APPENDIX Q:
HERITAGE AND PALAEONTOLOGY

CULTURAL HERITAGE ASSESSMENT REPORT FOR THE UNDERGROUND COAL GASIFICATION PROJECT AND ASSOCIATED INFRASTRUCTURE IN SUPPORT OF CO-FIRING OF GAS AT THE MAJUBA POWER STATION, AMERSFOORT, MPUMALANGA

CULTURAL HERITAGE IMPACT SCOPING ASSESSMENT REPORT FOR THE UNDERGROUND COAL GASIFICATION PROJECT AND ASSOCIATED INFRASTRUCTURE IN SUPPORT OF CO-FIRING OF GAS AT THE MAJUBA POWER STATION, AMERSFOORT, MPUMALANGA

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Declaration:

I, J.A. van Schalkwyk, declare that I do not have any financial or personal interest in the proposed development, nor its developers or any of their subsidiaries, apart from the provision of heritage assessment and management services.

J A van Schalkwyk (D Litt et Phil)
Heritage Consultant
May 2013

EXECUTIVE SUMMARY

CULTURAL HERITAGE IMPACT SCOPING ASSESSMENT REPORT FOR THE UNDERGROUND COAL GASIFICATION PROJECT AND ASSOCIATED INFRASTRUCTURE IN SUPPORT OF CO-FIRING OF GAS AT THE MAJUBA POWER STATION, AMERSFOORT, MPUMALANGA

South Africa's heritage resources, also described as the 'national estate', comprise a wide range of sites, features, objects and beliefs. According to Section 27(18) of the National Heritage Resources Act (NHRA), No. 25 of 1999, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site.

Therefore, in accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by **Royal HaskoningDHV** on behalf of the applicant to conduct a Heritage Impact Assessment (HIA), as part of an Environmental Impact Assessment (EIA) of the area where the proposed development is to take place.

The aim of this study, broadly speaking, is to determine if any sites, features or objects of cultural heritage significance occur within the boundaries of the area where it is planned to utilise underground gasification technology.

The cultural landscape qualities of the region essentially consist of a single component. This is a rural area in which the human occupation is made up of a limited pre-colonial element (Stone Age and Iron Age) as well as a much later colonial (farmer) component.

The following heritage sites were identified in the study area:

- A number of old farmstead and associated outbuildings occur sporadically over the larger area. Central to all is the farmhouse with associated outbuildings and in some cases, associated features such as stock enclosures, sheep dips, etc. located some distance away. According to current understanding none of these features would be impacted on by the proposed development.

- A number of farm labourer homesteads occur on the farm. According to current understanding none of these features would be impacted on by the proposed development.

- A number of informal cemeteries/burial sites occur sporadically over the larger area. According to current understanding none of these features would be impacted on by the proposed development.

- A number of semi-circular walls of packed stone are located on a ridge overlooking a valley to the north of the core development area. The function of these is unknown at present. They remind one of shelters erected by soldiers during the Anglo Boer War, known as sangars. However, new information indicates that they were hunting blinds used during the recent past.

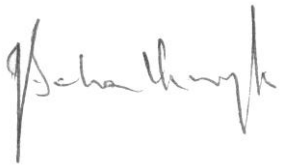
According to present understanding, none of the identified sites, features or objects of cultural significance would be impacted on by the proposed development. However, for the project to continue, we propose the following:

- The mitigation measures set out for each category of sites in Section 5.3 is implemented if development takes place in the vicinity of any of these.

- The management measures, as set out in Section 7 of this report should be implemented prior to construction taking place.

- We recommend that if archaeological sites or graves are exposed during construction work, it should immediately be reported to a heritage consultant so that an investigation and evaluation of the finds can be made.

No impact on heritage sites, features or objects can be allowed without a valid permit from SAHRA.



J A van Schalkwyk
Heritage Consultant
May 2013

TECHNICAL SUMMARY

Property details						
Province	Mpumalanga					
Magisterial district	Amersfoort					
Topo-cadastral map	2629DD, 2629DC, 2729BA, 2729BB					
Farm name & no.	Roodekopjes					
Coordinates	Centre point					
	No	Latitude	Longitude	No	Latitude	Longitude
	1	S 27.06581	E 29.80496			

Development criteria in terms of Section 38(1) of the NHR Act	Yes/No
Construction of road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length	Yes
Construction of bridge or similar structure exceeding 50m in length	
Development exceeding 5000 sq m	Yes
Development involving three or more existing erven or subdivisions	
Development involving three or more erven or divisions that have been consolidated within past five years	
Rezoning of site exceeding 10 000 sq m	Yes
Any other development category, public open space, squares, parks, recreation grounds	

Developer	
Name	ESKOM
Address	-
Telephone no.	-
E-mail	-

Environmental Specialist	
Company	Royal HaskoningDHV
Representative	Ms. P Reddy
Address	PO Box 25302, Monument Park, 0105
Telephone no.	012 367 5800
E-mail	prashikar@ssi.co.za

Development	
Description	Underground Coal Gasification in support of co-firing of gas at the Majuba Power Station
Project name	UCG

Land use	
Previous land use	Agriculture
Current land use	Agriculture

TABLE OF CONTENTS

LIST OF FIGURES

GLOSSARY OF TERMS AND ABBREVIATIONS

TERMS

Study area: Refers to the entire study area as indicated by the client in the accompanying Fig. 1 & 2.

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.

Early Stone Age	2 000 000 - 150 000 Before Present
Middle Stone Age	150 000 - 30 000 BP
Late Stone Age	30 000 - until c. AD 200

Iron Age: Period covering the last 1800 years, when new people brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and they herded cattle as well as sheep and goats. As they produced their own iron tools, archaeologists call this the Iron Age.

Early Iron Age	AD 200 - AD 900
Middle Iron Age	AD 900 - AD 1300
Late Iron Age	AD 1300 - AD 1830

Historical Period: Since the arrival of the white settlers - c. AD 1800 - in this part of the country

ABBREVIATIONS

ADRC	Archaeological Data Recording Centre
ASAPA	Association of Southern African Professional Archaeologists
BP	Before Present
CS-G	Chief Surveyor-General
EIA	Early Iron Age
ESA	Early Stone Age
LIA	Late Iron Age
LSA	Later Stone Age
HIA	Heritage Impact Assessment
MSA	Middle Stone Age
NASA	National Archives of South Africa
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Agency
SAHRA	South African Heritage Resources Agency

CULTURAL HERITAGE IMPACT SCOPING ASSESSMENT REPORT FOR THE UNDERGROUND COAL GASIFICATION PROJECT AND ASSOCIATED INFRASTRUCTURE IN SUPPORT OF CO-FIRING OF GAS AT THE MAJUBA POWER STATION, AMERSFOORT, MPUMALANGA

1. INTRODUCTION

Underground Coal Gasification (UCG), a process whereby coal is converted *in situ* into combustible gas that can be used for power generation, is one of the new clean coal technologies being developed for implementation by Eskom. The technology has been through 12 years of intensive research by Eskom since 2001 to achieve a better understanding of the gasification process, and the nature of the gas produced. In order to meet the fuel requirements for optimal power generation at the Majuba Power Station, Eskom proposes the use of synthetic gas or *syngas (*15 000 Nm^3/hr) produced by the UCG process as a supplementary fuel source within the boilers at the power station. The 15000 Nm^3/hr plant will be scaled up to 7 0000 Nm^3/hr and based on the outcomes of the 70000 Nm^3/hr plant, Eskom may investigate the option of a commercial size power plant based on UCG technology.

