Cultural Heritage Impact Assessment:

Phase 1 Investigation of the Proposed Brick Manufacturing Plant and Storage Facilities on Portion 4 of the Farm Witkoppie 373 IR, Henley on Klip, Midvaal Local Municipality, Sedibeng District Municipality, Gauteng

For

Project Applicant	**Environmental Consultant**
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By

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Executive Summary

This report contains a comprehensive heritage impact assessment investigation in accordance with the provisions of Sections 38(1) and 38(3) of the *National Heritage Resources Act* (Act No. 25 of 1999) and focuses on the survey results from a cultural heritage survey as requested by SRK Consulting (Pty) Ltd. In terms of the 2014 Environmental Impact Assessment (EIA) Regulations published in terms of Section 24(5) of the National Environmental Management Act 107 of 1998 (NEMA), the intent is to apply for Environmental Authorisation as part of a Basic Assessment process, for the proposed Proposed Brick Manufacturing Plant and Storage Facilities on Portion 4 of the Farm Witkoppie 373 IR, Henley on Klip, Midvaal Local Municipality, Sedibeng District Municipality, Gauteng.

Stone Age settlements

No Stone Age settlements, structures, features, assemblages or artefacts were recorded during the survey.

Iron Age settlements

No Late Iron Age artefacts, structures, features or settlements were identified during the survey.

Graveyards

No Graveyards or individual graves were identified.

Historical structures

No historical buildings or structures were recorded.

Recommendations

It is therefore recommended, from a cultural heritage perspective, that the proposed expansion of the existing plant, which will include the erection of a brick making plant, offices, bathroom facilities, stores and associated infrastructure may proceed.

However, please note:

Archaeological deposits usually occur below ground level. Should archaeological artefacts or skeletal material be revealed in the area during development activities, such activities should be halted, and a university or museum notified in order for an investigation and evaluation of the find(s) to take place **(*cf*. NHRA (Act No. 25 of 1999)**, Section 36 (6)).

Definitions and abbreviations

Midden:	Refuse that accumulates in a concentrated heap.
Stone Age:	An archaeological term used to define a period of stone tool use and manufacture
Iron Age:	An archaeological term used to define a period associated with domesticated livestock and grains, metal working and ceramic manufacture
LIA:	Late Iron Age sites are usually demarcated by stone-walled enclosures
NHRA:	National Heritage Resources Act (Act No. 25 of 1999)
SAHRA:	South African Heritage Resources Agency
SAHRIS:	South African Heritage Resources Information System
PHRA-G:	Provincial Heritage Resources Authority - Gauteng
GDARD:	Gauteng Department of Agriculture and Rural Development
HIA:	Heritage Impact Assessment
DMR:	Department of Mineral Resources

I, Francois Coetzee, hereby confirm my independence as a cultural heritage specialist and declare that I do not have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of the listed environmental processes, other than fair remuneration for work performed on this project.

_____

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1. Introduction and Terms of Reference

SRK Consulting (Pty) Ltd an independent environmental consultant was appointed to undertake a Basic Assessment (BA) process provided for in Regulation 19 read with Appendix 1 of GN R326 of 4 December 2014 of the 2014 EIA Regulations, as amended published under NEMA will be followed for the application for Environmental Authorisation. In terms of the 2014 Environmental Impact Assessment (EIA) Regulations published in terms of Section 24(5) of the National Environmental Management Act 107 of 1998 (NEMA), the intent is to apply for Environmental Authorisation for the proposed Brick Manufacturing Plant and Storage Facilities on Portion 4 of the Farm Witkoppie 373 IR, Henley on Klip, Midvaal Local Municipality, Sedibeng District Municipality, Gauteng.

2. Objectives

The general objective of the cultural heritage survey is to record and document cultural heritage remains consisting of both tangible and intangible archaeological and historical artefacts, structures (including graves), settlements and oral traditions of cultural significance.

As such the terms of reference of this survey are as follows:

- Identify and provide a detailed description of all artefacts, assemblages, settlements and structures of an archaeological or historical nature (cultural heritage sites) located on the study area,
- Estimate the level of significance/importance of these remains in terms of their archaeological, historical, scientific, social, religious, aesthetic and tourism value,
- Assess any impact on the archaeological and historical remains within the area emanating from the development activities, and
- Propose recommendations to mitigate heritage resources where complete or partial conservation may not be possible and thereby limit or prevent any further impact.

3. Description of Physical Environment of Study Area

The heritage survey focussed on an area situated adjacent to the Bass Lake Quarry (off the N3 highway) near Henley on Klip (north of Vereeniging) within the Midvaal Local Municipality, north of Vereeniging, Gauteng.

Farm Name(s) and Portions	Witkoppie 373 IR • A portion of Portion 4
Size of Survey Area	Approximately 7 hectares
Magisterial Districts	Midvaal Local Municipality Sedibeng District Municipality
1:50 000 Map Sheet	2628CA
1:250 0000 Map Sheet	2628
Central Coordinates of the Development	28.05835°E 26.50523°S

Table 1: Physical Environment

The survey area falls within the Grassland Biome, particularly the Mesic Highveld Grassland Bioregion and more specifically the Soweto Highveld Grassland (Gm8) and the Dry Highveld Grassland Bioregion and more specifically the Carletonville Dolomite Grassland (Gh15). The Soweto Highveld Grassland (Gm8) vegetation type occurs in Mpumalanga, Gauteng (and to a very small extent also in neighbouring Free State and North West Provinces. It also occurs in a broad band roughly delimited by the N17 road between Ermelo and Johannesburg in the north, Perdekop in the southeast and the Vaal River (border with the Free State) in the south. It extends further westwards along the southern edge of the Johannesburg Dome (including part of Soweto) as far as the vicinity of Randfontein. In southern Gauteng it includes the surrounds of Vanderbijlpark and Vereeniging as well as Sasolburg in the northern Free State. The Carletonville Dolomite Grassland (Gh15) vegetation type occurs in North West Province (mainly) and Gauteng and marginally into the Free State Province. It also occurs in the region of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng Province (Mucina & Rutherford 2010).

