in situ*, and alert SAHRA as soon as possible so that appropriate action (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist (refer to Section 9).

8 Recommended monitoring

None at present.

9 Protocol for the identification, protection and recovery of heritage resources during construction and operation

It is possible that sub-surface heritage resources will be encountered during the construction phase of this project. The Project Engineer, Environmental Control Officer and all other persons responsible for site management and excavation should be aware that indicators of sub-surface sites could include:

- Ash deposits (unnaturally grey appearance of soil compared to the surrounding substrate);
- Bone concentrations, either animal or human;
- Ceramic fragments, including potsherds;
- Stone concentrations that appear to be formally arranged (may indicate the presence of an underlying burial); and
- Fossilised remains of fauna and flora, including trees.

In the event that such indicator(s) of heritage resources are identified, the following actions should be taken immediately:

- All construction within a radius of at least 20m of the indicator should cease. This distance should be increased at the discretion of supervisory staff if heavy machinery or explosives could cause further disturbance to the suspected heritage resource.
- This area must be marked using clearly visible means, such as barrier tape, and all personnel should be informed that it is a no-go area.
- A guard should be appointed to enforce this no-go area if there is any possibility that it could be violated, whether intentionally or inadvertently, by construction staff or members of the public.
- No measures should be taken to cover up the suspected heritage resource with soil, or to collect any remains such as bone or stone.
- If a heritage practitioner has been appointed to monitor the project, s/he should be contacted and a site inspection arranged as soon as possible.

- If no heritage practitioner has been appointed to monitor the project, Dr Mariagrazia Galimberti at SAHRA's Cape Town head office should be contacted (telephone 021 462 4502).
- The South African Police Services should be notified by a SAHRA staff member or an independent heritage practitioner if human remains are identified. No SAPS official may disturb or exhume such remains, whether of recent origin or not.
- All parties concerned should respect the potentially sensitive and confidential nature of the heritage resources, particularly human remains, and refrain from making public statements until a mutually agreed time.
- Any extension of the project beyond its current footprint involving vegetation and/or earth clearance should be subject to prior assessment by a qualified heritage practitioner, taking into account all information gathered during this initial heritage impact assessment.

10 Conclusion

We recommend that the development proceed with the proposed heritage mitigation and have submitted this report to SAHRA in fulfilment of the requirements of the NHRA. According to Section 38(4) of the Act the report shall be considered timeously by the Council which shall, after consultation with the person proposing the development, decide –

- whether or not the development may proceed;
- any limitations or conditions are to be applied to the development;
- what general protections in terms of this Act apply, and what formal protections may be applied to such heritage resources;
- whether compensatory action shall be required in respect of any heritage resources damaged or destroyed as a result of the development; and
- whether the appointment of specialists is required as a condition of approval of the proposal.

Relevant staff members may be contacted at the SAHRA Cape Town head office (Mariagrazia Galimberti telephone 021 462 4502; MGALIMBERTI@sahra.org.za).

If permission is granted for development to proceed, the client is reminded that the NHRA requires that a developer cease all work immediately and follow the protocol contained in Section 9 of this report should any heritage resources, as defined in the Act, be discovered during the course of development activities.

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Appendix B

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Appendix C (Methodology)

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Appendix A

Statutory Requirements

General

The Constitution of the Republic of South Africa Act 108 of 1996 is the source of all legislation. Within the Constitution the Bill of Rights is fundamental, with the principle that the environment should be protected for present and future generations by preventing pollution, promoting conservation and practising ecologically sustainable development. With regard to spatial planning and related legislation at national and provincial levels the following legislation may be relevant:

- Physical Planning Act 125 of 1991
- Municipal Structures Act 117 of 1998
- Municipal Systems Act 32 of 2000
- Development Facilitation Act 67 of 1995 (DFA)
- KwaZulu-Natal Planning and Development Act 6 of 2008.

The identification, evaluation and management of heritage resources in South Africa is required and governed by the following legislation:

- National Environmental Management Act 107 of 1998 (NEMA)
- KwaZulu-Natal Heritage Act 4 of 2008 (KZNHA)
- National Heritage Resources Act 25 of 1999 (NHRA)
- Minerals and Petroleum Resources Development Act 28 of 2002 (MPRDA)

National Heritage Resources Act 25 of 1999

The NHRA established the South African Heritage Resources Agency (SAHRA) together with its Council to fulfil the following functions:

- co-ordinate and promote the management of heritage resources at national level;
- set norms and maintain essential national standards for the management of heritage resources in the Republic and to protect heritage resources of national significance;
- control the export of nationally significant heritage objects and the import into the Republic of cultural property illegally exported from foreign countries;
- enable the provinces to establish heritage authorities which must adopt powers to protect and manage certain categories of heritage resources; and
- provide for the protection and management of conservation-worthy places and areas by local authorities.

Heritage Impact Assessments

Section 38(1) of the NHRA of 1999 requires the responsible heritage resources authority to notify the person who intends to undertake a development that fulfils the following criteria to submit an impact assessment report **if there is reason to believe that heritage resources will be affected by such development**:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- the construction of a bridge or similar structure exceeding 50m in length;
- any development or other activity which will change the character of a site—
  (i) exceeding 5 000m² in extent; or
  (ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
(iv) 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 000m² in extent; or
- any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

Reports in fulfilment of Section 38(3) of the Act must include the following information:

- the identification and mapping of all heritage resources in the area affected;
- an assessment of the significance of such resources in terms of the heritage assessment criteria set out in regulations;
- an assessment of the impact of the development on such heritage resources;
- an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
- the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
- if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
- plans for mitigation of any adverse effects during and after completion of the proposed development.

Definitions of heritage resources

The NHRA defines a heritage resource as any place or object of cultural significance i.e. of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. This includes, but is not limited to, the following wide range of places and objects:

- living heritage as defined in the National Heritage Council Act No 11 of 1999 (cultural tradition; oral history; performance; ritual; popular memory; skills and techniques; indigenous knowledge systems; and the holistic approach to nature, society and social relationships);
- ecofacts (non-artefactual organic or environmental remains that may reveal aspects of past human activity; definition used in KwaZulu-Natal Heritage Act 2008);
- places, buildings, structures and equipment;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds;
- public monuments and memorials;
- sites of significance relating to the history of slavery in South Africa;
- movable objects, but excluding any object made by a living person; and
- battlefields.

Furthermore, a place or object is to be considered part of the national estate if it has cultural significance or other special value because of—

- its importance in the community, or pattern of South Africa's history;
- its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;

- its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons; and
- its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.

'**Archaeological**' means –

- material remains resulting from human activity which are in a state of disuse and are in or on land and are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and is older than 100 years including any area within 10 m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found.

'**Palaeontological**' means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

A '**place**' is defined as:
- a site, area or region;
- a building or other structure which may include equipment, furniture, fittings and articles associated with or connected with such building or other structure;
- a group of buildings or other structures which may include equipment, furniture, fittings and articles associated with or connected with such group of buildings or other structures;
- an open space, including a public square, street or park; and
- in relation to the management of a place, includes the immediate surroundings of a place.

'**Public monuments and memorials**' means all monuments and memorials—
- erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government; or
- which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual;

'**Structures**' means any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith.

Management of Graves and Burial Grounds

- **Graves younger than 60 years** are protected in terms of Section 2(1) of the Removal of Graves and Dead Bodies Ordinance 7 of 1925 as well as the Human Tissues Act 65 of 1983. Such graves are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial Member of the Executive Council for Local Government and Planning, or in some cases the MEC for Housing and Welfare.

  Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains the institution conducting the relocation should be authorised under Section 24 of the Human Tissues Act 65 of 1983.

- **Graves older than 60 years situated outside a formal cemetery administered by a local authority** are protected in terms of Section 36 of the NHRA as well as the Human Tissues Act of 1983. Accordingly, such graves are the jurisdiction of SAHRA. The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of NHRA) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in the category located inside a formal cemetery administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

  If the grave is not situated inside a formal cemetery but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the cemetery authority must be adhered to.

The **protocol for the management of graves older than 60 years situated outside a formal cemetery administered by a local authority** is detailed in Section 36 of the NHRA:

(3) *(a)* No person may, without a permit issued by SAHRA or a provincial heritage resources authority—
(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
(c) bring onto or use at a burial ground or grave referred to in paragraph *(a)* or *(b)* any excavation equipment, or any equipment which assists in the detection or recovery of metals.
(4) SAHRA or a provincial heritage resources authority may not issue a permit for the destruction or damage of any burial ground or grave referred to in subsection (3)*(a)* unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation and re-interment of the contents of such graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.
(5) SAHRA or a provincial heritage resources authority may not issue a permit for any activity under subsection (3)*(b)* unless it is satisfied that the applicant has, in accordance with regulations made by the responsible heritage resources authority—
(a) made a concerted effort to contact and consult communities and individuals who by tradition have an interest in such grave or burial ground; and
(b) reached agreements with such communities and individuals regarding the future of such grave or burial ground.
(6) Subject to the provision of any other law, any person who in the course of development or any other activity discovers the location of a grave, the existence of which was previously unknown, must immediately cease such activity and report the discovery to the responsible heritage resources authority which must, in

co-operation with the South African Police Service and in accordance with regulations of the responsible heritage resources authority—
(a) carry out an investigation for the purpose of obtaining information on whether or not such grave is protected in terms of this Act or is of significance to any community; and
(b) if such grave is protected or is of significance, assist any person who or community which is a direct descendant to make arrangements for the exhumation and re-interment of the contents of such grave or, in the absence of such person or community, make any such arrangements as it deems fit.