South Africa's heritage resources, also described as the 'national estate', comprise a wide range of sites, features, objects and beliefs. According to Section 27(18) of the National Heritage Resources Act (NHRA), No. 25 of 1999, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site.

Therefore, in accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by **Royal HaskoningDHV** on behalf of the applicant to conduct a heritage impact assessment, as part of an Environmental Impact Assessment (EIA) of the area where the proposed development is to take place.

2. TERMS OF REFERENCE

This report does not deal with development projects outside of or even adjacent to the study area as is presented in Section 5 of this report. The same holds true for heritage sites, except in a generalised sense where it is used to create an overview of the heritage potential in the larger region.

The aim of this HIA, broadly speaking, is to determine if any sites, features or objects of cultural heritage significance occur within the boundaries of the area where it is planned to utilise underground gasification technology and its associated infrastructure.

The scope of work for this study consisted of:

- Conducting of a desk-top investigation of the area, in which all available literature, reports, databases and maps were studied;
- A visit to the proposed development area.

The objectives were to

- Identify possible archaeological, cultural and historic sites within the proposed development area;
- Evaluate the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources;
- Recommend mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance.

2.3 Assumptions

- It is assumed that the Social Impact Assessment and Public Participation Process might also result in the identification of sites, features and objects and that these then will also have to be considered in the EIA.
- It is assumed that a Paleontological Review will be done by a suitably qualified specialist.

3. HERITAGE RESOURCES

3.1 The National Estate

The NHRA (No. 25 of 1999) defines the heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations that must be considered part of the national estate to include:

- places, buildings, structures and equipment of cultural significance;
- 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;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, including-
    - ancestral graves;
    - royal graves and graves of traditional leaders;
    - graves of victims of conflict;
    - graves of individuals designated by the Minister by notice in the Gazette;
    - historical graves and cemeteries; and
    - other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
- sites of significance relating to the history of slavery in South Africa;
- movable objects, including-
    - objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
    - objects to which oral traditions are attached or which are associated with living heritage;
    - ethnographic art and objects;
    - military objects;
    - objects of decorative or fine art;
    - objects of scientific or technological interest; and
    - books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

3.2 Cultural significance

In the NHRA, Section 2 (vi), it is stated that ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. This is determined in relation to a site or feature’s uniqueness, condition of preservation and research potential.

According to Section 3(3) of the NHRA, 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;
- its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
- sites of significance relating to the history of slavery in South Africa.

A matrix was developed whereby the above criteria were applied for the determination of the significance of each identified site (see Appendix 1). This allowed some form of control over the application of similar values for similar sites.

4. STUDY APPROACH AND METHODOLOGY

4.1 Extent of the Study

This survey and impact assessment covers the area as presented in Section 5 and as illustrated in Figures 1 & 2.

4.2 Methodology

4.2.1 *Preliminary investigation*

4.2.1.1 Survey of the literature
A survey of the relevant literature was conducted with the aim of reviewing the previous research done and determining the potential of the area. Some published books and papers deal with areas, events or groups of people in the larger region e.g. Bergh 1999, Cloete 2000, Coetzee 1976, Delius 2007, Delius & Hay 2009; Mason 1962; Praagh 1906. Other sources are unpublished reports, mostly scoping studies and HIAs done in the region (Van Schalkwyk 2006, 2007).

- All of these sources contributed some information on historic events in the larger region as well as on the location of specific heritage sites and features.

4.2.1.2 Data bases
The *Heritage Atlas Database,* the *Environmental Potential Atlas*, the *Chief Surveyor General* (CS-G) and the *National Archives of South Africa* (NASA) were consulted.

- Database surveys produced information on a number of sites located in the larger region of the proposed development.
- The original Title Deeds of some of the farms were located, but produced limited information of use.

4.2.1.3 Other sources
Aerial photographs and topocadastral and other maps were also studied - see the list of references below.

- Information of a very general nature were obtained from these sources

4.2.2 *Field survey*

The area that had to be investigated was identified by **Royal HaskoningDHV** by means of maps. The development site was surveyed by foot. As the development basically consists of a number of linear developments, the site was surveyed by walking the routes for the access road and pipeline route. During the survey, the heritage consultant was accompanied by Mr Bheki Nhlapho, who has been working and living on the farm for the past more than 30 years. After walking the routes, Mr Nhlapo then took the consultant and showed him all the cemeteries and farmsteads in order to plot them in relation to the proposed development.

No track log was kept as walking the routes took the whole day and GPS battery power did not allow keeping the instrument on the whole time.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

5.1 Site location and description

The location and extent of the study area can be determined from the map in Figure 1 and 2. It is located to the south and west of the town of Amersfoort. For more detail, please see the Technical Summary presented above.

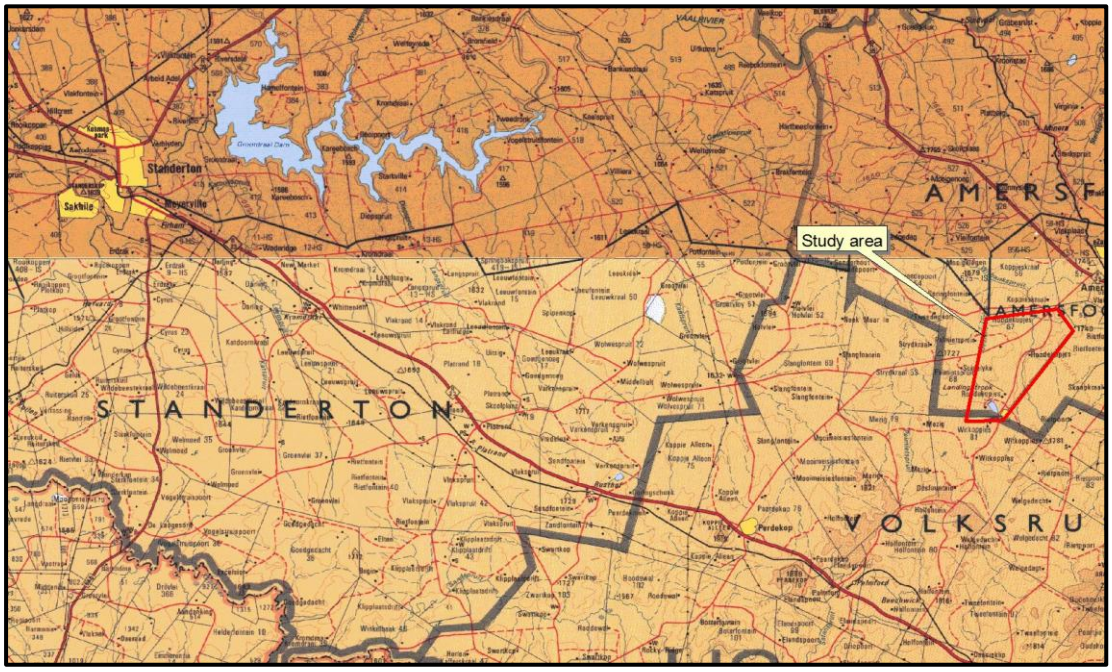


Fig. 1. Location of the study area in regional context.

Topographically, the area can be described as rolling hills, with a number of smaller rivers running through it. The geology is largely made up of dolorite in the northern section and shale in the southern section. The original vegetation is classified as Moist Clay Highveld Grassland. The current land use is farming, with grazing as the dominant activity.

Fig. 2. Elements of the landscape in the larger study area.