The survey area is characterised by open flat area mostly covered in grass, trees and bushes. The survey footprint has been converted into a 4x4 track some years ago and has been landscaped with excavations and embankments and several tracks. The area has been extensively disturbed. The survey footprint is adjacent to the old Glen Douglas Dolomite mine with several excavations and mining still active in the area. A large quarry (Bass Lake) is located to the east of the survey footprint.

The Vereeniging region is located within an area of summer rainfall which is characterized by afternoon thunderstorms. December and January are the wettest months, characterized by torrential downpours in the afternoon with an annual rainfall of 752 mm. Average annual temperature is 17°C (SA Explorer 2021).

Current Zoning	Mining
Economic activities	Mining and manufacturing Tourism
Soil and basic geology	The Transvaal Supergroup fills an east-west elongated basin in the south-central part of the old Transvaal (now North – West, Gauteng and Mpumalanga) as far south as Potchefstroom. It is Vaalian in age, approximately 2600 Ma to 2100 Ma. A maximum thickness of the Transvaal Supergroup reaches 2000 m in the north-eastern section. The east-west elongated basin is filled with clastic, volcanic and chemical sedimentary rocks. Three groups based on lithological differences have been established: they are the Rooiberg, Pretoria and Chuniespoort Groups as well as other smaller groups. It is the Bushveld Complex that is responsible for the tilting of the Transvaal sediments and the heat of its intrusion having created andalusite crystals. This Supergroup is underlain by the Ventersdorp, Witwatersrand and Pongola Supergroups, and the Dominion Group. Three prominent ridges are present from the oldest to the youngest, the Time Ball Hill, Daspoort and Magaliesberg Formations. Chemical sediments such as fine-grained limestone and dolomite of the Malmani Subgroup is made

	up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites (See Fourie 2021).
Hydrology	Several non-perennial streams drain towards the Klip River further to the east. An artificial reservoir (Bass Lake) was created due to quarrying activities to the east.
Socio Economic Environment	Sedibeng District Municipality (SDM) is regarded category C. The municipality covers the entire southern part of Gauteng Province and consists of three local municipalities: Emfuleni, Midvaal and Lesedi. Towns within these municipalities include Vereeniging, Vanderbijlpark, Meyerton and Heidelberg. Townships include Evaton, Sebokeng, Boipatong, Bophelong, Sharpeville and Ratanda. The total population of the District is 916 484. Lesedi has a population of 99 520, Midvaal 95 301 and Emfuleni 721 663. The population density of the District as a whole is 198 people per km². It is clear from the stats that 8 out of every 10 people in Sedibeng live in Emfuleni and the vast majority (more than 700 000 people) live in the black township areas especially Sebokeng and Evaton.
Evaluation of Impact	An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits NHRA (Act No. 25 of 1999, Section 38(3d)): **Positive**

Table 2: Biodiversity and socio-economic environment

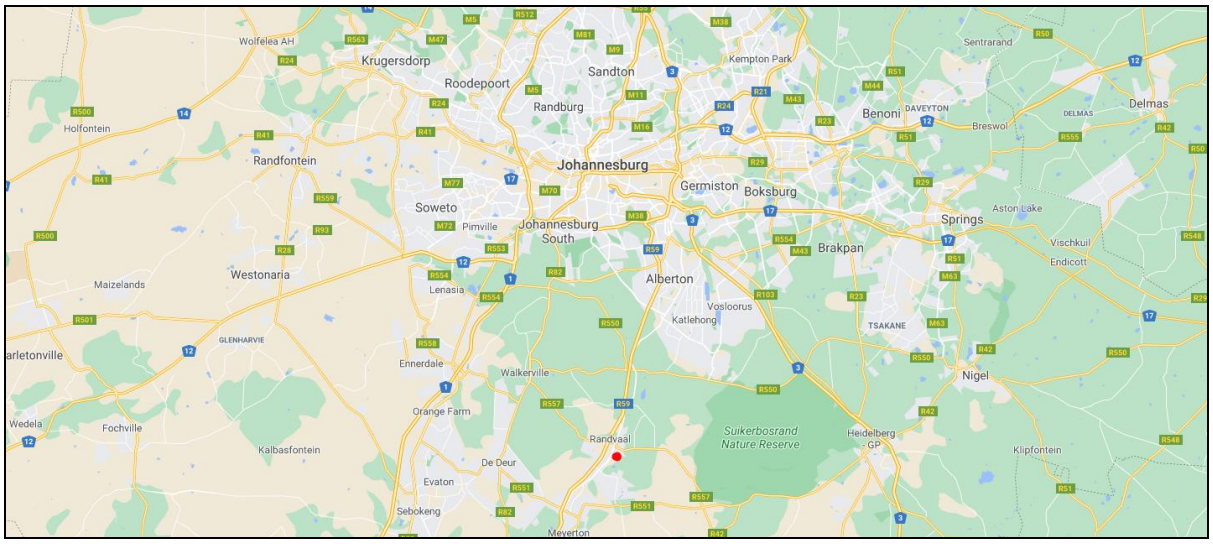

Figure 1: Regional context of the survey located north of Meyerton (indicated by the red area)