The Vermillion Accord on Human Remains[6]

Adopted in 1989 at WAC Inter-Congress, South Dakota, USA

1. Respect for the mortal remains of the dead shall be accorded to all, irrespective of origin, race, religion, nationality, custom and tradition.

2. Respect for the wishes of the dead concerning disposition shall be accorded whenever possible, reasonable and lawful, when they are known or can be reasonably inferred.

3. Respect for the wishes of the local community and of relatives or guardians of the dead shall be accorded whenever possible, reasonable and lawful.

4. Respect for the scientific research value of skeletal, mummified and other human remains (including fossil hominids) shall be accorded when such value is demonstrated to exist.

5. Agreement on the disposition of fossil, skeletal, mummified and other remains shall be reached by negotiation on the basis of mutual respect for the legitimate concerns of communities for the proper disposition of their ancestors, as well as the legitimate concerns of science and education.

6. The express recognition that the concerns of various ethnic groups, as well as those of science are legitimate and to be respected, will permit acceptable agreements to be reached and honoured.

[6] http://www.worldarchaeologicalcongress.org/

Appendix B

Archaeological and Historical Context of the Study Area

The Stone Age[7]

No systematic Early and Middle Stone Age research has been undertaken in the proposed development area, hence the general nature of this section. Open air scatters of stone artefacts, probably with low heritage significance, could be expected in areas with minimal environmental disturbance.

South Africa's prehistory has been divided into a series of phases based on broad patterns of technology. The primary distinction is between a reliance on chipped and flaked stone implements (the Stone Age) and the ability to work iron (the Iron Age). Spanning a large proportion of human history, the Stone Age in Southern Africa is further divided into the Early Stone Age, or Paleolithic Period (about 2 500 000–150 000 years ago), the Middle Stone Age, or Mesolithic Period (about 150 000–30 000 years ago), and the Late Stone Age, or Neolithic Period (about 30 000–2 000 years ago). The simple stone tools found with australopithecine fossil bones fall into the earliest part of the Early Stone Age.

- The Early Stone Age

Most Early Stone Age sites in South Africa can probably be connected with the hominin species known as *Homo erectus*. Simply modified stones, hand axes, scraping tools, and other bifacial artifacts had a wide variety of purposes, including butchering animal carcasses, scraping hides, and digging for plant foods. Most South African archaeological sites from this period are the remains of open camps, often by the sides of rivers and lakes, although some are rock shelters, such as Montagu Cave in the Cape region.

- The Middle Stone Age

The long episode of cultural and physical evolution gave way to a period of more rapid change about 200 000 years ago. Hand axes and large bifacial stone tools were replaced by stone flakes and blades that were fashioned into scrapers, spear points, and parts for hafted, composite implements. This technological stage, now known as the Middle Stone Age, is represented by numerous sites in South Africa.

Open camps and rock overhangs were used for shelter. Day-to-day debris has survived to provide some evidence of early ways of life, although plant foods have rarely been preserved. Middle Stone Age bands hunted medium-sized and large prey, including antelope and zebra, although they tended to avoid the largest and most dangerous animals, such as the elephant and the rhinoceros. They also ate seabirds and marine mammals that could be found along the shore and sometimes collected tortoises and ostrich eggs in large quantities.

- The Late Stone Age

Basic toolmaking techniques began to undergo additional change about 40 000 years ago. Small finely worked stone implements known as microliths became more common, while the heavier scrapers and points of the Middle Stone Age appeared less frequently. Archaeologists refer to this technological stage as the Late Stone Age. The numerous collections of stone tools from South African archaeological sites show a great degree of variation through time and across the subcontinent.

The remains of plant foods have been well preserved at such sites as Melkhoutboom Cave, De Hangen, and Diepkloof in the Cape region. Animals were trapped and hunted with spears and arrows on which were mounted well-crafted stone blades. Bands moved with the seasons as they followed game into higher lands in the spring and early summer months, when plant foods could also be found. When available, rock

[7] http://www.britannica.com; article authored by Colin J. Bundy, Julian R. D. Cobbing, Martin Hall and Leonard Monteath Thompson

overhangs became shelters; otherwise, windbreaks were built. Shellfish, crayfish, seals, and seabirds were also important sources of food, as were fish caught on lines, with spears, in traps, and possibly with nets.

Dating from this period are numerous engravings on rock surfaces, mostly on the interior plateau, and paintings on the walls of rock shelters in the mountainous regions, such as the Drakensberg and Cederberg ranges. The images were made over a period of at least 25 000 years. Although scholars originally saw the South African rock art as the work of exotic foreigners such as Minoans or Phoenicians or as the product of primitive minds, they now believe that the paintings were closely associated with the work of medicine men, shamans who were involved in the well-being of the band and often worked in a state of trance. Specific representations include depictions of trance dances, metaphors for trance such as death and flight, rainmaking, and control of the movement of antelope herds.

Iron Age[8]

Archaeological evidence shows that Bantu-speaking agriculturists first settled in southern Africa around AD 300. Bantu-speakers originated in the vicinity of modem Cameroon from where they began to move eastwards and southwards, some time after 400 BC, skirting around the equatorial forest. An extremely rapid spread throughout much of sub-equatorial Africa followed: dating shows that the earliest communities in Tanzania and South Africa are separated in time by only 200 years, despite the 3 000 km distance between the two regions. It seems likely that the speed of the spread was a consequence of agriculturists deliberately seeking iron ore sources and particular combinations of soil and climate suitable for the cultivation of their crops.

The earliest agricultural sites in KwaZulu-Natal date to between AD 400 and 550. All are situated close to sources of iron ore, and within 15 km of the coast. Current evidence suggests it may have been too dry further inland at this time for successful cultivation. From 650 onwards, however, climatic conditions improved and agriculturists expanded into the valleys of KwaZulu-Natal, where they settled close to rivers in savanna or bushveld environments. There is a considerable body of information available about these early agriculturists.

Seed remains show that they cultivated finger millet, bulrush millet, sorghum and probably the African melon. It seems likely that they also planted African groundnuts and cowpeas, though direct evidence for these plants is lacking from the earlier periods. Faunal remains indicate that they kept sheep, cattle, goats, chickens and dogs, with cattle and sheep providing most of the meat. Men hunted, perhaps with dogs, but hunted animals made only a limited contribution to the diet in the region.

Metal production was a key activity since it provided the tools of cultivation and hunting. The evidence indicates that people who worked metal lived in almost every village, even those that were considerable distances from ore sources.

Large-scale excavations in recent years have provided data indicating that first-millennium agriculturist society was patrilineal and that men used cattle as bridewealth in exchange for wives. On a political level, society was organised into chiefdoms that, in our region, may have had up to three hierarchical levels. The villages of chiefs tended to be larger than others, with several livestock enclosures, and some were occupied continuously for lengthy periods. Social forces of the time resulted in the concentration of unusual items on these sites. These include artefacts that originated from great distances, ivory items (which as early as AD 700 appear to have been a symbol of chieftainship), and initiation paraphernalia.

This particular way of life came to an end around AD 1000, for reasons that we do not yet fully understand. There was a radical change in the decorative style of agriculturist ceramics at this time, while the preferred

[8] Whitelaw (1997). See also Prins and Granger (1993), Whitelaw (1991, 2009).

village locations of the last four centuries were abandoned in favour of sites along the coastal littoral. In general, sites dating to between 1050 and 1250 are smaller than most earlier agriculturist settlements. It is tempting to see in this change the origin of the Nguni settlement pattern. Indeed, some archaeologists have suggested that the changes were a result of the movement into the region of people who were directly ancestral to the Nguni-speakers of today. Others prefer to see the change as the product of social and cultural restructuring within resident agriculturist communities.

Whatever the case, it seems likely that this new pattern of settlement was in some way influenced by a changing climate, for there is evidence of increasing aridity from about AD 900. A new pattern of economic inter-dependence evolved that is substantially different from that of earlier centuries, and is one that continued into the colonial period nearly 500 years later.

Colonial rule[9]

By the closing decades of the 18th century, South Africa had fallen into two broad regions: west and east. Colonial settlement dominated the west, including the winter rainfall region around the Cape of Good Hope, the coastal hinterland northward toward the present-day border with Namibia, and the dry lands of the interior. Trekboers took increasingly more land from the Khoekhoe and from remnant hunter-gatherer communities, who were killed, were forced into marginal areas, or became labourers tied to the farms of their new overlords. Indigenous farmers controlled both the coastal and valley lowlands and the Highveld of the interior in the east, where summer rainfall and good grazing made mixed farming economies possible.

A large group of British settlers arrived in the eastern Cape in 1820; this, together with a high European birth rate and wasteful land usage, produced an acute land shortage, which was alleviated only when the British acquired more land through massive military intervention against Africans on the eastern frontier. Until the 1840s the British vision of the colony did not include African citizens (referred to pejoratively by the British as “Kaffirs”), so, as Africans lost their land, they were expelled across the Great Fish River, the unilaterally proclaimed eastern border of the colony.