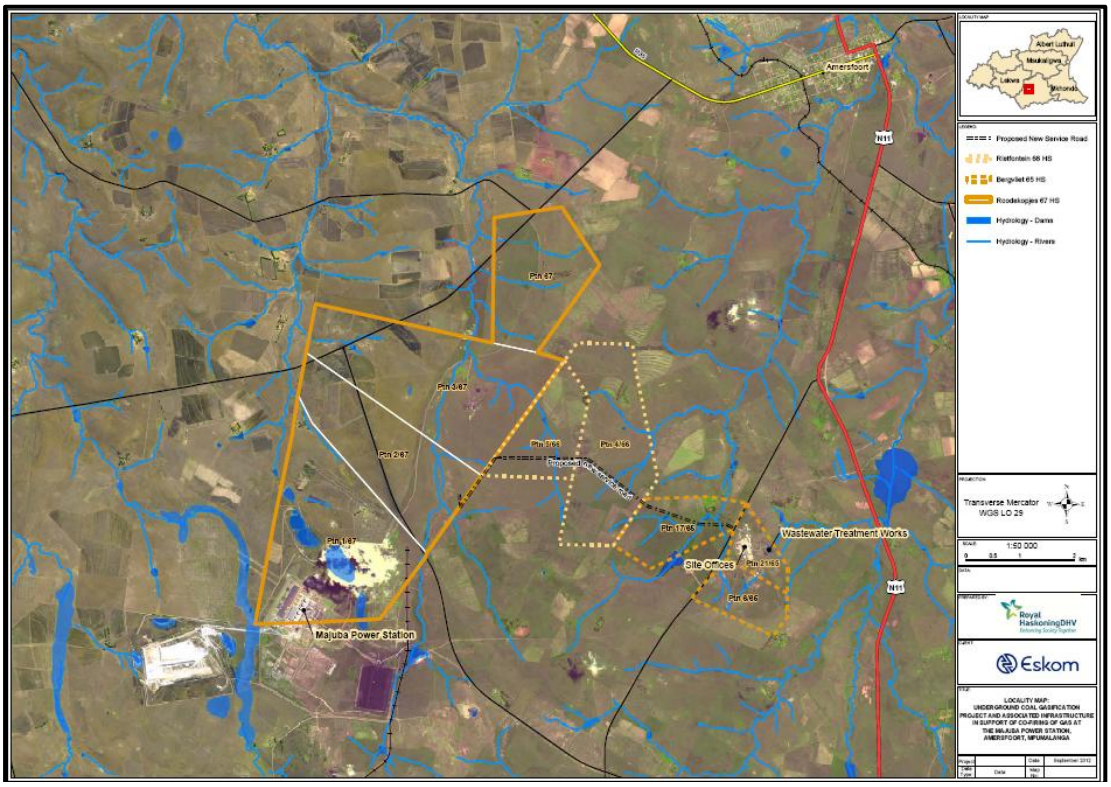


Fig. 3. Map showing the layout of the project as well as infrastructure development.

5.2 The heritage potential of the larger region

The aim of this section is to present an overview of the history of the larger region in order to eventually determine the significance of heritage sites identified in the study area, within the context of their historic, aesthetic, scientific and social value, rarity and representivity – see Section 3.2 and Appendix 1 for more information.

The cultural landscape qualities of the region essentially consist of a rural setup. In this the human occupation is made up of a pre-colonial element consisting of limited Stone Age occupation and somewhat more intense Late Iron Age occupation, as well as a much later colonial (farmer) component.

5.2.1 *Rural landscape*

The rural landscape has always been sparsely populated and it was only during the last couple of hundred years that people, through the application of specific economic strategies, succeeded to occupy a section of the region for any length of time.

- Archaeological sites

Archaeological sites in this area predominantly date to the Late Iron Age, although some sites dating to the Stone Age are also found in the larger region.

NHRA Category	Archaeological and palaeontological sites
Protection status	
General Protection - Section 35: Archaeology, palaeontology and meteorites	

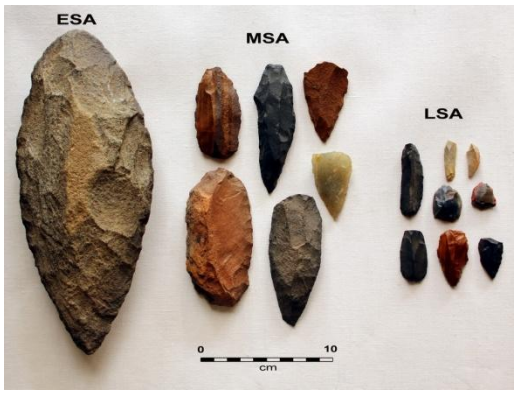


Fig. 4. Typical Stone Age tools and a stone walled site dating to the Late Iron Age.
The stone tools (on the left) are not from the region and are only used to illustrate the difference between Early (left), Middle (middle) and Later Stone Age (right) technology.

Human occupation of the larger geographical region took place since Early Stone Age (ESA) times. This is evidenced by the scattered stone tools found in a secondary context (open surface material), where they have been exposed in gravel terraces by rivers and streams. Normally this material is viewed to have a low significance and the localities where they are found are referred to as find spots rather than sites.

As this region was probably too cold and it does not have many rock shelters, occupation during Stone Age times remained low, resulting in very few sites dating to this period occurring in the region.

Iron Age people started to settle in southern Africa c. AD 300, with one of the oldest known sites at Silver Leaves, south east of Tzaneen dating to AD 270. However, Iron Age occupation of the eastern highveld area (including the study area) did not start much before the 1500s. Some sites dating to the Late Iron Age is known to exist to the north west of the study area.

As this was a period signified by high stress levels, people tended to settle in towns, usually located on hill tops for protection. The villages were laid out in complex manner and different areas were demarcated by stone walled enclosures.

- Farmsteads

Farmsteads are complex features in the landscape, being made up of different yet interconnected elements. Typically these consist of a main house, gardens, outbuildings, sheds and barns, with some distance from that labourer housing and various cemeteries. In addition roads and tracks, stock pens and wind mills complete the setup. An impact on one element therefore impacts on the whole.

NHRA Category	Buildings, structures, places and equipment of cultural significance
Protection status	
General Protection - Section 34: Structures older than 60 years	

Fig. 5. Examples of farmsteads/homesteads identified in the region.

By the early 19th century white settlers took up farms. An investigation of the Title Deeds of most of the farms under consideration indicated that they were surveyed as early as the 1860s, implying that they would have been occupied by colonists since then.

Many farmsteads and even houses in Amersfoort were destroyed during the Anglo Boer War. As a result most structures date to the period after that. The architecture of these farmsteads can be described as eclectic as they were built and added to as required over a period of time. In some cases outbuildings would be in the same style as the main house, if they date to the same period. However, they tend to vary considerably in style and materials used.

- Cemeteries

Apart from the formal cemeteries that occur in municipal areas (towns or villages), a number of these, some quite informal, i.e. without fencing, occur sporadically all over. Many also seem to have been forgotten, making it very difficult to trace the descendants in a case where the graves are to be relocated.

Most of these cemeteries, irrespective of the fact that they are for land owner or farm labourers (with a few exceptions where they were integrated), are family orientated. They are therefore serve as important 'documents' linking people directly by name to the land.

NHRA Category	Graves, cemeteries and burial grounds
Protection status	
General Protection - Section 36: Graves or burial grounds	
	

Fig. 6. Examples of cemeteries and burial places.