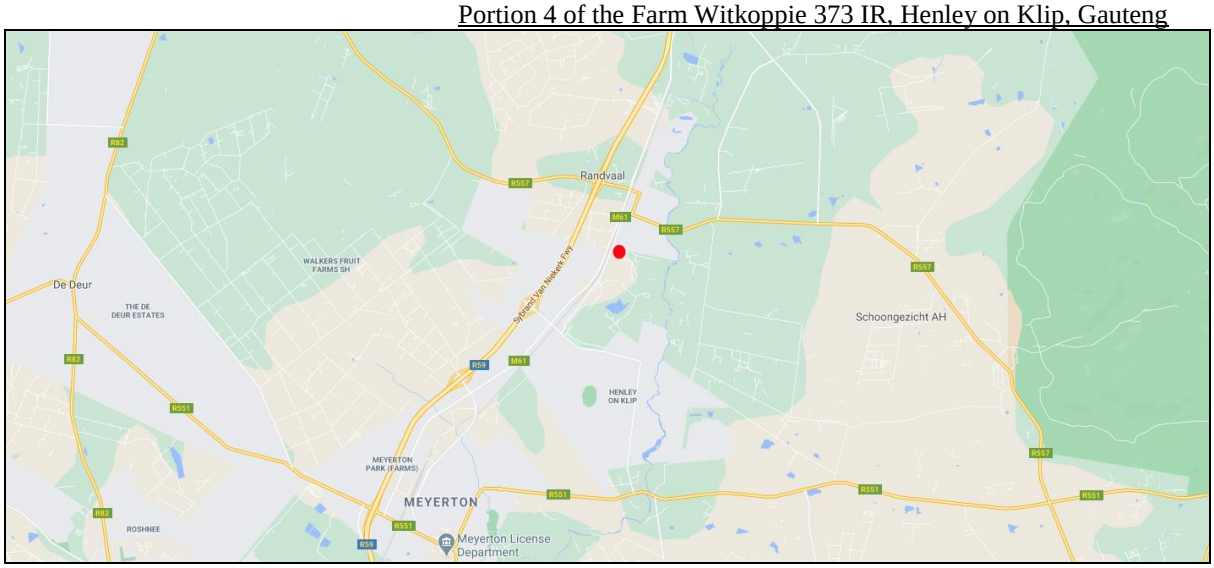

Figure 2: General location of the proposed area of development in Henley on Klip

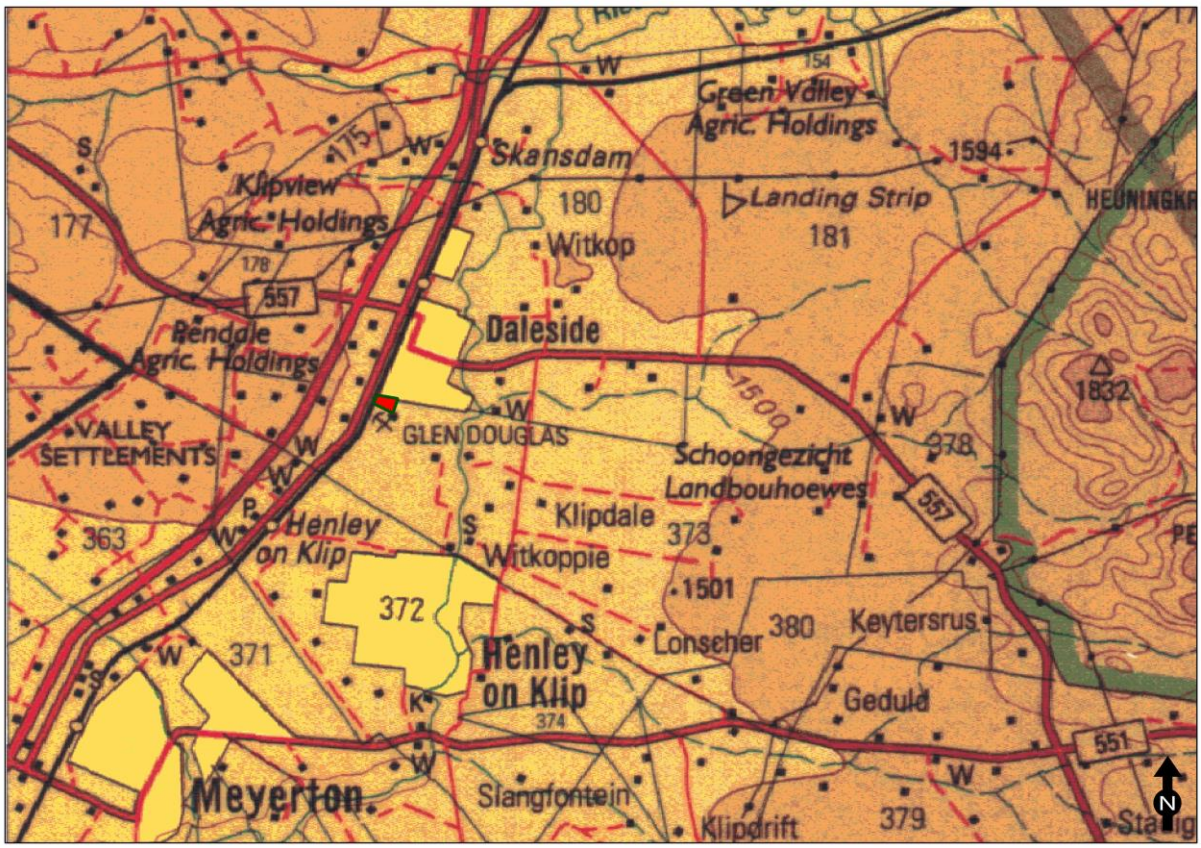

Figure 3: Local context of the survey area (near Glen Douglas Mine) (1:250 000 Map 2628)