The first step in this process included attacks in 1811–12 by the British army on the Xhosa groups, the Gqunukhwebe and Ndlambe. An attack by the Rharhabe-Xhosa on Graham’s Town in 1819 provided the pretext for the annexation of more African territory, to the Keiskamma River. Various Rharhabe-Xhosa groups were driven from their lands throughout the early 1830s. They counterattacked in December 1834, and Governor Benjamin D’Urban ordered a major invasion the following year, during which thousands of Rharhabe-Xhosa died. The British crossed the Great Kei River and ravaged territory of the Gcaleka-Xhosa as well; the Gcaleka chief, Hintsa, invited to hold discussions with British military officials, was held hostage and died trying to escape. The British colonial secretary, Lord Glenelg, who disapproved of D’Urban’s policy, halted the seizure of all African land east of the Great Kei. D’Urban’s initial attempt to rule conquered Africans with European magistrates and soldiers was overturned by Glenelg; instead, for a time, Africans east of the Keiskamma retained their autonomy and dealt with the colony through diplomatic agents.

However, after further fighting with the Rharhabe-Xhosa on the eastern frontier in 1846, Governor Colonel Harry Smith finally annexed, over the next two years, not only the region between the Great Fish and the Great Kei rivers (establishing British Kaffraria) but also a large area between the Orange and Vaal rivers, thus establishing the Orange River Sovereignty. These moves provoked further warfare in 1851–53 with the Xhosa (joined once more by many Khoe), with a few British politicians ineffectively trying to influence events.

Between 1811 and 1858 colonial aggression deprived Africans of most of their land between the Sundays and Great Kei rivers and produced poverty and despair. From the mid-1850s British magistrates held political power in British Kaffraria, destroying the power of the Xhosa chiefs. Following a severe lung sickness

[9] http://www.britannica.com; article authored by Colin J. Bundy, Julian R. D. Cobbing, Martin Hall and Leonard Monteath Thompson.

epidemic among their cattle in 1854–56, the Xhosa killed many of their remaining cattle and in 1857–58 grew few crops in response to a millenarian prophecy that this would cause their ancestors to rise from the dead and destroy the whites. Many thousands of Xhosa starved to death, and large numbers of survivors were driven into the Cape Colony to work. British Kaffraria fused with the Cape Colony in 1865, and thousands of Africans newly defined as Fingo resettled east of the Great Kei, thereby creating Fingoland. The Transkei, as this region came to be known, consisted of the hilly country between the Cape and Natal. It became a large African reserve and grew in size when those parts that were still independent were annexed in the 1880s and ’90s (Pondoland lost its independence in 1894).

Under apartheid blacks were treated like “tribal” people and were required to live on reserves under hereditary chiefs except when they worked temporarily in white towns or on white farms. The government began to consolidate the scattered reserves into 8 (eventually 10) distinct territories, designating each of them as the “homeland,” or Bantustan, of a specific black ethnic community. The government manipulated homeland politics so that compliant chiefs controlled the administrations of most of those territories. Arguing that Bantustans matched the decolonization process then taking place in tropical Africa, the government devolved powers onto those administrations and eventually encouraged them to become “independent.” Between 1976 and 1981 four accepted independence—Transkei, Bophuthatswana, Venda, and Ciskei—though none was ever recognized by a foreign government. Like the other homelands, however, they were economic backwaters, dependent on subsidies from Pretoria.

Conditions in the homelands continued to deteriorate, partly because they had to accommodate vast numbers of people with minimal resources. Many people found their way to the towns; but the government, attempting to reverse this flood, strengthened the pass laws by making it illegal for blacks to be in a town for more than 72 hours at a time without a job in a white home or business. A particularly brutal series of forced removals were conducted from the 1960s to the early ’80s, in which more than 3.5 million blacks were taken from towns and white rural areas (including lands they had occupied for generations) and dumped into the reserves, sometimes in the middle of winter and without any facilities.

Dutywa[10]

Dutywa (formerly Idutywa) is a town in the Eastern Cape of South Africa, formerly part of the Transkei bantustan. It is the birthplace of Thabo Mbeki, who became President of South Africa in 1999. It is 35 kilometres north of Gcuwa (formerly known as Butterworth) on the N2 road. Idutywa is in the Mbhashe Municipality of Amathole District.

The town was founded in 1858 as a military fort after a dispute between a KwaZulu-Natal raiding party and local people. It is named after the Dutywa River, a tributary of the Mbhashe River, which is derived from the Xhosa *ukudutywa* ‘one who is disturbed’ and therefore ‘Place of Disorder’, a reference to the tribal disturbances that took place here *c.*1820[11]. Its spelling was officially changed from "Idutywa" to "Dutywa" on 16 July 2004. The settlement was laid out in 1884 and was made a municipality in 1913.

Willowvale

Willowvale is a town in the Eastern Cape with a population of between 2000 and 5000 in Galekaland, 32km southeast of Dutywa. It is known as Gatyana in Xhosa[12]. It was established as a military post in 1879 and so named because of its situation on a stream with willow trees on its banks.

[10] http://en.wikipedia.org/
[11] http://www.encyclopedia.com/doc/1O209-Idutywa.html
[12] http://www.collinsmaps.com/

Appendix D

Palaeontological Specialist Study: Desktop Assessment

Proposed Eskom Dutywa – Gatyana 132 kV transmission line and Gatyana Substation, Willowvale area, Amatole District Municipality, Eastern Cape

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PALAEONTOLOGICAL HERITAGE IMPACT STATEMENT

Eskom are proposing to construct a new 132 kV transmission line of approximately 40 km length between the existing Indutywa Substation, situated about 30 km northeast of Butterworth, and a new Gatyana Substation to the north of Willowvale, Amatole District Municipality, Eastern Cape.

The proposed new Dutywa – Gatyanan 132 kV transmission line route and new Gatyana substation site overlie the outcrop area of Lower Beaufort Group (Adelaide Subgroup) sediments that may contain important fossil heritage – notably Late Permian vertebrate, plant and trace fossil remains. However, the Lower Beaufort Group bedrocks in the study region are generally deeply weathered and mantled in unfossiliferous superficial sediments (*e.g.* soils, alluvium). Furthermore, their original fossil content has probably been compromised by thermal metamorphism (baking) during dolerite intrusion. Hitherto major vertebrate fossil finds are unknown from the study area, although recent impact studies in the region suggest this may be partially due to insufficient palaeontological research. Substantial sectors of the powerline route traverse Karoo dolerite outcrops of no palaeontological significance. Alluvial sediments near Indutywa are of low palaeontological sensitivity.

Significant impacts on local fossil heritage are therefore not anticipated during the operational phase of the transmission line development. Should substantial fossil remains be exposed during construction, however, such as vertebrate bones and teeth, plant-rich fossil lenses or dense fossil burrow assemblages, the ECO should safeguard these, preferably *in situ*, and alert SAHRA as soon as possible so that appropriate action (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

1. Outline and location of the proposed development

Eskom is proposing to upgrade the 132 kV network to the densely populated Willowvale area, situated some 25 to 30 km northeast of Butterworth, Amatole District Municipality, Eastern Cape. According to the Basic Information Document prepared by Arcus Gibb Engineering and Science, the planned network strengthening involves:

- Construction of 132/22kV 2x20MVA Gatyana substation in the Willowvale area;
- Construction of ±40km of 132kV Chicadee line from Idutywa substation to Gatyana substation;
- Upgrade existing 22kV link lines and build new 22kV link lines.

Based on similar transmission line projects, excavations for the 132 kV transmission pylons may be up to 2-3 m deep, depending on substrate conditions.

The location of these developments is indicated on a satellite image in Fig. 1 below.

A preliminary comment (April 2012) by the author on palaeontological heritage issues for this project was as follows:

> The proposed Eskom Dutywa – Gatyana 132 kV powerline and Gatyana Substation projects are underlain by Permian fluvial sediments of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) that are extensively intruded by Late Jurassic dolerites of the Karoo Dolerite Suite. The Adelaide sediments are potentially fossiliferous but bedrock exposure levels are very low and it is likely that the rocks are often highly weathered near-surface. Although few fossil sites are recorded from this area, recent fieldwork by palaeontological colleagues in the Transkei region shows that vertebrate fossils are indeed present. While palaeontological field assessment at this stage would probably be unproductive, a desktop review of potential fossil heritage in the study area with recommendations for mitigation of fossil material should any be exposed during construction is considered necessary for this project.

A palaeontological heritage basic assessment (desktop study) for this transmission line development was commissioned by Ethembeni Cultural Heritage (Box 20057 Ashburton 3213 Pietermaritzburg; Telephone 033 326 1136 / 082 655 9077 / 082 529 3656; Facsimile 086 672 8557; email thembeni@iafrica.com) on behalf of Arcus GIBB Engineering and Science, East London (9 Pearce Street, Berea, East London 5241 Box 19844, Tecoma 5214; Telephone Mary-Anne Crocker 043 706 3610; 071 546 0937; Fax 043 721 0141; email macrocker@gibb.co.za).

1.2. Approach to the desktop study

The present desktop report, commissioned by Ethembeni Cultural Heritage, Pietermaritzburg on behalf of Arcus Gibb Engineering and Science, East London, forms part of the Basic Assessment for the proposed 132 kV transmission line and new substation project and it will also inform the EIA and Environmental Management Plan for the project. This development falls under Section 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999). The various categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance
- palaeontological sites
- palaeontological objects and material, meteorites and rare geological specimens

Minimum standards for the palaeontological component of heritage impact assessment reports are currently being developed by SAHRA. The latest version of the SAHRA guidelines is dated 2011.