- Infrastructure and industrial heritage

In many cases this aspect of heritage is left out of surveys, largely due to the fact that it is taken for granted. However, the land and its resources could not be accessed and exploited without the development of features such as roads, bridges, railway lines, electricity lines and telephone lines.

NHRA Category	Buildings, structures, places and equipment of cultural significance
Protection status	
General Protection - Section 34: Structures older than 60 years	
	

Fig. 7. An old bridge across the Vaal River.

5.3.2 *Urban landscape*

The urban landscape in the region includes a number of small towns, of which Amersfoort is the closest to the study area. The study area per sé does not contain any section that can be classified as an urban environment.

NHRA Category	Buildings, structures, places and equipment of cultural significance
Protection status	
General Protection - Section 34: Structures older than 60 years	

NHRA Category	Graves, cemeteries and burial grounds
Protection status	
General Protection - Section 36: Graves or burial grounds	

NHRA Category	Buildings, structures, places and equipment of cultural significance
Protection status	
General Protection - Section 37: Public Monuments and Memorials	

Fig. 8. Various heritage elements found in an urban environment.

- Amersfoort:

The town of Amersfoort was founded in 1876 and proclaimed in 1888. From its earliest days it was well-known for its wealthy farmer community (Praagh 1906; Raper 2004).

According to the various databases consulted it has approximately 5 houses, buildings and other structures listed as provincial heritage sites or are viewed of conservation worthy status.

Fig. 9. Cadastral information of the region in 1899.
(Map: Jeppe 1899)

5.3 Identified sites

The following sites, features and objects of cultural heritage significance were identified in the study area (Fig. 10):

5.3.1 *Stone Age*

- No sites, features or objects dating to the Stone Age were identified in the study area.

5.3 2 *Iron Age*

- No sites, features or objects dating to the Iron Age were identified in the study area.

5.3.3 *Historic period*

The following sites, features or objects of cultural significance dating to the historic period were identified in the study area.

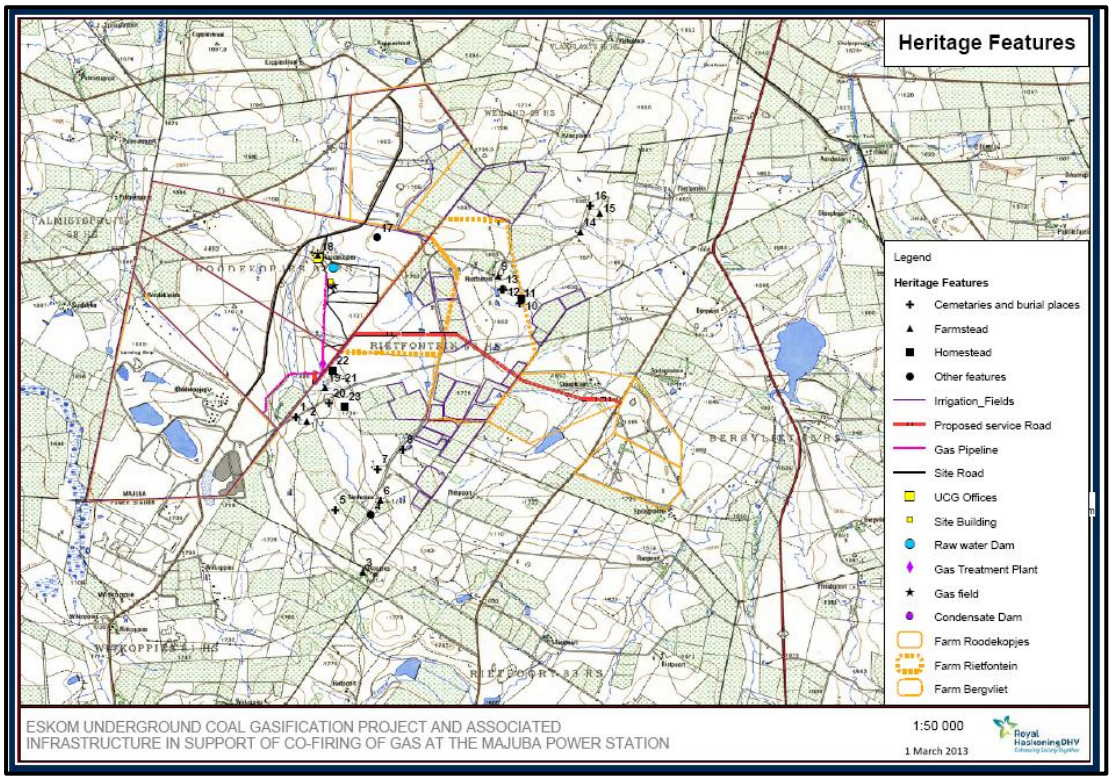


Fig. 10. The identified heritage sites in relation to the proposed development.
(Map supplied by Royal HaskoningDHV)

- Farmsteads

Location	No. 2. No. 3. No. 6. No. 9. No. 14. No. 15. No. 18. No. 19-21.	S 27.08864 S 27.11389 S 27.10190 S 27.06441 S 27.05712 S 27.05405 S 27.06106 S 27.08301	E 29.79753 E 29.80690 E 29.80980 E 29.82947 E 29.84322 E 29.84648 E 29.79941 E 29.80060
Description			
A number of old farmsteads and associated outbuildings occur sporadically over the larger area. Central to all is the farmhouse with associated outbuildings and in some cases, associated features such as stock enclosures, sheep dips, etc. located some distance away.			
Significance	High on a local level – Grade III		
Mitigation			
According to current understanding none of these features would be impacted on by the proposed development. **Recommendations**: If development activities might have an impact on any of these features, mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. In exceptional cases mitigation, the documentation (mapping and photographing) and archaeological excavation, can be implemented after required procedures have been followed.			


2


3


6


9


14


15


18


19-21

Fig. 11. The identified farmsteads.

- Homesteads

Location	No. 10. No. 22. No. 23.	S 27.06824 S 27.08033 S 27.08625	E 29.83339 E 29.80186 E 29.80386
Description			
No. 10. Remains of farm labourer homestead, built with locally quarried stone. No. 22. Remains of possible farm labourer homestead, built with locally quarried stone. No. 23. Remains of possible farm labourer homestead, built with locally quarried stone.			
Significance	High on a local level – Grade III		
Mitigation			
According to current understanding none of these features would be impacted on by the proposed development. **Recommendations**: If development activities might have an impact on any of these features, mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. In exceptional cases mitigation, the documentation (mapping and photographing) and archaeological excavation, can be implemented after required procedures have been followed.			

No. 10

N0. 22

No. 23

Fig. 12. The identified homesteads.

- Other features

Location	No. 4. No. 17	S 27.10438 S 27.05802	E 29.80821 E 29.80927
Description			
No. 4. Old concrete bridge across an old conveyor route, the latter which was demolished some years ago. The bridge is classified as a rigid frame concrete bridge. At present is serves to give access to a farmstead that is still occupied.			

No. 17. A number of small. Half-moon shaped features on a ridge overlooking a valley. At first it was thought to date to the Anglo-Boer War, where it served as sangars. However, it turned out to be hunting blinds that were used in the recent past.	
Significance	Low on a local level – Grade III
Mitigation	
It is very unlikely that the proposed development would have an impact on this site. Although it is viewed to have a low significance, is does represent some past activities in the landscape and it is recommended that it is retained. **Recommendation**: If any work is carried out in the vicinity of these features, the sites should be demarcated with danger tape, leaving a buffer of at least 10 metres around it.	