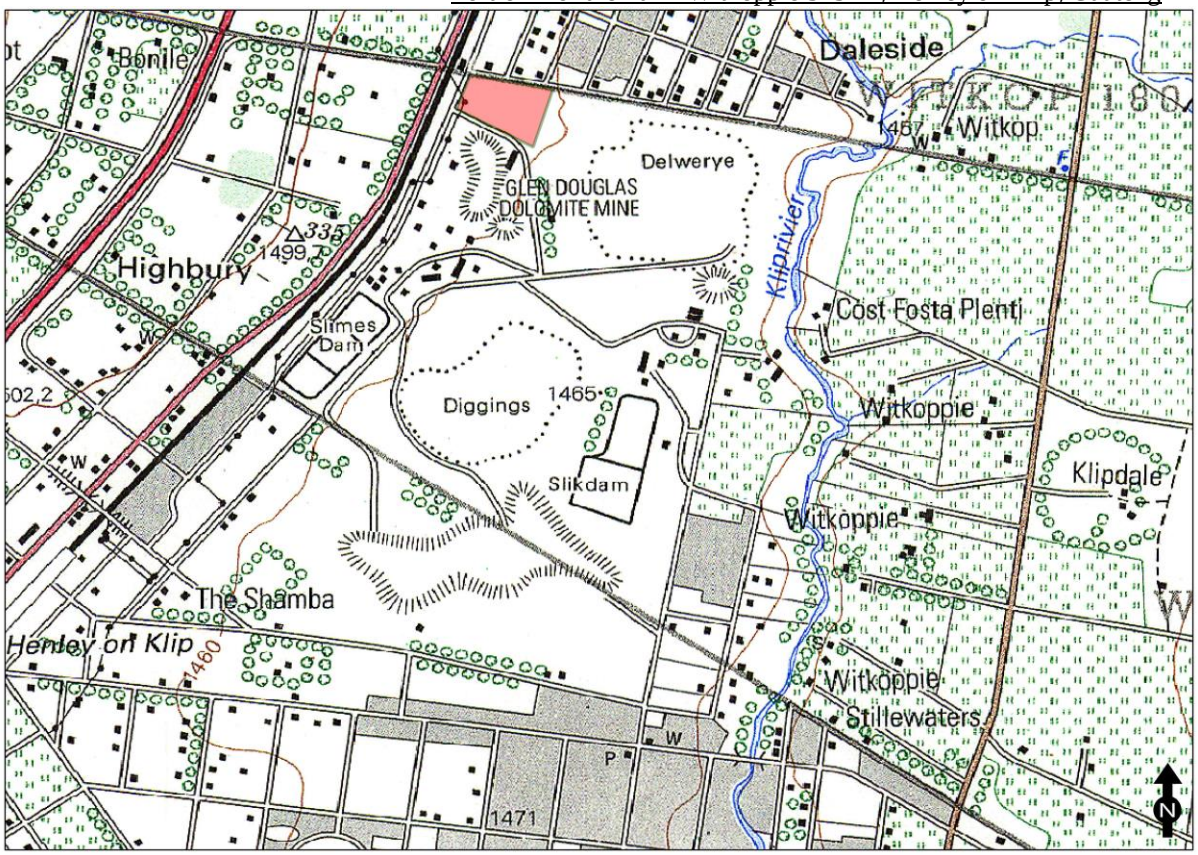

Figure 4: General location of the survey area as indicated on the 1:50 000 topographic map 2628AC

Figure 5: General location of the survey footprint as indicated on Google Earth Pro (2021)

Figure 6: Detail of the survey footprint as indicated on Google Earth Pro (2021)

Figure 7: General view of the western section of the survey area

Figure 8: General view of the western section of the survey area (embankment and power pylon)

Figure 9: General view of the northern section of the survey area (off road tracks and embankment)

Figure 10: General view of the central section of the survey area

Figure 11: Existing infrastructure (4x4 tracks) central section of the survey area

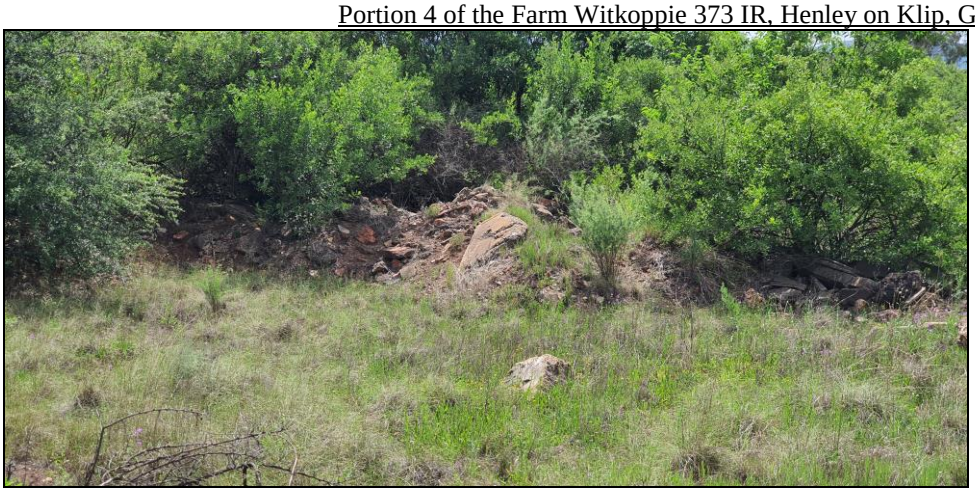

Figure 12: General view of the central section of the survey area (surface disturbed by earth works)

4. Proposed Project Description

The proposed project entails the expansion of the existing plant at SA Block (Pty) Ltd which will include the erection of a brick making plant. The automated brick manufacturing plant will be located under a 1500 m² roof and have a small storage area (±5000 m²) outside with temporary building structures (100 m²) as offices, bathroom facilities and stores.
The operation might be extended in the near future to include a ready-mix concrete batching facility as well as a basic asphalt plant.