This palaeontological specialist report provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations for further specialist palaeontological input where this is considered necessary. The information used in this desktop study was based on the following:

1. A short project outline as well as a satellite-based map provided by Arcus Gibb Engineering and Science, East London;

2. A review of the relevant scientific literature, including published geological maps and accompanying sheet explanations;

3. The author's previous field experience with the formations concerned and their palaeontological heritage, supplemented by field data supplied by Ethembeni Cultural Heritage;

4. A review of Eastern Cape fossil heritage produced for SAHRA by Almond *et al.* (2008).

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc*) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (Consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later following field assessment during the compilation of the final report). This data is then used to assess the palaeontological sensitivity of each rock unit to development (Provisional tabulations of palaeontological sensitivity of all formations in the Western, Eastern and Northern Cape have already been compiled by J. Almond and colleagues; *e.g.* Almond *et al.* 2008). The likely impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most significantly the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a Phase 1 field assessment study by a professional palaeontologist is usually warranted to identify any palaeontological hotspots and make specific recommendations for any mitigation required before or during the construction phase of the development.

On the basis of the desktop and Phase 1 field assessment studies, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are then determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Phase 2 mitigation by a professional palaeontologist – normally involving the recording and sampling of fossil material and associated geological information (*e.g.* sedimentological data) may be required (a) in the pre-construction phase where important fossils are already exposed at or near the land surface and / or (b) during the construction phase when fresh fossiliferous bedrock has been exposed by excavations. To carry out mitigation, the palaeontologist involved will need to apply for a palaeontological collection permit from the relevant heritage management authority (*e.g.* SAHRA for the Eastern Cape). It should be emphasized that, *providing appropriate mitigation is carried out*, the majority of developments involving bedrock excavation can make a *positive* contribution to our understanding of local palaeontological heritage.

1.4. Assumptions & limitations

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.

2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.

3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information;

4. The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (*e.g*. of commercial mining companies) - that is not readily available for desktop studies;

5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

(a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

(b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium *etc*).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

In the present case, useful data on local field conditions was kindly provided by Ethembeni Cultural Heritage who had previously conducted a field assessment of the project area. As anticipated, bedrock exposure in the area is very limited and bedrocks are highly weathered. For these reasons, a separate palaeontological field assessment was considered unnecessary by the author, since little would be achieved by it.

Fig. 1: Google earth© satellite image of the study area between Indutywa and Willowvale, Eastern Cape, showing route of the proposed new 40 km 132 kV transmission line between Indutywa Substation in the northwest and the new Gatyana Substation north of Willowvale in the southeast (Image kindly provided by Arcus Gibb Engineering & Science, East London).

2. GEOLOGY OF THE STUDY AREA

As seen on satellite images, the Dutywa – Gatyana region is situated on the southeastern side of the N2 trunk road some 25 to 30 km northeast of Butterworth, Eastern Cape (Fig. 1). The Willowvale area lies between the meandering Mbashe River in the north and the Qora River in the south. The terrain is rolling hilly country that is largely taken up by farmland and numerous small human settlements, with denser vegetation along river courses. Inland, near Indutywa the rolling landscape lies at around 800 to 600m amsl, while the lower-lying coastal sector north of Willowvale is much more dissected by innumerable small dendritic drainage systems. Bedrock exposure is generally very poor indeed, and probably largely confined to the banks of more deeply incised river courses. Cultivated areas and areas of donga erosion show reddish-brown soils suggesting extensive subtropical lateritic weathering of dolerites and other bedrocks.

The geology of the Indutywa – Gatyana study area is shown on the 1: 250 000 geology sheet 3228 Kei Mouth published by the Council for Geoscience, Pretoria (Fig. 2). A very brief sheet explanation for this map has been published by Johnson & Caston (1979). The study area – including the proposed Gatyana substation site - is largely underlain by continental (fluvial) sediments of the **Lower Beaufort Group** (**Adelaide Subgroup**) of Late Permian age (Pa). Slightly younger, Early Triassic sediments of the Katberg Formation (Tarkstad Subgroup / Upper Beaufort Group) near Indutywa itself will not be directly affected by the proposed transmission line development and are not treated further here.

These Karoo Supergroup sediments are extensively intruded and baked by large dolerite sills of Early Jurassic age (**Karoo Dolerite Suite**, Jd). Close to Indutywa an area of Palaeozoic bedrocks is overlain by substantial **alluvial deposits** of probable Late Caenozoic (Quaternary – Recent) age, shown in pale yellow on the geological map.

The main geological units represented within the broader Dutywa – Gatyana study area are briefly described here, paying special attention to those formations that may be of palaeontological heritage significance.

2.1. Beaufort Group

The continental (mainly fluvial and lacustrine) sediments of the Beaufort Group range in age from Late Permian to Early Triassic, generally increasing in age across the study area as one moves from the northwest towards the southeast. A useful overview of this internationally famous rock succession has been given by Johnson *et al.* (2006). Due to the absence of unambiguous sandstone marker horizons, the Adelaide Subgroup is not subdivided into individual formations on the Kei Mouth sheet (Johnson & Caston 1979). It is apparent from biostratigraphic (*i.e.* fossil-based) mapping, however, that only the upper, Late Permian portion of the Adelaide Subgroup is present within the study area, corresponding to the *Dicynodon* Assemblage Zone (Rubidge 2005, Van der Walt in press; see also Fig. 3 and Section 3 below). The succession here is therefore broadly equivalent to the Balfour Formation that is recognised at the top of the Adelaide Subgroup succession within the Main Karoo Basin to the east of 24º East (Rubidge 2005, Johnson *et al.* 2006).

Geological and palaeoenvironmental analyses of the Lower Beaufort Group sediments in the Great Karoo region have been conducted by a number of workers. Key references within an extensive scientific literature include various papers by Roger Smith (*e.g.* Smith 1979, 1980, 1986, 1987, 1988, 1989, 1990, 1993a, 1993b) and Stear (1978, 1980), as well as several informative field guides (*e.g.* Smith *et al.* 2002, Cole & Smith 2008). In brief, these thick successions of clastic sediments were laid down by a series of large, meandering rivers within a subsiding basin over a period of some ten or more million years within the Late Permian Period (*c*. 265-251 Ma). Sinuous sandstone bodies of lenticular cross-section represent ancient channel infills, while thin (<1.5m), laterally-extensive sandstone beds were deposited by crevasse splays during occasional overbank floods. The bulk of the Beaufort sediments are

greyish-green to reddish-brown or purplish mudrocks ("mudstones" = fine-grained claystones and slightly coarser siltstones) that were deposited over the floodplains during major floods. Thin-bedded, fine-grained playa lake deposits also accumulated locally where water ponded-up in floodplain depressions and are associated with distinctive fossil assemblages (*e.g.* fish, amphibians, coprolites or fossil droppings, arthropod, vertebrate and other trace fossils).

Frequent development of fine-grained pedogenic (soil) limestone or calcrete as nodules and more continuous banks indicates that semi-arid, highly seasonal climates prevailed in the Late Permian Karoo. This is also indicated by the frequent occurrence of sand-infilled mudcracks and silicified gypsum "desert roses" (Smith 1980, 1990, 1993a, 1993b). Highly continental climates can be expected from the palaeogeographic setting of the Karoo Basin at the time – embedded deep within the interior of the Supercontinent Pangaea and in the rainshadow of the developing Gondwanide Mountain Belt. Fluctuating water tables and redox processes in the alluvial plain soil and subsoil are indicated by interbedded mudrock horizons of contrasting colours. Reddish-brown to purplish mudrocks probably developed during drier, more oxidising conditions associated with lowered water tables, while greenish-grey mudrocks reflect reducing conditions in waterlogged soils during periods of raised water tables. However, diagenetic (post-burial) processes also greatly influence predominant mudrock colour (Smith 1990).

2.1.2. Karoo Dolerite Suite

The Permo-Triassic Beaufort Group sediments across the study area are extensively intruded and thermally metamorphosed (baked) by subhorizontal sills and steeply inclined dykes of the **Karoo Dolerite Suite** (Jd). These Early Jurassic (*c*. 183 Ma) basic intrusions were emplaced during crustal doming and stretching that preceded the break-up of Gondwana (Duncan and Marsh 2006). The hot dolerite magma baked adjacent Beaufort Group mudrocks and sandstones to form splintery hornfels and quartzites respectively. Blocky colluvium and corestones released by weathering and erosion of the dolerites blanket many mountain slopes, often obscuring the underlying fossiliferous Beaufort Group sediments. Reddish-brown soils seen in the study area in satellite images may well reflect lateritic weathering of doleritic bedrocks.

2.1.3. Superficial deposits

Various types of **superficial deposits** ("drift") of Late Caenozoic (largely Quaternary to Recent) age occur widely throughout the Karoo region, including in the study area. They include pedocretes (*e.g*. calcretes or soil limestones), colluvial slope deposits (sandstone and dolerite scree, downwasted gravels *etc*), sheet wash, river channel alluvium and terrace gravels, as well as spring and pan sediments (Johnson & Keyser 1979, Le Roux & Keyser 1988, Cole *et al.,* 2004, Partridge *et al*. 2006). Only the larger tracts of Quaternary to Recent **alluvium** overlying the Beaufort Group bedrock that are associated with the larger drainage courses are shown on the 1: 250 000 geological maps (*e.g.* alluvial deposits near Indutywa). The levels of potentially fossiliferous bedrock outcrop *versus* superficial sediment cover within the study area cannot be accurately estimated on the basis of the satellite images available; they can only be determined through fieldwork. According to archaeologists of Ethembeni Cultural Heritage, however, superficial sediment cover within the study region is very high.