Fig. 13. The identified structures.

- Cemeteries and burial places

Location	1.	S 27.08807	E 29.79571
	5.	S 27.10347	E 29.80232
	7.	S 27.09677	E 29.80940
	8.	S 27.09341	E 29.81359
	11.	S 27.06903	E 29.83311
	12.	S 27.06670	E 29.83038
	13.	S 27.06669	E 29.83009
	16.	S 27.05263	E 29.84490
	20.	S 27.08567	E 29.80128
Description			
1. Single grave of child, now vandalised, with the headstone broken in pieces. The date on the headstone = 1908 – 1909. 5. Small informal farm labourer cemetery. All only marked with stone cairns. 7. Small farm labourer cemetery, with at least three burial periods. None of the graves have headstones, making it impossible to identified or date. The last of the three burial episodes probably took place within the last five years. The remains of old rondawel shape house is located close by. 8. Large farm labourer cemetery. Few have headstones, making it difficult to determine an exact number. Those with headstones are impossible to read. According to Mr Bheki Nhlapho these graves were already on the farm when he started to work on the farm more than 30 years ago. 11. A small informal farm labourer cemetery that can probably be linked to old homestead in record no. 10. According to Mr Bheki Nhlapho these graves were already on the farm when he started to work on the farm more than 30 years ago. 12. Single grave marked with stone cairn. Based on its size, it is probably that of a child. As there is no headstone it could not be dated. 13. Small farm labourer cemetery with possibly as many as 5 graves. According to Mr			

Bheki Nhlapho these graves were already on the farm when he started to work on the farm more than 30 years ago. 16. Small farm cemetery of Swanepoel family, containing at approximately 10 graves. At least four of the people died during 1918. 20. Number of old graves, now vandalised, making it difficult to establish the original number or names of the occupants as headstones have been smashed and strewn over a large area.	
Significance	High on a local level – Grade III
Mitigation	
It is highly unlikely that the proposed development would have an impact on any these sites and they should rather be retained in their original location. **Recommendation**: If development is to take place in their vicinity, these sites should be fenced off with danger tape, leaving a barrier of at least 10 metres from the outer most graves. If any of the graves are to be impacted on, it should be relocated after obtaining the necessary permits and in consultation with the descendants.	

No. 1

No. 5

No. 7

No. 8

No. 11

No. 12

No. 13

No. 16

No. 20

Fig. 14. The identified cemeteries and burial places.

6. SITE SIGNIFICANCE AND ASSESSMENT

6.1 Heritage assessment criteria and grading

According to the NHRA, No. 25 of 1999, Section 2(vi), the *significance* of heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential.

The NHRA stipulates the assessment criteria and grading of archaeological sites. The following categories are distinguished in Section 7 of the Act:

- **Grade I**: Heritage resources with qualities so exceptional that they are of special national significance;
- **Grade II**: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
- **Grade III**: Other heritage resources worthy of conservation, on a local authority level.

The occurrence of sites with a Grade I significance will demand that the development activities be drastically altered in order to retain these sites in their original state. For Grade II and Grade III sites, the application of mitigation measures would allow the development activities to continue.

6.2 Statement of significance

A matrix was developed whereby the above criteria, as set out in Sections 3(3) and 7 of the NHRA, No. 25 of 1999, were applied for each identified site (see Appendix 1). This allowed some form of control over the application of similar values for similar sites. Three categories of significance are recognized: low, medium and high. In terms of Section 7 of the NHRA, all the sites currently known or which are expected to occur in the study area are evaluated to have a grading as identified in the table below.

Table 1. Summary of identified heritage resources in the study area.

Identified heritage resources	
Category, according to NHRA	*Identification/Description*
Formal protections (NHRA)	
National heritage site (Section 27)	None
Provincial heritage site (Section 27)	None
Provisional protection (Section 29)	None
Place listed in heritage register (Section 30)	None
General protections (NHRA)	
structures older than 60 years (Section 34)	Farmsteads/homesteads
archaeological site or material (Section 35)	None
palaeontological site or material (Section 35)	None
graves or burial grounds (Section 36)	Yes
public monuments or memorials (Section 37)	None

Other	
Any other heritage resources (describe)	None

6.3 Impact assessment

Impact analysis on cultural heritage resources under threat of the proposed development is based on the present understanding of the development, as set out in Section 5.2 above. The criteria used are explained in Appendix 4.

CATEGORY	DESCRIPTION OF DEFINITION
Farmsteads	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole
Extent	1 - Site
Duration	4 - Permanent
Probability	2 - Possible
Intensity	2 - Medium

Significance rating	9 - medium
Status	Negative

Mitigation measures	Mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.

CATEGORY	DESCRIPTION OF DEFINITION
Homesteads	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole
Extent	1 - Site
Duration	4 - Permanent
Probability	2 - Possible
Intensity	2 - Medium

Significance rating	9 - medium
Status	Negative

Mitigation measures	Mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.

CATEGORY	DESCRIPTION OF DEFINITION
Additional features	The various features are subject to damage. Easier to identify and therefore easier to avoid. Variety of interconnected elements makes up the whole. Impact on part therefore implies an impact on the whole
Extent	2 - Local
Duration	4 - Permanent
Probability	2 - Possible
Intensity	2 - Moderate

Significance rating	10 - high
Status	Negative

Mitigation measures	Mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.

CATEGORY	DESCRIPTION OF DEFINITION
Informal cemeteries	The various features are subject to damage. Sometimes difficult to identify and therefore difficult to avoid.
Extent	2 - Local
Duration	4 - Permanent
Probability	2 - Possible
Intensity	2 - Moderate

Significance rating	10 - high
Status	Negative

Mitigation measures	Mitigation should take the form of isolating known sites and declare them as no-go zones with sufficient large buffer zones around them for protection. In exceptional cases mitigation can be implemented after required procedures have been followed.

7. RECOMMENDED MANAGEMENT MEASURES

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Those resources that cannot be avoided and that are directly impacted by the proposed development can be excavated/recorded and a management plan can be developed for future action. Those sites that are not impacted on can be written into the management plan, whence they can be avoided or cared for in the future.

7.1 Objectives

- Protection of archaeological, historical and any other site or land considered being of cultural value within the project boundary against vandalism, destruction and theft.
- The preservation and appropriate management of new discoveries in accordance with the NHRA, should these be discovered during development activities.

The following shall apply:

- Known sites should be clearly marked in order that they can be avoided during construction activities.
- The contractors and workers should be notified that archaeological sites might be exposed during the construction activities.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible;
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken;
- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51. (1).

7.2 Control

In order to achieve this, the following should be in place:

- A person or entity, e.g. the Environmental Control Officer, should be tasked to take responsibility for the heritage sites and should be held accountable for any damage.
- Known sites should be located and isolated, e.g. by fencing them off. All construction workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer as identified above.
- In areas where the vegetation is threatening the heritage sites, e.g. growing trees pushing walls over, it should be removed, but only after permission for the methods proposed has been granted by SAHRA. A heritage official should be part of the team executing these measures.

8. CONCLUSIONS

The aim of this study, broadly speaking, is to determine if any sites, features or objects of cultural heritage significance occur within the boundaries of the area where it is planned to utilise underground gasification technology.

The cultural landscape qualities of the region essentially consist of a single component. This is a rural area in which the human occupation is made up of a limited pre-colonial element (Stone Age and Iron Age) as well as a much later colonial (farmer) component.