5. Legal Framework

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE APPLIED
The Constitution of the Republic of South Africa (Act No. 108 of 1996)	
The National Environmental Management Act (Act No. 107 of 1998)	Section 24 Section 28
The National Water Act (Act No. 36 of 1998)	
Air Quality Act (Act No. 39 of 2004)	
National Forests Act, Act of 84 of 1998	
The National Heritage Resources Act (Act No. 25 of 1999)	Section 38, 34, 35, 36
Conservation of Agricultural Resources Act (Act No. 85 of 1983)	-
Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)	-
The National Water Act (Act No. 36 of 1998)	
Mine Health and Safety Act (Act No. 29 of 1996) (MHSA)	
Biodiversity Act (Act 10 of 2004)	
World Heritage Convention Act (Act No. 49 of 1999)	
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)	
Sedibeng District Municipality Integrated Management Plan 2018	

Table 3: Legal framework

- Section 38 of the NHRA (Act No. 25 of 1999) stipulates that the following activities trigger a heritage survey:

Development criteria in terms of Section 38(1a-e) of the NHRA (Act No. 25 of 1999)	Yes/No
Construction of road, wall, powerline, pipeline, canal or other linear form of development or barrier exceeding 300m in length	No
Construction of bridge or similar structure exceeding 50m in length	No
Development exceeding 5000 m^2 in extent	Yes
Development involving three or more existing erven or subdivisions	No
Development involving three or more erven or divisions that have been consolidated within past five years	No
Rezoning of site exceeding 10 000 m^2	No
Any other development category, public open space, squares, parks, recreation grounds	No

Table 4: Activities that trigger Section 38 of the NHRA

- Field rating system as recommended by SAHRA:

Field Rating	Grade	Significance	Recommended Mitigation
National Significance	Grade I	High significance	Conservation by SAHRA, national site nomination, mention any relevant international ranking. No alteration
Provincial Significance	Grade II	High significance	Conservation by provincial heritage authority, provincial site nomination. No alteration whatsoever without permit
Local Significance	Grade III-A	High significance	Conservation by local authority, no alteration whatsoever without permit from provincial heritage authority. Mitigation as part of development process not
Local Significance	Grade III-B	High significance	Conservation by local authority, no external alteration without permit from provincial heritage authority. Could
Generally Protected A	Grade IV-A	High/medium significance	Conservation by local authority. Site should be mitigated before destruction. Destruction permit required from
Generally Protected B	Grade IV-B	Medium significance	Conservation by local authority. Site should be recorded before destruction. Destruction permit required from provincial heritage authority.
Generally Protected C	Grade IV-C	Low significance	Conservation by local authority. Site has been sufficiently recorded in the Phase 1 HIA. It requires no further recording before destruction. Destruction permit

Table 5: Field rating system to determine site significance

- Heritage resources have lasting value in their own right and provide evidence of the origins of South African society and they are valuable, finite, non-renewable and irreplaceable.

- All archaeological remains, features, structures and artefacts older than 100 years and historic structures older than 60 years are protected by the relevant legislation, in this case the National Heritage Resources Act (NHRA) (Act No. 25 of 1999, Section 34 & 35). The Act makes an archaeological impact assessment as part of an EIA and EMPR mandatory (see Section 38). No archaeological artefact, assemblage or settlement (site) may be moved or destroyed without the necessary approval from the South African Heritage Resources Agency (SAHRA). Full cognisance is taken of this Act in making recommendations in this report.

- Cognisance will also be taken of the Mineral and Petroleum Resources Development Act (Act No 28 of 2002) and the National Environmental Management Act (Act No 107 of 1998) when making any recommendations.

- Human remains older than 60 years are protected by the NHRA, with reference to Section 36. Human remains that are less than 60 years old are protected by the Regulations Relating to the Management of Human Remains (GNR 363 of 22 May 2013) made in terms of the National Health Act No. 61 of 2003 as well as local Ordinances and regulations.

- With reference to the evaluation of sites, the certainty of prediction is definite, unless stated otherwise.

- The guidelines as provided by the NHRA (Act No. 25 of 1999) in Section 3, with special reference to subsection 3, and the Australian ICOMOS (International Council on Monuments and Sites) Charter (also known as the Burra Charter) are used when determining the cultural significance or other special value of archaeological or historical sites.

- A copy of this report will be submitted on SAHRIS as stipulated by the National Heritage Resources Act (NHRA) (Act No. 25 of 1999), Section 38 (especially subsection 4) and the relevant Provincial Heritage Resources Authority (PHRA).

- Note that the final decision for the approval of permits, or the removal or destruction of sites, structures and artefacts identified in this report, rests with the SAHRA (or relevant PHRA).

6. Study Approach/Methodology

Geographical information (ESRI shapefiles) on the proposed prospecting areas was supplied by SRK Consulting. The most up-to-date Google Earth images and topographic maps were used to indicate the survey area. Topographic maps were sources from the Surveyor General. Please note that all maps are orientated with north facing upwards (unless stated otherwise).

The strategy during this survey was to cover the whole development footprint (relatively small). The survey footprint is generally very homogeneous dominated by shaped embankments and roads for use as 4x4 tracks. The area was surveyed by conducting a pedestrian (foot) survey.

Figure 13: Recorded survey tracks for the project

6.1 Review of existing information/data

Additional information on the cultural heritage of the area was sourced from the following records:

- National Mapping Project by SAHRA (which lists heritage impact assessment reports submitted for South Africa);
- Environmental Potential Atlas (ENPAT)
- Online SAHRIS database;
- National Automated Archival Information retrieval System (NAAIRS)
- Maps and information documents supplied by the client; and
- Heritage surveys conducted in the vicinity of the survey area (published and unpublished material on the area).

A few heritage surveys have been completed in the general vicinity of the project footprint during the last few years. These include historical buildings and features as well as graves. However, no heritage sites were recorded near the survey footprint as indicated by SAHRIS 2021.

The Surveyor General's map of the farm Witkoppie 373 IR indicates that the farm was first surveyed in 1920 with the Deed of Transfer already issued in 10 June 1869 to Johannes Jacobus Bronkhorst (also see Addendum 2).

Although no Late Iron Age sites were recorded near the survey footprint, they do occur in the general region, also rock art is known in the general region (Also see Addendum 1).