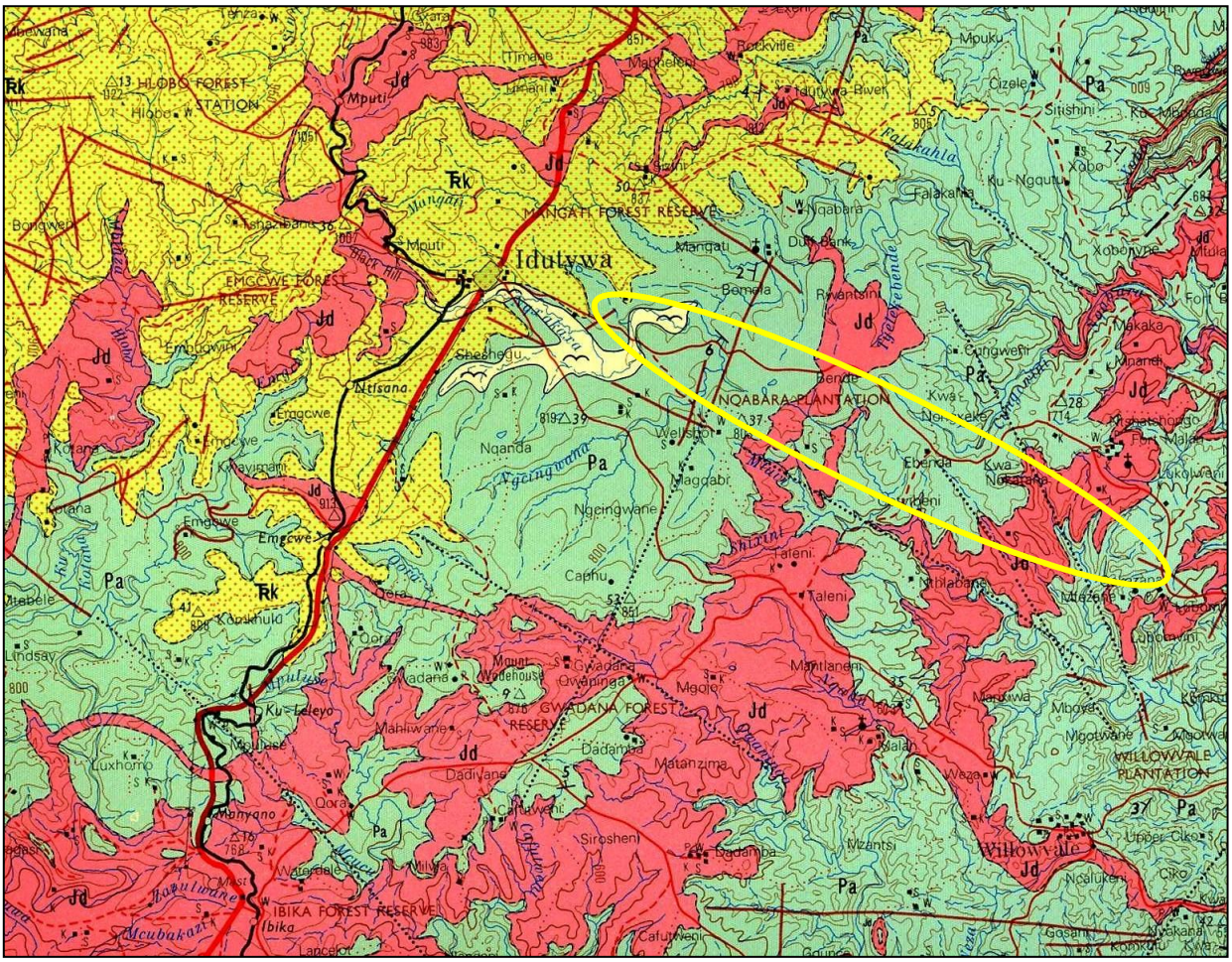

Fig. 2. Extract from 1: 250 000 geology sheet 328 Kei Mouth (Council for Geoscience, Pretoria) showing approximate location of the Dutywa – Gatyana study area near Willowvale (yellow ellipse). The existing Indutywa and proposed Gatyana substations are located towards either end of the ellipse, overlying Beaufort Group bedrocks. Rock units represented within the study area include:

Late Permian Adelaide Subgroup (Beaufort Group, Karoo Supergroup) (Pa, green)

Early Jurassic Karoo Dolerite Suite (Jd, pink)

Late Caenozoic alluvium (pale yellow with flying bird symbol)

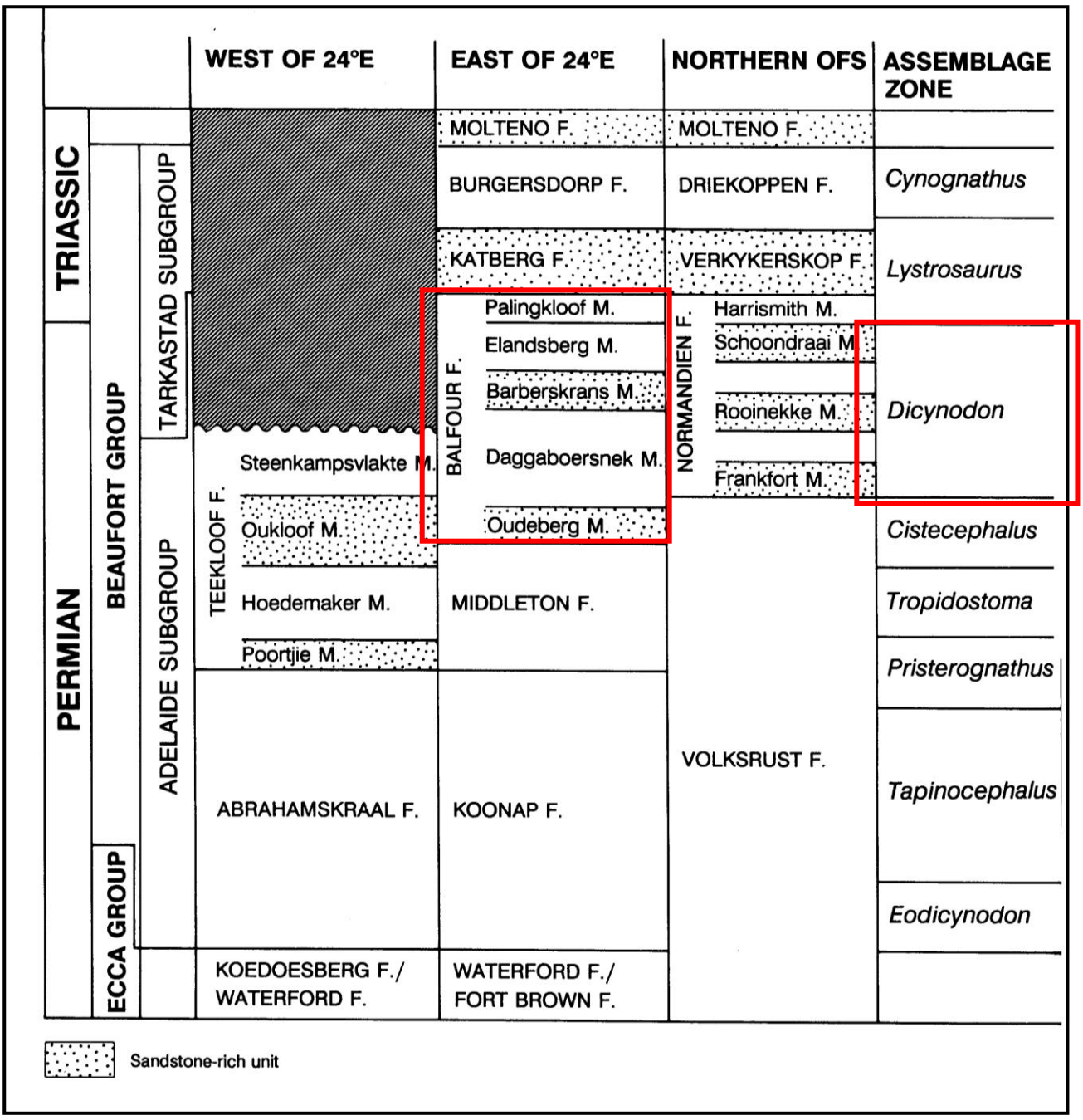

Fig. 3: Chart showing the lithostratigraphic (rock-based) and biostratigraphic (fossil-based) subdivisions of the Beaufort Group with rock units and fossil assemblage zones that are most likely to be relevant to the present study area outlined in red (Modified from Rubidge 1995). The precise horizon and fossil assemblages within the area remain uncertain due to lack of field data.