The following heritage sites were identified in the study area:

- A number of old farmstead and associated outbuildings occur sporadically over the larger area. Central to all is the farmhouse with associated outbuildings and in some cases, associated features such as stock enclosures, sheep dips, etc. located some distance away. According to current understanding none of these features would be impacted on by the proposed development.

- A number of farm labourer homesteads occur on the farm. According to current understanding none of these features would be impacted on by the proposed development.

- A number of informal cemeteries/burial sites occur sporadically over the larger area. According to current understanding none of these features would be impacted on by the proposed development.

- A number of semi-circular walls of packed stone are located on a ridge overlooking a valley to the north of the core development area. The function of these is unknown at present. They remind one of shelters erected by soldiers during the Anglo Boer War, known as sangars. However, new information indicates that they were hunting blinds used during the recent past.

According to present understanding, none of the identified sites, features or objects of cultural significance would be impacted on by the proposed development. However, for the project to continue, we propose the following:

- The mitigation measures set out for each category of sites in Section 5.3 is implemented if development takes place in the vicinity of any of these.

- The management measures, as set out in Section 7 of this report should be implemented prior to construction taking place.

- We recommend that if archaeological sites or graves are exposed during construction work, it should immediately be reported to a heritage consultant so that an investigation and evaluation of the finds can be made.

No impact on heritage sites, features or objects can be allowed without a valid permit from SAHRA.

9. REFERENCES

9.1 Data bases

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South African Heritage Resources Agency

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Van Schalkwyk, J.A. 2007. *Heritage scoping report for the proposed Majuba CCGT power plant, Amersfoort magisterial district, Mpumalanga*. Unpublished report 2007/JvS/081.

9.3 Maps and aerial photographs

1:50 000 Topocadastral maps: 2629DC 2629DD, 2729BA, 2729BB
Google Earth

9.4 Interviews

Mr Bheki Nhlapho (073 971 4671)

APPENDIX 1: CONVENTIONS USED TO ASSESS THE IMPACT OF PROJECTS ON HERITAGE RESOURCES

Significance

According to the NHRA, Section 2(vi) the **significance** of heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

Matrix used for assessing the significance of each identified site/feature

1. Historic value			
Is it important in the community, or pattern of history			
Does it have strong or special association with the life or work of a person, group or organisation of importance in history			
Does it have significance relating to the history of slavery			
2. Aesthetic value			
It is important in exhibiting particular aesthetic characteristics valued by a community or cultural group			
3. Scientific value			
Does it have potential to yield information that will contribute to an understanding of natural or cultural heritage			
Is it important in demonstrating a high degree of creative or technical achievement at a particular period			
4. Social value			
Does it have strong or special association with a particular community or cultural group for social, cultural or spiritual reasons			
5. Rarity			
Does it possess uncommon, rare or endangered aspects of natural or cultural heritage			
6. Representivity			
Is it important in demonstrating the principal characteristics of a particular class of natural or cultural places or objects			
Importance in demonstrating the principal characteristics of a range of landscapes or environments, the attributes of which identify it as being characteristic of its class			
Importance in demonstrating the principal characteristics of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province, region or locality.			
7. Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Regional			
Local			
Specific community			
8. Significance rating of feature			
1. Low			
2. Medium			
3. High			

APPENDIX 2. RELEVANT LEGISLATION

All archaeological and palaeontological sites, and meteorites are protected by the National Heritage Resources Act (Act no 25 of 1999) as stated in Section 35:

(1) Subject to the provisions of section 8, the protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority: Provided that the protection of any wreck in the territorial waters and the maritime cultural zone shall be the responsibility of SAHRA.

(2) Subject to the provisions of subsection (8)(a), all archaeological objects, palaeontological material and meteorites are the property of the State. The responsible heritage authority must, on behalf of the State, at its discretion ensure that such objects are lodged with a museum or other public institution that has a collection policy acceptable to the heritage resources authority and may in so doing establish such terms and conditions as it sees fit for the conservation of such objects.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

(4) No person may, without a permit issued by the responsible heritage resources authority-

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

In terms of cemeteries and graves the following (Section 36):

(1) Where it is not the responsibility of any other authority, SAHRA must conserve and generally care for burial grounds and graves protected in terms of this section, and it may make such arrangements for their conservation as it sees fit.

(2) SAHRA must identify and record the graves of victims of conflict and any other graves which it deems to be of cultural significance and may erect memorials associated with the grave referred to in subsection (1), and must maintain such memorials.

(3) No person may, without a permit issued by SAHRA or a provincial heritage resources authority-

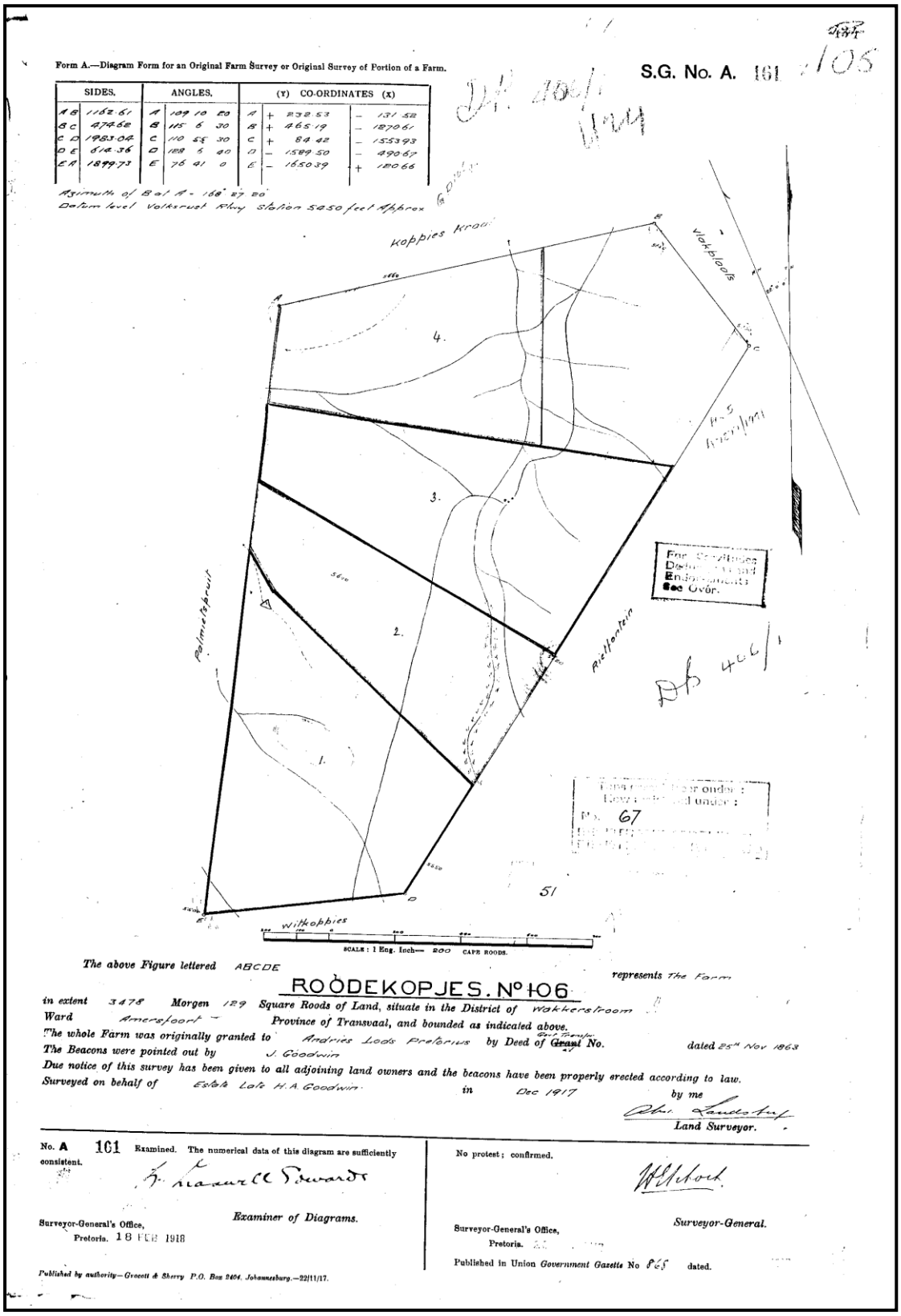
(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(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.