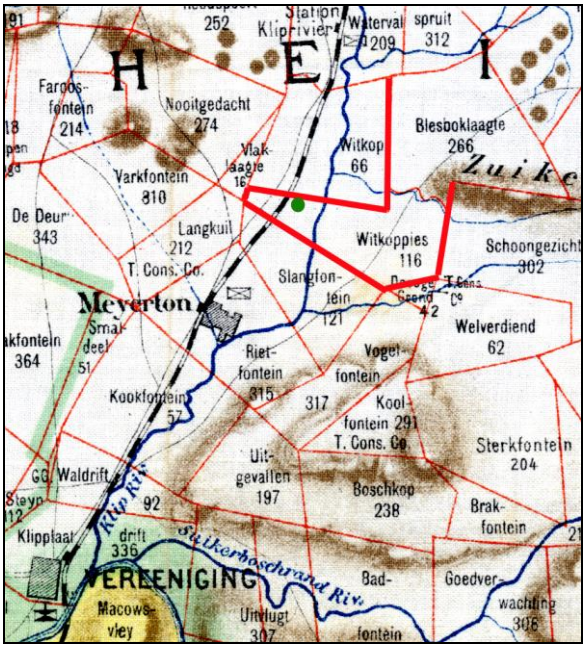

Figure 14: The survey footprint indicated on Jeppe's Map dating to 1899

Figure 15: War Office Map indicating the probable location of the survey area in 1900

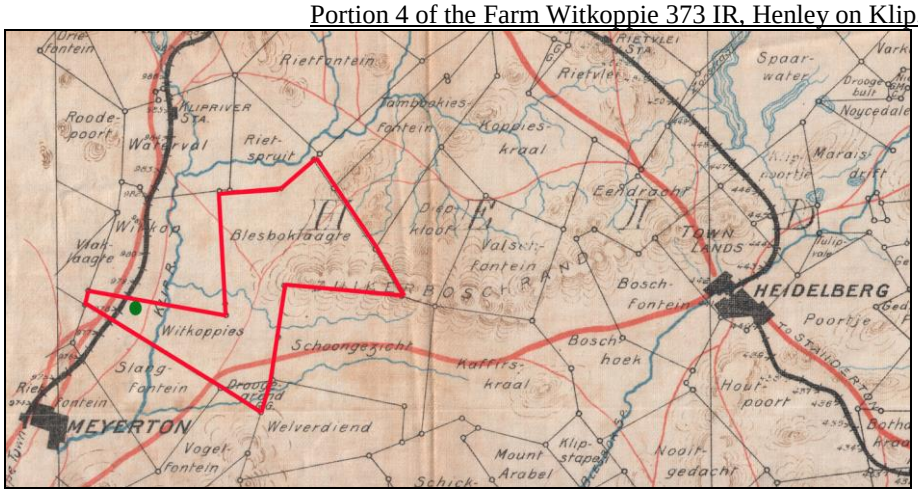

Figure 16: Surveyor General Office, map of Pretoria and Heidelberg 1905

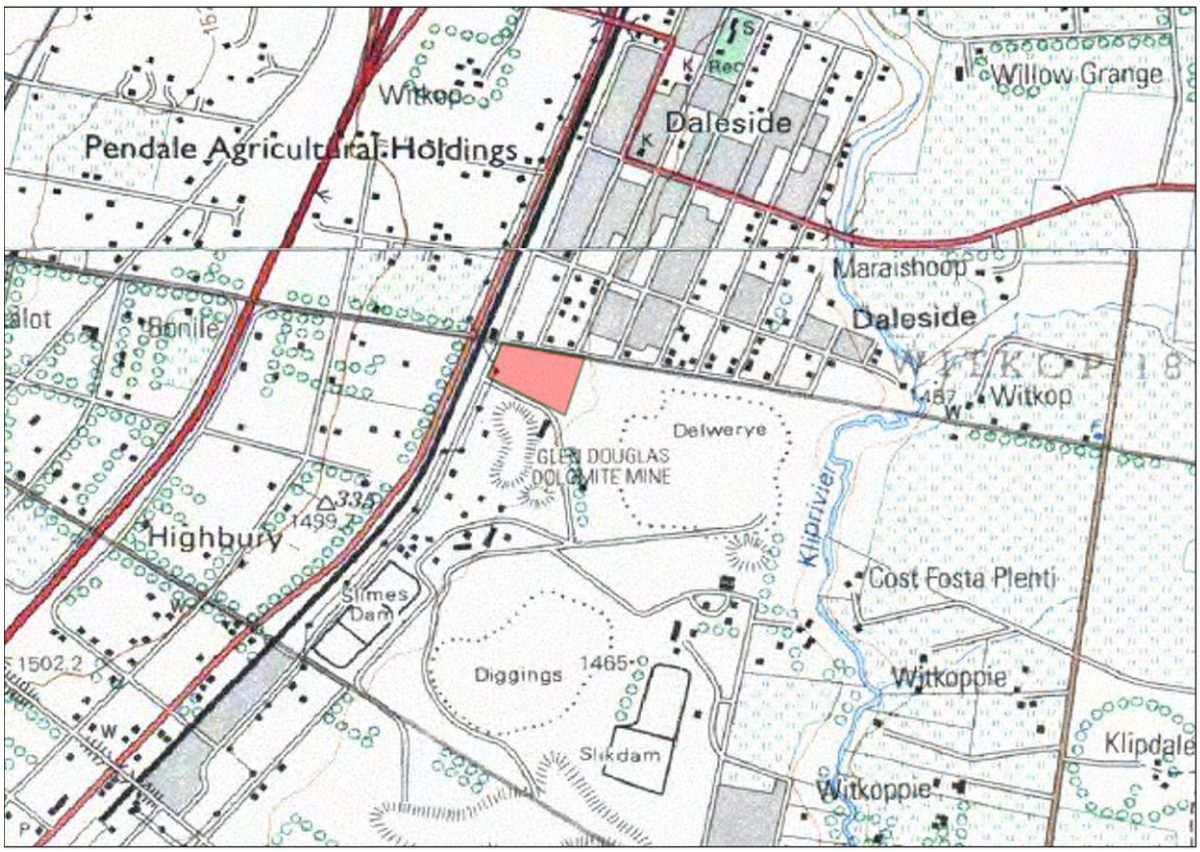

Figure 17: The survey area as indicated on the 1:50 000 topographic map 2628CA (1986)