3. PALAEONTOLOGICAL HERITAGE

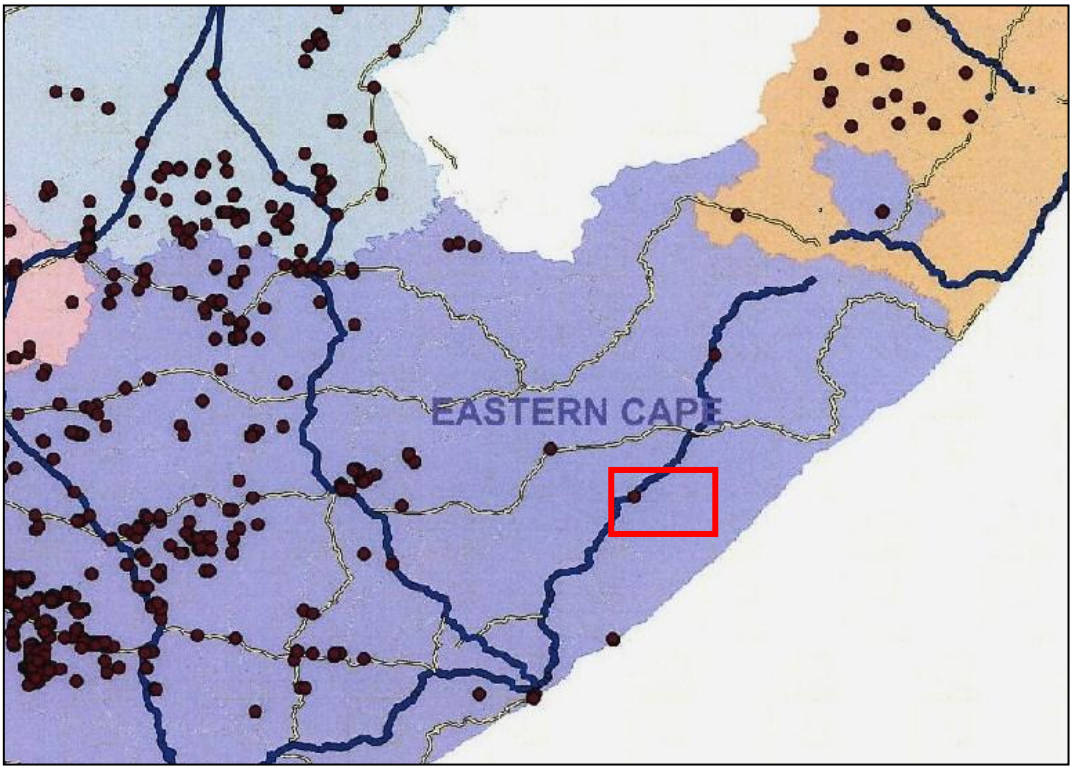

Fig. 4 : Plot of known Beaufort Group fossil localities within the eastern portion of the Eastern Cape (Modified from Nicolas 2007). Note paucity of fossil sites in the entire region, including the present study area (red rectangle) with the exception of one site near Indutywa (probably in the Early Triassic Katberg Formation).

3.1. Fossils within the Adelaide Subgroup

The overall palaeontological sensitivity of the Beaufort Group sediments is high to very high (Almond *et al.* 2008). These continental sediments have yielded one of the richest fossil records of land-dwelling plants and animals of Permo-Triassic age anywhere in the world (MacRae 1999, Rubidge 2005, McCarthy & Rubidge 2005). Bones and teeth of Late Permian tetrapods have been collected in the Great Karoo region since at least the 1820s and this region remains a major focus of palaeontological research in South Africa.

Middle Permian to earliest Triassic vertebrate fossil assemblages of the lower Beaufort Group are dominated by a variety of small to large true reptiles and – more especially – by a wide range of therapsids. This last group of animals are also commonly, but misleadingly, known as "mammal-like reptiles" or protomammals (*e.g.* Cluver 1978, Rubidge 1995, MacRae 1999). By far the most abundant group among the Late Permian therapsids are the dicynodonts, an extinct group of two-tusked herbivorous therapsids. Other important therapsid subgroups are the dinocephalians, gorgonopsians, therocephalians and cynodonts. Aquatic animals include large, crocodile-like temnospondyl amphibians and various primitive bony fish (palaeoniscoids).

A high proportion of the tetrapod (*i.e.* four-limbed, terrestrial vertebrate) fossils from the Beaufort Group are found within the overbank mudrocks. They are very commonly encased within calcrete or pedogenic limestone that often obscures their anatomy and makes such fossils difficult to recognise in the field, even for experienced palaeontologists (Smith 1993a,b). Rarer fossil specimens preserved within the Beaufort Group sandstones are usually

disarticulated and fragmentary due to extensive, pre-burial transport. Occasionally vertebrate fossils are found embedded within baked (thermally metamorphosed) mudrocks or hornfels in the vicinity of dolerite intrusions. However, such fossils are extremely difficult to prepare out in the laboratory and so are generally of limited scientific value.

Key studies on the taphonomy (pre-burial history) of Late Permian vertebrate remains in the Great Karoo have been carried out in the Beaufort West area and have yielded a wealth of fascinating data on Late Permian terrestrial wildlife and palaeoenvironments (*e.g.* Smith 1980, 1993a). Therapsid fossils are most abundant and best preserved (well-articulated) within muddy and silty overbank sediments deposited on the proximal floodplain (*i.e.* close to the river channel). Here they are often associated with scoured surfaces and mature palaeosols (ancient soils), these last indicated by abundant calcrete nodules. In the distal floodplain sediments, far from water courses, fossils are rarer and mostly disarticulated. Channel bank sediments usually contain few fossils, mostly disarticulated, but occasionally rich concentrations of calcrete-encrusted remains, some well-articulated, are found. These dense bone assemblages may have accumulated in swale fills or chute channels which served as persistent water holes after floods (Smith 1993a). Such detailed interdisciplinary field studies re-emphasise how essential it is that fossil collecting be undertaken by experienced professionals with a good grasp of relevant sedimentology as well as palaeontology, lest invaluable scientific data be lost in the process.

Plant fossils in the lower Beaufort Group are poorly represented and often very fragmentary (*cf*. Anderson & Anderson 1985, dealing primarily with material from the eastern Karoo Basin, Gastaldo *et al*. 2005, dealing with Permo-Triassic boundary floras in the Main Karoo Basin). They belong to the *Glossopteris* Flora that is typical of Permian Gondwana and include reedy sphenophytes or "horsetails" (Arthrophyta, now recognised as a fern subgroup) and distinctive tongue-shaped leaves of the primitive, tree-sized gymnosperm *Glossopteris*. Well-preserved petrified wood ("*Dadoxylon*") occurs widely and may prove of biostratigraphic and palaeoecological value in future (*e.g.* Bamford 1999, 2004). Elongate plant root casts or *rhizoliths* are frequently found associated with calcrete nodule horizons. Transported plant debris preserved within channel sandstones is often associated with secondary iron ("*koffieklip*") and uranium mineralization (Cole & Smith 2008 and refs. therein).

Mid to Late Permian invertebrate fossils from the western Karoo Basin comprise almost exclusively relatively featureless, thin-shelled freshwater bivalves, while fairly low diversity insect faunas are recorded from plant-rich horizons further east. The most prominent vertebrate trace fossils in the Lower Beaufort Group are well-preserved tetrapod trackways attributed to various groups of reptiles and therapsids (Smith 1993a), as well as substantial, inclined to helical scratch burrows that were probably constructed by smaller therapsids as an adaptation to the highly seasonal, and occasionally extreme, continental climates at high palaeolatitudes of 60-70º S. (Smith 1987). Invertebrate trace fossils include the locally abundant scratch burrows of the ichnogenus *Scoyenia* that are generally attributed to infaunal arthropods such as insects or even earthworms. Diverse freshwater ichnofaunas (trace fossil assemblages) with trails, burrows and trackways generated by fish, snails, arthropods, worms and other animals have been recorded by Smith (1993a, Smith & Almond 1998).

A recent plot of Beaufort Group fossil sites recorded within the Main Karoo Basin by Nicolas (2007) shows a marked absence of localities within the eastern portion of the Eastern Cape Province (Fig. 4 herein). No specific fossil occurrences are noted for the Kei Mouth sheet area by Johnson and Caston (1979). This is probably due mainly to the very low levels of bedrock exposure here (due to extensive vegetation and soil cover) as well as the high levels of bedrock weathering under warm, moist climatic conditions since Late Cretaceous times.

Furthermore, as a consequence of their proximity to large dolerite intrusions, the Beaufort Group sediments in the study region have often been thermally metamorphosed or "baked" (*ie*. recrystallised, impregnated with secondary minerals). Embedded fossil material of phosphatic composition, such as bones and teeth, is frequently altered by baking and may be very difficult to extract from the hard matrix by mechanical preparation (Smith & Keyser, p. 23

in Rubidge 1995). Thermal metamorphism by dolerite intrusions therefore tends to reduce the palaeontological heritage potential of Beaufort Group sediments.

It should be noted, however, that recent palaeontological impact studies in the former Transkei region have begun to yield important new fossil remains from the Beaufort Group (Dr R. Gess, pers. comm., 2012). It appears that previous lack of attention from research scientists has probably been a major limiting factor in limiting our understanding of the Karoo palaeontology of this region.

A chronological series of mappable fossil biozones or assemblage zones (AZ), defined mainly on their characteristic tetrapod faunas, has been established for the Main Karoo Basin of South Africa (Rubidge 1995, 2005) (Fig. 3). Maps showing the distribution of the Beaufort assemblage zones within the Main Karoo Basin have been provided by Kitching (1977), Keyser and Smith (1977-78) and Rubidge (1995, 2005). An updated version based on a comprehensive GIS fossil database is currently in press (Nicolas 2007, Van der Walt *et al.* 2010). According the most recent Karoo Supergroup biozone map (Van der Walt, in press), the Lower Beaufort Group sediments in the study area belong to the latest Permian *Dicynodon* Assemblage Zone.