APPENDIX 3: ILLUSTRATIONS



Form A.—Diagram Form for an Original Farm Survey or Original Survey of Portion of a Farm.

S.G. No. A. 161

SIDES.		ANGLES.			(Y) CO-ORDINATES (X)			
AB	1162.61	A	109	10 50	A	+ 232.53	−	131.52
BC	474.62	B	115	6 30	B	+ 465.19	−	187.061
CD	1983.04	C	110	55 30	C	+ 84.42	−	155.393
DE	814.36	D	188	5 40	D	− 1589.50	−	49.067
EA	1899.73	E	76	41 0	E	− 1650.39	+	120.66

Azimuth of Bal A - 168° 27' 20"
Datum level Volksrust Rly Station 5450 feet Approx

Koppies Kroon
Vlakbloots
Palmietspruit
Rietfontein
Witkoppies
4.
3.
2.
1.
51
SCALE: 1 Eng. Inch— 200 CAPE RODS.

The above Figure lettered ABCDE represents The Farm

ROODEKOPJES. Nº 106

in extent 3478 Morgen 129 Square Roods of Land, situate in the District of Wakkerstroom
Ward Amersfoort Province of Transvaal, and bounded as indicated above.
The whole Farm was originally granted to Andries Loots Pretorius by Deed of Grant No. dated 25th Nov 1863
The Beacons were pointed out by J. Goodwin
Due notice of this survey has been given to all adjoining land owners and the beacons have been properly erected according to law.
Surveyed on behalf of Estate Late H.A. Goodwin in Dec 1917 by me
Land Surveyor.

No. A 161 Examined. The numerical data of this diagram are sufficiently consistent.
Examiner of Diagrams.
Surveyor-General's Office, Pretoria. 18 FEB 1918

No protest; confirmed.
Surveyor-General.
Surveyor-General's Office, Pretoria.
Published in Union Government Gazette No 865 dated.

Published by authority—Govett & Sherry P.O. Box 2404, Johannesburg.—22/11/17.

Fig. 15. Title Deed for Roodekopjes (dated 1863).

APPENDIX 4: IMPACT ASSESSMENT CRITERIA

Criteria used for the rating of impacts

CRITERIA	DESCRIPTION			
EXTENT	**National (4)** The whole of South Africa	**Regional (3)** Provincial and parts of neighbouring provinces	**Local (2)** Within a radius of 2 km of the construction site	**Site (1)** Within the construction site
DURATION	**Permanent (4)** Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient	**Long-term (3)** The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory	**Medium-term (2)** The impact will last for the period of the construction phase, where after it will be entirely negated	**Short-term (1)** The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase
INTENSITY	**Very High (4)** Natural, cultural and social functions and processes are altered to extent that they permanently cease	**High (3)** Natural, cultural and social functions and processes are altered to extent that they temporarily cease	**Moderate (2)** Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way	**Low (1)** Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected
PROBABILTY OF OCCURANCE	**Definite (4)** Impact will certainly occur	**Highly Probable (3)** Most likely that the impact will occur	**Possible (2)** The impact may occur	**Improbable (1)** Likelihood of the impact materialising is very low

Significance rating of classified impacts

Low impact (4 - 6 points)	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
Medium impact (7 - 9 points)	Mitigation is possible with additional design and construction inputs.
High impact (10 - 12 points)	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.

Very high impact (13 - 16 points)	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a “very high impact” is likely to be a fatal flaw.
Status	Denotes the perceived effect of the impact on the affected area.
Positive (+)	Beneficial impact.
Negative (-)	Deleterious or adverse impact.
Neutral (/)	Impact is neither beneficial nor adverse.

Palaeontological Impact Assessment
for
Majuba Underground Coal Gasification Project, Mpumalanga

Phase 1 Report

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SOUTH AFRICA

30 November 2012.

INTRODUCTION

As requested by Royal HaskoningDHV, who have been appointed by Eskom Holdings SOC Ltd., here is the Phase 1 or desktop study of Palaeontological Impact Assessment for the proposed Underground Coal Gasification (UCG) Project and associated infrastructure on Portions 1, 2, 3 and remaining extent of the farm Roodekopjes 67 HS, Portions 17 and 21 of the farm Bergvliet 65HS and Portions 4 and 5 of the farm Rietfontein 66HS in Mpumalanga Province, associated with Majuba Power station and Amersfoort Power Station.

GEOLOGY AND PALAEONTOLOGY

The site is in the north eastern part of the Karoo Basin in Permian Ecca deposits, ranging in age from approximately 280 to 260 million years old. The formations present in this area are the middle Ecca Vryheid Formation, the upper Ecca Volksrust formation and the Lower Beaufort Adelaide Formation. Much of this area has economically important coal seams and these were formed in mostly fluvial settings, where peat swamps developed in broad abandoned alluvial plains and interfluves (Cadle et al., 1993; Cairncross, 2001; Johnston et al., 2006). The lithologies comprise shales, sandstones, mudstones and coals but are interrupted by Jurassic aged intrusive dolerite dykes (see Figure 1 and Table 1.)

By their nature coals are plant rich. Good quality coals do not preserve the anatomy of the original plant matter, but the shales between the sequences do. Here it is possible to find well preserved *Glossopteris* leaves, roots and inflorescences, lycopod and sphenophyte stems, ferns, cordaitaleans and early gymnosperms (Table 2). Bones of the vertebrates that occurred at this time are seldom if ever preserved with the plants but insects are often abundant.

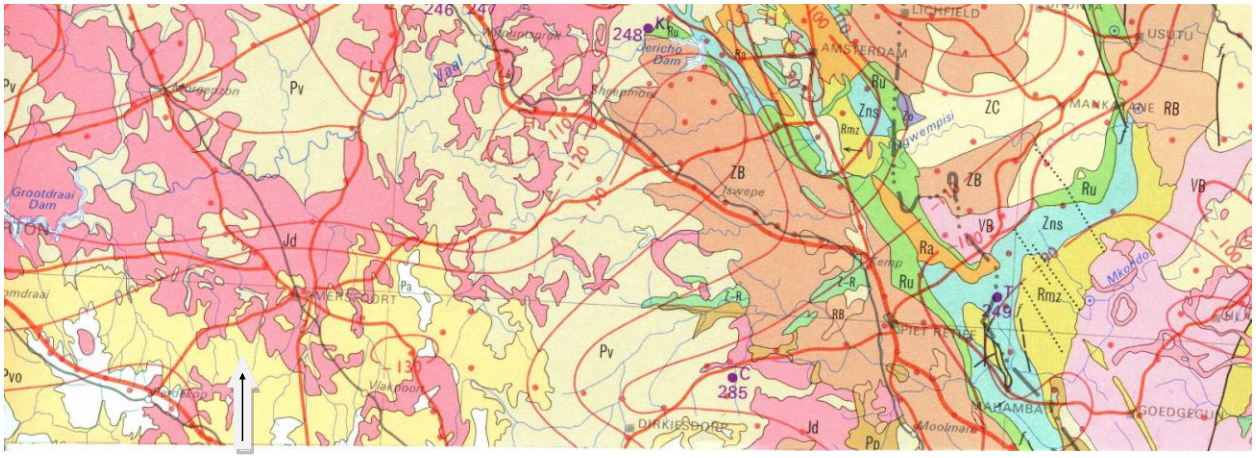

Figure 1: Geology of the Majuba-Amersfoort area. Arrow marks the proposed development area. Abbreviations and lithology in Table 1. Map from the Geolological Survey, Pretoria; 1984, 1: 1 000 000.