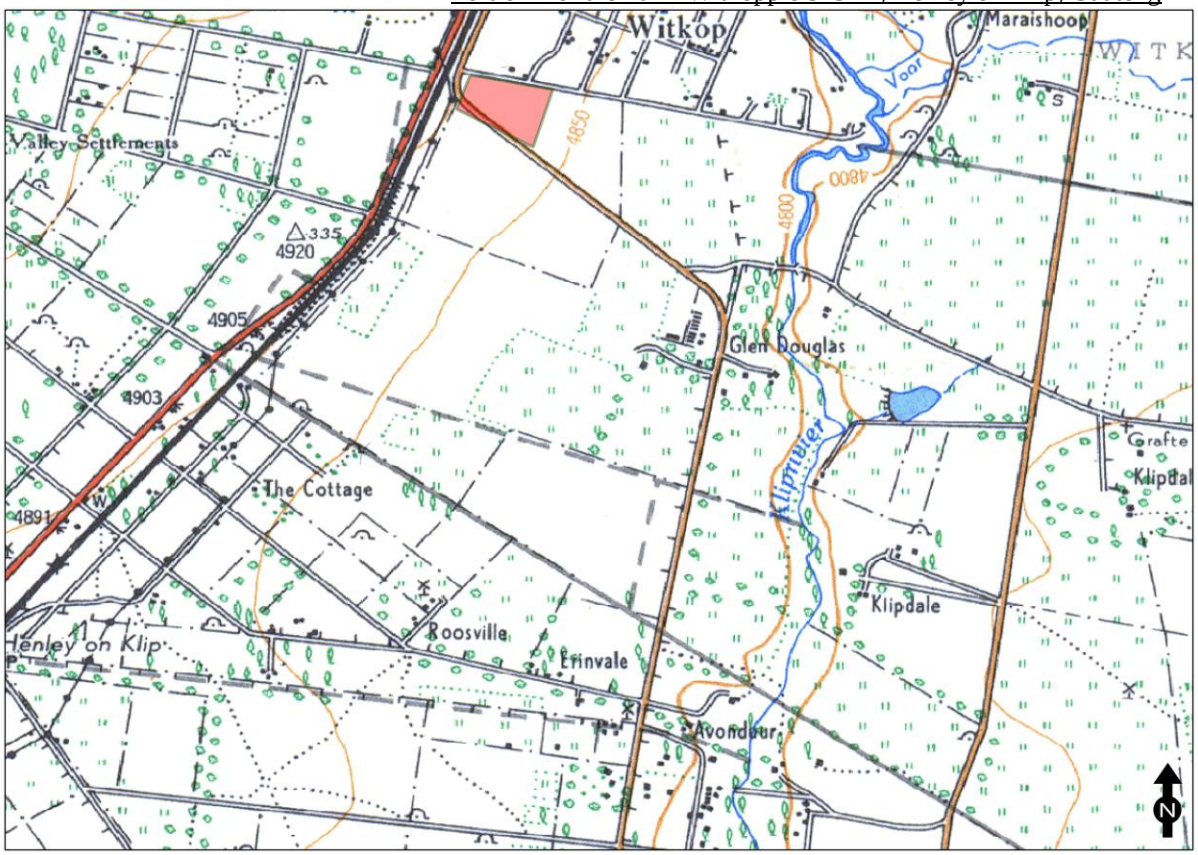

Figure 18: The survey area as indicated on the 1:50 000 topographic map 2628CA (1953)

6.2 Palaeontological sensitivity

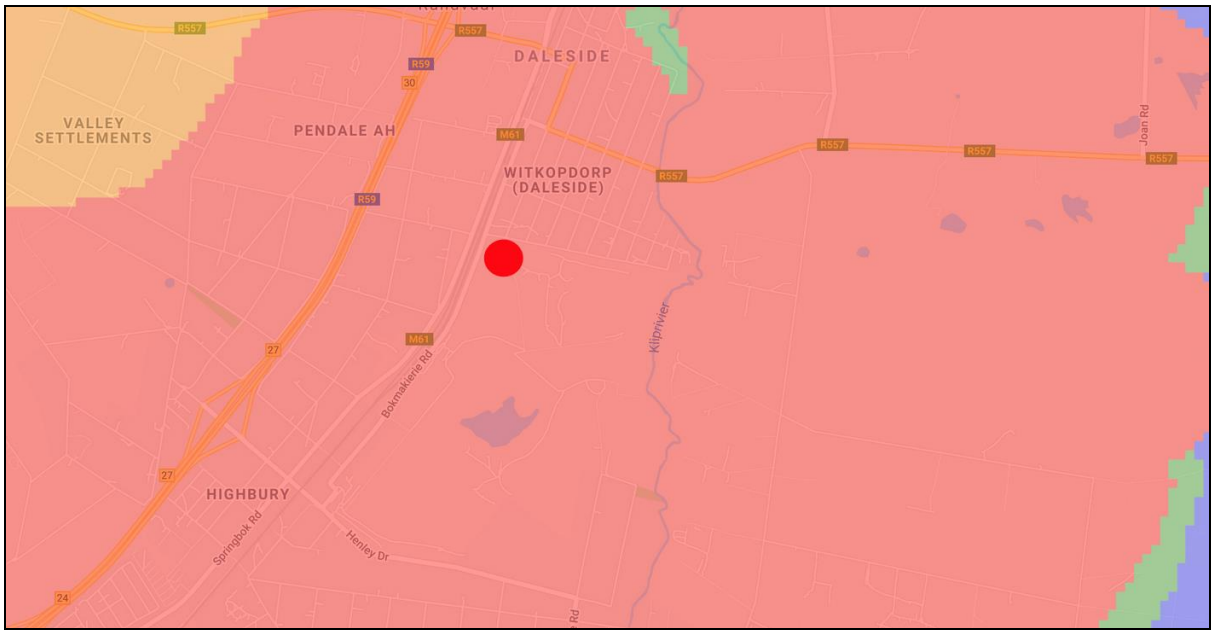

Figure 19: Palaeontological sensitivity zones as indicated for the survey footprint (SAHRIS 2021)

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

The palaeontological sensitivity map was extracted from the SAHRIS database and clearly shows Red (VERY HIGH) sensitivity. As a result a field assessment and protocol for finds will be required for the survey footprint. Please refer to Addendum 3.