3.1.1. The *Dicynodon* Assemblage Zone

A Lower Beaufort sediments close to the Katberg sandstone outcrop area near Indutywa area can be equated with the upper part of the Balfour Formation to the southwest, the greater part of is characterised by Late Permian fossil biotas of the ***Dicynodon* Assemblage Zone**. This biozone has been assigned to the Changhsingian Stage (= Late Tartarian) right at the end of the Permian Period, with an approximate age range of 253.8-251.4 million years (Rubidge 1995, 2005). Good accounts, with detailed faunal lists, of the fossil biotas of the *Dicynodon* Assemblage Zone have been given by Kitching (*in* Rubidge 1995) and by Cole *et al*. (2004). See also the reviews by Cluver (1978), MacRae (1999), McCarthy & Rubidge (2005) and Almond *et al*. (2008). In general, the following broad categories of fossils might be expected within the Balfour Formation:

- isolated petrified bones as well as articulated skeletons of terrestrial vertebrates such as true **reptiles** (notably large pareiasaurs, small millerettids) and **therapsids** (diverse dicynodonts such as *Dicynodon* and the much smaller *Diictodon*, gorgonopsians, therocephalians such as *Theriognathus*, primitive cynodonts like *Procynosuchus*, and biarmosuchians) (See Fig. 9 herein);
- aquatic vertebrates such as large temnospondyl **amphibians** like *Rhinesuchus* (usually disarticulated), and palaeoniscoid **bony fish** (*Atherstonia*, *Namaichthys*);
- freshwater **bivalves;**
- **trace fossils** such as worm, arthropod and tetrapod burrows and trackways, coprolites;
- **vascular plant remains** including leaves, twigs, roots and petrified woods ("*Dadoxylon*") of the *Glossopteris* Flora (usually sparse, fragmentary), especially glossopterids and arthrophytes (horsetails).

From a palaeontological viewpoint, these diverse *Dicynodon* Assemblage Zone biotas are of extraordinary interest in that they provide some of the best available evidence for the last flowering of ecologically-complex terrestrial ecosystems immediately preceding the catastrophic end-Permian mass extinction (*e.g.* Smith & Ward, 2001, Rubidge 2005, Retallack *et al*., 2006, Smith & Botha 2005, Botha & Smith 2006, 2007).

As far as the biostratigraphically important tetrapod remains are concerned, the best fossil material is generally found within overbank mudrocks, whereas fossils preserved within channel sandstones tend to be fragmentary and water-worn (Rubidge 1995, Smith 1993).

Many fossils are found in association with ancient soils (palaeosol horizons) that can usually be recognised by bedding-parallel concentrations of calcrete nodules. The abundance and variety of fossils within the *Dicynodon* Assemblage Zone decreases towards the top of the succession (Cole *et al*., 2004).

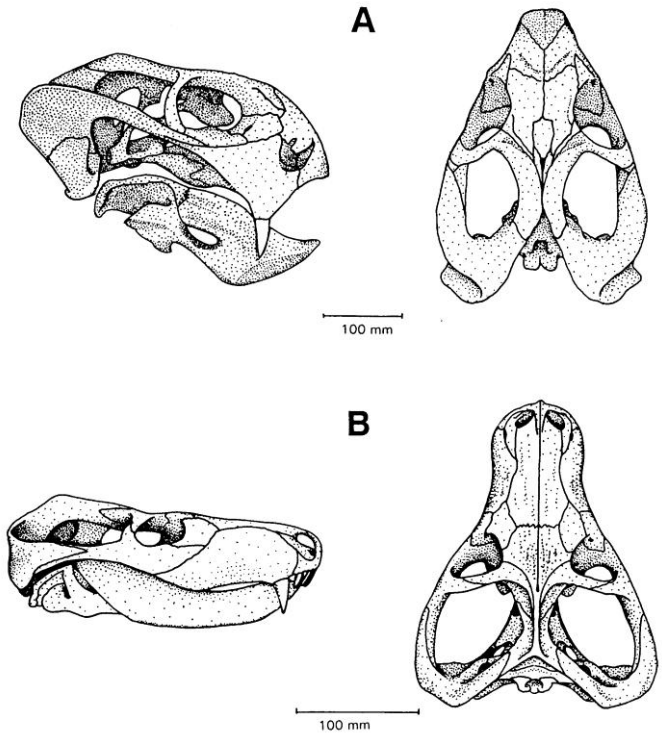

Fig. 5: Skulls of key therapsids ("mammal-like reptiles") from the Late Permian *Dicynodon* Assemblage Zone: the dicynodont *Dicynodon* and the therocephalian *Theriognathus* (From Kitching *in* Rubidge 1995).

3.2. Fossils in the Karoo Dolerite Suite

Dolerite outcrops within the study area are in themselves of no palaeontological significance since these are high temperature igneous rocks emplaced at depth within the Earth's crust. However, as a consequence of their proximity to large dolerite intrusions the adjacent Lower Beaufort Group sediments have often been thermally metamorphosed or "baked" (*i.e*. recrystallised, impregnated with secondary minerals). Embedded fossil material of phosphatic composition, such as bones and teeth, was frequently altered by baking. Bones may become blackened and they can be very difficult to extract from the hard matrix by mechanical preparation (Smith & Keyser 1995b). Thermal metamorphism by dolerite intrusions therefore tends to *reduce* the palaeontological heritage potential of adjacent Beaufort Group sediments.

3.3. Fossils in Late Caenozoic superficial sediments

The Karoo "drift" deposits have been comparatively neglected in palaeontological terms for the most part. However, they may occasionally contain important fossil biotas, notably the bones, teeth and horn cores of mammals (*e.g.* Pleistocene mammal faunas at Florisbad, Cornelia and Erfkroon, Free State and elsewhere; Wells & Cooke 1942, Cooke 1974, Skead 1980, Klein 1984, Brink, J.S. 1987, Bousman *et al.* 1988, Bender & Brink 1992, Brink *et al*. 1995, MacRae 1999, Churchill *et al*. 2000 Partridge & Scott 2000) including skeletal remains of early humans (Grine *et al*. 2007). Other late Caenozoic fossil biotas from these superficial deposits include non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (*e.g.* calcretised

termitaria, coprolites), and plant remains such as palynomorphs in organic-rich alluvial horizons (Scott 2000) and diatoms in pan sediments.

4. CONCLUSIONS & RECOMMENDATIONS

The proposed new Dutywa – Gatyana 132 kV transmission line route and new Gatyana substation site overlie the outcrop area of Lower Beaufort Group (Adelaide Subgroup) sediments that may contain important fossil heritage – notably Late Permian vertebrate, plant and trace fossil remains. During the construction phase any fossils exposed at the ground surface or at shallow depths below this are vulnerable to disturbance, damage or destruction within the development footprint. Bedrock excavations for pylon footings (up to 3m deep), substation foundations and any new access roads may also expose, damage or destroy previously buried fossil material. However, the Beaufort Group bedrocks in the study region are generally deeply weathered and mantled in unfossiliferous superficial sediments (*e.g.* soils, alluvium). Furthermore, their original fossil content has probably been compromised by thermal metamorphism (baking) during dolerite intrusion. Hitherto major vertebrate fossil finds are unknown from the study area, although recent impact studies in the region suggest this may be partially due to insufficient palaeontological research. Substantial sectors of the powerline route traverse Karoo dolerite outcrops of no palaeontological significance. Alluvial sediments near Indutywa are of low palaeontological sensitivity.

Significant impacts on local fossil heritage are therefore not anticipated during the operational phase of the transmission line development. Should substantial fossil remains be exposed during construction, however, such as vertebrate bones and teeth, plant-rich fossil lenses or dense fossil burrow assemblages, the ECO should safeguard these, preferably *in situ*, and alert SAHRA as soon as possible so that appropriate action (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

5. ACKNOWLEDGEMENTS

I would like to thank Mr Len van Schalkwyk and Ms Elizabeth Wahl of eThembeni Cultural Heritage, Pietermaritzburg, for commissioning this desktop study and for providing information on local terrain and bedrock exposure levels. Ms Mary-Anne Crocker (Arcus GIBB, East London) kindly provided the necessary transmission line maps, and I am also grateful for discussions with her concerning palaeontological heritage assessments of transmission line projects.

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7. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape under the aegis of his Cape Town-based company *Natura Viva* cc. He is a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHAP (Association of Professional Heritage Assessment Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed transmission line development project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

Dr John E. Almond
Palaeontologist
***Natura Viva* cc**

Appendix D

Determination of Significance of and Impacts on Heritage Resources

Assessment of heritage resource value and significance

Heritage resources are significant only to the extent that they have public value, as demonstrated by the following guidelines for determining site significance developed by Heritage Western Cape in 2007 and utilised during this assessment.

Grade I Sites (National Heritage Sites)

Regulation 43 Government Gazette no 6820. 8 No. 24893 30 May 2003, Notice No. 694 states that:
Grade I heritage resources are heritage resources with qualities so exceptional that they are of special national significance should be applied to any heritage resource which is

a) Of outstanding significance in terms of one or more of the criteria set out in section 3(3) of the NHRA;
b) Authentic in terms of design, materials, workmanship or setting; and is of such universal value and symbolic importance that it can promote human understanding and contribute to nation building, and its loss would significantly diminish the national heritage.

1. Is the site of outstanding national significance?
2. Is the site the best possible representative of a national issue, event or group or person of national historical importance?
3. Does it fall within the proposed themes that are to be represented by National Heritage Sites?
4. Does the site contribute to nation building and reconciliation?
5. Does the site illustrate an issue or theme, or the side of an issue already represented by an existing National Heritage Site – or would the issue be better represented by another site?
6. Is the site authentic and intact?
7. Should the declaration be part of a serial declaration?
8. Is it appropriate that this site be managed at a national level?
9. What are the implications of not managing the site at national level?