Symbol	Formation	Lithology	Age
Jd		Dolerite dykes	Jurassic
Pa	Adelaide and Estcourt	Mustdtone, sandstone	Beaufort; Late Permian
Pva	Volksrust	Shale	Upper Ecca; Late Permian
Pv	Vryheid	Sandstone, shale, coal	Middle Ecca; middle Permian

Table 1: Geology of the proposed development area. Refer to map in Figure 1.

Fossil plants from the Permian

Fossil plants have been collected by Edna Plumstead, Stephanus Le Roux, Heidi and John Anderson, Shirley Smithies and many others from the northeastern Karoo Basin and are now housed in the Palaeobotany Herbarium of the Bernard Price Institute for Palaeontological Research, University of the Witwatersrand. These plants are typical examples from fossil floras of this age in Gondwana. In Table 1 is a full list of plants from this age and the species that occur in the Early to middle Permian and the Upper Permian of the Karoo Basin are indicated. Although the species will have little meaning to non-palaeobotanists, they give an indication of the richness of these floras. Coal floras tend to be comparable at the generic level but there are many differences at the species level and there is much research still to be done on South African coal floras.

Plant group/common name	***Genus and species***	**Early to Middle**	**Upper**
Lycopods (clubmosses)	*Haplostigma permianica*	+	
	Leptophloem santae-helenae	+	
	Azaniadendron fertile	+	
	Cyclodendron leslii	+	
Sphenopsids (horsetails)	*Sphenophyllum hammanskraalensis*	+	
	Sphenophyllum mesoccaense	+	
	Sphenohyllum speciosum	+	+
	Annularia hammanskraalensis	+	
	Raniganjia kilburnensis	+	+
	Raniganjia rayneri	+	
	Raniganjia lanceolate	+	
	Phyllotheca australis		+
	Phyllotheca lawleyensis	+	+
	Phyllotheca westensis		+
	Schizoneura gondwanansis		+
Ferns	*Asterotheca hammanskraalensis*	+	
	Asterotheca leeuwkuilensis	+	
	Sphenopteris lobifolia	+	+
	Liknopetalon enigmata	+	
Glossopteridales	*Numerous leaves – morphotypes, not species*	+++++	+++
- Female fructifications	*Arberia hlobanensis*	++	
-	*Arberia madagascariensis*	+	
-	*Bifariala intermittens*	+	
-	*Dictyopteridium natalensis*	+	
-	*Dictyopteridium flabellatum*	+	
-	*Elatra leslii*	+	

-	*Estcourtia bergvillensis*		+
-	*Estcourtia conspicua*	+	
-	*Estcourtia vandijkii*		+
-	*Gladiopomum acadarense*	+	
-	*Gonophylloides strictum*	+	
-	*Gonophylloides waltonii*	+	
-	*Lidgettonia africana*	+	+
-	*Lidgettonia elegans*	+	+
-	*Lidgettonia inhluzanensis*		+
-	*Lidgettonia lidgettonioides*	+	+
-	*Lidgettonia mooiriverensis*		+
-	*Ottokaria buriadica*	+	
-	*Ottokaria hammanskraalensis*	+	
-	*Ottokaria transvaalensis*	+	+
-	*Plumsteadia gibbosa*	+	+
-	*Plumsteadia natalensis*		+
-	*Plumsteadia lerouxii*	+	
-	*Rigbya arberioides*	+	+
-	*Scutum leslii*	+	
-	*Vereenia leeukuilensis*	+	
- -male fructifications	*Eretmonia spp.*	+	
Ginkgoales	*Sphenobaiera eccaensis*	+	
	Metreophyllum lerouxii	+	
	Ginkgophyllum kidstonii	+	
	Ginkgophyllum spatulifolia	+	
	Flabellofolium leeukuilensis	+	
Conifers	*Noeggerathiopsis hislopii*	+	
	Noeggerathiopsis spathulata		+
	Walkomiella transvaalensis	+	
	Podozamites hlobanensis	+	
	Pagiophyllum vandijkii		+
	Benlightfootia mooiensis		+
	Cyparissidium sp.	+	
Incertae sedis	*Taeniopteris gemmina*	+	
	Taeniopteris estcourtiana		+
	Botrychiopsis valida	+	
	Various seeds	+	

Table 2: List of Early to middle Permian and Upper Permian plants from the Karoo Basin, South Africa. Compiled from Plumstead, 1969; Anderson and Anderson, 1985; Adendorff, 2004; Adendorff et al., 2003; Prevec et al., 2008, Taylor et al., 2009.

RECOMMENDATION

There is a strong likelihood of fossil plants occurring in the shales and mudstones associated with the coals. There are two aspects to the proposed development. The first is to take place underground and obviously associated with coal deposits (but no details provided by Royal HaskoningDHV). The second is a surface access road between the site office and the boundary of Roodekopjes 67 HS, passing through Bergvleit 65 HS and Rietfontein 65 HS. The latter is to take place in a region that has been used for agriculture and if there were any fossils on the surface they are likely to have been destroyed already.

The fossils associated with the underground coal seams will be poorly preserved as the plants are greatly altered by the natural process of coalification, from peat, through lignite to bituminous coal. Recognizable plant fossils are likely to occur in the non-economic shales and mudstone layers or lenses between the coal seams.

The National Heritage Resources Act (Act 25 of 1999) draft document **MINIMUM STANDARDS: PALAEONTOLOGICAL COMPONENT OF HERITAGE IMPACT ASSESSMENT REPORTS** (October 2011) states**:**
As states develop and landscapes are modified, heritage resources, including palaeontological resources, are threatened. As such, both the environmental and heritage legislation require that development activities must be preceded by an assessment of the impact undertaken by qualified professionals. Palaeontological Impact Assessments (PIAs) are specialist reports that form part of the wider heritage component of:

- Heritage Impact Assessments (HIAs) called for in terms of Section 38 of the National Heritage Resources Act, Act No. 25, 1999 by a heritage resources authority.
- Environmental Impact Assessment process as required in terms of other legislation listed in s. 38(8) of NHRA.
- Environmental Management Programmes (EMPs) required by the Department of Mineral Resources.

It is therefore recommended that the development may proceed BUT that a responsible person (geologist, environmental officer, or other) regularly monitors the excavations, removes and collects fossil material that is found. The fossils should then be given to an institute that is recognized by SAHRA as a repository for fossils. As there is no such repository in Mpumalanga the material could go to the Ditsong Museum or Council for Geosciences in Pretoria or the Bernard Price Institute for Palaeontological Research, University of the Witwatersrand in Johannesburg.

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