Grade II Sites (Provincial Heritage Sites)

Regulation 43 Government Gazette no 6820. 8 No. 24893 30 May 2003, Notice No. 694 states that:
Grade II heritage resources are those with special qualities which make them significant in the context of a province or region and should be applied to any heritage resource which -

a) is of great significance in terms of one or more of the criteria set out in section 3(3) of the NHRA; and
(b) enriches the understanding of cultural, historical, social and scientific development in the province or region in which it is situated, but that does not fulfil the criteria for Grade 1 status.

Grade II sites may include, but are not limited to –

(a) places, buildings, structures and immovable equipment of cultural significance;
(b) places to which oral traditions are attached or which are associated with living heritage;
(c) historical settlements and townscapes;
(d) landscapes and natural features of cultural significance;
(e) geological sites of scientific or cultural importance;
(f) archaeological and palaeontological sites; and
(g) graves and burial grounds.

The cultural significance or other special value that Grade II sites may have, could include, but are not limited to –

(a) its importance in the community or pattern of the history of the province;
(b) the uncommon, rare or endangered aspects that it possess reflecting the province's natural or cultural heritage
(c) the potential that the site may yield information that will contribute to an understanding of the province's natural or cultural heritage;
(d) its importance in demonstrating the principal characteristics of a particular class of the province's natural or cultural places or objects;
(e) its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group in the province;
(f) its importance in demonstrating a high degree of creative or technical achievement at a particular period in the development or history of the province;
(g) its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons; and
(h) its strong or special association with the life or work of a person, group or organization of importance in the history of the province.

Grade III (Local Heritage Resources)

Regulation 43 Government Gazette no 6820. 8 No. 24893 30 May 2003, Notice No. 694 states that:
Grade III heritage status should be applied to any heritage resource which

(a) fulfils one or more of the criteria set out in section 3(3) of the NHRA; or
(b) in the case of a site contributes to the environmental quality or cultural significance of a larger area which fulfils one of the above criteria, but that does not fulfill the criteria for Grade 2 status.

Grade IIIA

This grading is applied to buildings and sites that have sufficient intrinsic significance to be regarded as local heritage resources; and are significant enough to warrant *any* alteration being regulated. The significances of these buildings and/or sites should include at least some of the following characteristics:

- Highly significant association with a
  - historic person
  - social grouping
  - historic events
  - historical activities or roles
  - public memory
- Historical and/or visual-spatial landmark within a place
- High architectural quality, well-constructed and of fine materials
- Historical fabric is mostly intact (this fabric may be layered historically and/or past damage should be easily reversible)
- Fabric dates to the early origins of a place
- Fabric clearly illustrates an historical period in the evolution of a place
- Fabric clearly illustrates the key uses and roles of a place over time
- Contributes significantly to the environmental quality of a Grade I or Grade II heritage resource or a conservation/heritage area

Such buildings and sites may be representative, being excellent examples of their kind, or may be rare: as such they should receive maximum protection at local level.

Grade IIIB

This grading is applied to buildings and/or sites of a marginally lesser significance than grade IIIA; and such marginally lesser significance argues against the regulation of internal alterations. Such buildings and sites

may have similar significances to those of a grade IIIA building or site, but to a lesser degree. Like grade IIIA buildings and sites, such buildings and sites may be representative, being excellent examples of their kind, or may be rare, but less so than grade IIIA examples: as such they should receive less stringent protection than grade IIIA buildings and sites at local level and internal alterations should not be regulated (in this context).

Grade IIIC
This grading is applied to buildings and/or sites whose significance is, in large part, a significance that contributes to the character or significance of the environs. These buildings and sites should, as a consequence, only be protected and regulated *if the significance of the environs is sufficient to warrant protective measures*. In other words, these buildings and/or sites will only be protected if they are within declared conservation or heritage areas.

Assessment of development impacts
A heritage resource impact may be defined broadly as the net change, either beneficial or adverse, between the integrity of a heritage site with and without the proposed development. Beneficial impacts occur wherever a proposed development actively protects, preserves or enhances a heritage resource, by minimising natural site erosion or facilitating non-destructive public use, for example. More commonly, development impacts are of an adverse nature and can include:

- destruction or alteration of all or part of a heritage site;
- isolation of a site from its natural setting; and / or
- introduction of physical, chemical or visual elements that are out of character with the heritage resource and its setting.

Beneficial and adverse impacts can be direct or indirect, as well as cumulative, as implied by the aforementioned examples. Although indirect impacts may be more difficult to foresee, assess and quantify, they must form part of the assessment process. The following assessment criteria have been used to assess the impacts of the proposed development on identified heritage resources:

Criteria	Rating Scales	Notes
Nature	Positive	An evaluation of the type of effect the construction, operation and management of the proposed development would have on the heritage resource.
	Negative	
	Neutral	
Extent	Low	Site-specific, affects only the development footprint.
	Medium	Local (limited to the site and its immediate surroundings, including the surrounding towns and settlements within a 10 km radius);
	High	Regional (beyond a 10 km radius) to national.
Duration	Low	0-4 years (i.e. duration of construction phase).
	Medium	5-10 years.
	High	More than 10 years to permanent.
Intensity	Low	Where the impact affects the heritage resource in such a way that its significance and value are minimally affected.
	Medium	Where the heritage resource is altered and its significance and value are measurably reduced.
	High	Where the heritage resource is altered or destroyed to the extent that its significance and value cease to exist.
Potential for impact on irreplaceable resources	Low	No irreplaceable resources will be impacted.
	Medium	Resources that will be impacted can be replaced, with effort.
	High	There is no potential for replacing a particular vulnerable resource that will be impacted.
Consequence (a combination of extent, duration, intensity and the potential for impact on irreplaceable resources).	Low	A combination of any of the following: - Intensity, duration, extent and impact on irreplaceable resources are all rated low. - Intensity is low and up to two of the other criteria are rated medium. - Intensity is medium and all three other criteria are rated low.
	Medium	Intensity is medium and at least two of the other criteria are rated medium.
	High	Intensity and impact on irreplaceable resources are rated high, with any combination of extent and duration. Intensity is rated high, with all of the other criteria being rated medium or higher.
Probability (the likelihood of the impact occurring)	Low	It is highly unlikely or less than 50 % likely that an impact will occur.
	Medium	It is between 50 and 70 % certain that the impact will occur.
	High	It is more than 75 % certain that the impact will occur or it is definite that the impact will occur.
Significance (all impacts including potential cumulative impacts)	Low	Low consequence and low probability. Low consequence and medium probability. Low consequence and high probability.
	Medium	Medium consequence and low probability. Medium consequence and medium probability. Medium consequence and high probability. High consequence and low probability.
	High	High consequence and medium probability. High consequence and high probability.

Appendix E

Specialist Competency and Declaration of Independence

Specialist competency

Len van Schalkwyk is accredited by the Cultural Resources Management section of the Association of Southern African Professional Archaeologists (ASAPA) to undertake HIAs in South Africa. He is also a member of the ASAPA Cultural Resources Management Committee for 2011 and 2012. Mr van Schalkwyk has a master's degree in archaeology (specialising in the history of early farmers in southern Africa) from the University of Cape Town and 25 years' experience in heritage management. He has worked on projects as diverse as the establishment of the Ondini Cultural Museum in Ulundi, the cultural management of Chobe National Park in Botswana and various archaeological excavations and oral history recording projects. He was part of the writing team that produced the KwaZulu-Natal Heritage Act 1997. He has worked with many rural communities to establish integrated heritage and land use plans and speaks good Zulu.

Mr van Schalkwyk left his position as assistant director of Amafa aKwaZulu-Natali, the provincial heritage management authority, to start eThembeni in partnership with Elizabeth Wahl, who was head of archaeology at Amafa at the time. Over the past decade they have undertaken almost 1000 heritage impact assessments throughout South Africa, as well as in Mozambique.

Elizabeth Wahl has a BA Honours in African Studies from the University of Cape Town and has completed various Masters courses in Heritage and Tourism at the University of KwaZulu-Natal. She is currently studying for an MPhil in the Conservation of the Built Environment at UCT. She is also a member of ASAPA.

Ms Wahl was an excavator and logistical coordinator for Glasgow University Archaeological Research Division's heritage programme at Isandlwana Battlefield; has undertaken numerous rock painting surveys in the uKhahlamba/Drakensberg Mountains, northern KwaZulu-Natal, the Cederberg and the Koue Bokkeveld in the Cape Province; and was the principal excavator of Scorpion Shelter in the Cape Province, and Lenjane and Crystal Shelters in KwaZulu-Natal. Ms Wahl compiled the first cultural landscape management plan for the Mnweni Valley, northern uKhahlamba/Drakensberg, and undertook an assessment of and made recommendations for cultural heritage databases and organisational capacity in parts of Lesotho and South Africa for the Global Environment Facility of the World Bank for the Maloti Drakensberg Transfrontier Conservation and Development Area. She developed the first cultural heritage management plan for the uKhahlamba Drakensberg Park World Heritage Site, following UNESCO recommendations for rock art management in southern Africa.

Declaration of independence

We declare that Len van Schalkwyk, Elizabeth Wahl and eThembeni Cultural Heritage have no financial or personal interest in the proposed development, nor its developers or any of its subsidiaries, apart from in the provision of heritage impact assessment and management consulting services.