6.3 Site visits

The field surveys were conducted on 10 December 2020.

6.4 Social interaction and current inhabitants

Representatives of the mine and current workers knowledgeable of the survey area were consulted during the survey.

6.5 Public Consultation and Stakeholder Engagement

A Public Participation Process (PPP) will be conducted in terms of Chapter 6 of GN No. 982 of 04 December 2014, of the NEMA, 1998 (Act No. 107 of 1998). The Public Participation Guideline in the Integrated Environmental Management Guideline Series (Guideline 7) is also used, as published in Government Gazette No. 35769 on 10 October 2012.

6.6 Assumptions, restrictions, gaps and limitations

No severe physical restrictions were encountered as the survey area was fairly accessible.

6.7 Methodology for assessment of potential impacts

All impacts identified during the EIA stage of the study will be classified in terms of their significance. Issues were assessed in terms of the following criteria:

- The **nature**, a description of what causes the effect, what will be affected and how it will be affected;
- The **physical extent**, wherein it is indicated whether:
    - 1 - the impact will be limited to the site;
    - 2 - the impact will be limited to the local area;
    - 3 - the impact will be limited to the region;
    - 4 - the impact will be national; or
    - 5 - the impact will be international.

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

The significance is determined by combining the criteria in the following formula:

S = (E+D+M) x P; where:
S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

Points	Significance Weighting	Discussion
< 30 points	Low	Where this impact would not have a direct influence on the decision to develop in the area.
31-60 point	Medium	Where the impact could influence the decision to develop in the area unless it is effectively mitigated.
> 60 points	High	Where the impact must have an influence on the decision process to develop in the area.

7. The Cultural Heritage Sites

7.1. Isolated occurrences

Isolated occurrences are artefacts or small features recorded on the surface with no contextual information. No other associated material culture (in the form of structures or deposits) was noted that might provide any further context. This can be the result of various impacts and

environmental factors such as erosion and modern developments. By contrast archaeological sites are often complex sites with evidence of archaeological deposit and various interrelated features such as complex deposits, stone walls and middens. However, these isolated occurrences are seen as remains of erstwhile complex or larger sites and they therefore provide a broad indication of possible types of sites or structures that might be expected to occur or have occurred in the survey footprint.

Throughout the survey footprint no isolated finds were recorded.

7.2 Heritage sites

None

8. 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.

8.1 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 construction 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 NHRA (Act No. 25 of 1999), Section 51. (1).

8.2 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.

9. Recommendations and Conclusions

Stone Age settlements

No Stone Age settlements, structures, features, assemblages or artefacts were recorded during the survey.

Iron Age settlements

No Late Iron Age artefacts, structures, features or settlements were identified during the survey.

Graveyards

No Graveyards or individual graves were identified.

Historical structures

No historical buildings or structures were recorded.

It is therefore recommended, from a cultural heritage perspective, that the proposed expansion of the existing plant, which will include the erection of a brick making plant, offices, bathroom facilities, stores and associated infrastructure may proceed.

However, please note:

Archaeological deposits usually occur below ground level. Should archaeological artefacts or skeletal material be revealed in the area during development activities, such activities should be halted, and a university or museum notified in order for an investigation and evaluation of the find(s) to take place **(*cf*. NHRA (Act No. 25 of 1999)**, Section 36 (6)).

10. References

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Addendum 1: Archaeological and Historical Sequence

The table provides a general overview of the chronological sequence of the archaeological periods in South Africa.

PERIOD	APPROXIMATE DATES
Earlier Stone Age	more than 2 million years ago to >200 000 years ago
Middle Stone Age	<300 000 years ago to >20 000 years ago
Later Stone Age (Includes hunter-gatherer rock art)	<40 000 years ago up to historical times in certain areas
Early Iron Age	c. AD 200 - c. AD 900
Middle Iron Age	c. AD 900 – c. AD 1300
Late Iron Age (Stonewalled sites)	c. AD 1300 - c. AD 1840 (c. AD 1640 - c. AD 1840)

< = less than; > = greater than

Archaeological Context

Stone Age sequence

Concentrations of Early Stone Age (ESA) sites are usually present on the flood-plains of perennial rivers and may date to over 2 million years ago. These ESA open sites may contain scatters of stone tools and manufacturing debris and secondly, large concentrated deposits ranging from pebble tool choppers to core tools such as handaxes and cleavers. The earliest hominins who made these stone tools, probably not always actively hunted, instead relying on the opportunistic scavenging of meat from carnivore fill sites.

Middle Stone Age (MSA) sites also occur on flood plains, but are also associated with caves and rock shelters (overhangs). Sites usually consist of large concentrations of knapped stone flakes such as scrapers, points and blades and associated manufacturing debris. Tools may have been hafted but organic materials, such as those used in hafting, seldom preserve. Limited drive-hunting activities are also associated with this period.

Sites dating to the Later Stone Age (LSA) are better preserved in rock shelters, although open sites with scatters of mainly stone tools can occur. Well-protected deposits in shelters allow for stable conditions that result in the preservation of organic materials such as wood, bone, hearths, ostrich eggshell beads and even bedding material. By using San (Bushman) ethnographic data a better understanding of this period is possible. South African rock art is also associated with the LSA.

The following chronological sequence was recently established by prominent Stone Age archaeologists (Lombard et al 2012):

Later Stone Age

- Age Range: recent to 20-40 thousand years ago
- General characteristics: expect variability between assemblages, a wide range of formal tools, particularly scrapers (microlithic and macrolithic), backed artefacts, evidence of hafted stone and bone tools, borers, bored stones, upper and lower grindstones, grooved stones, ostrich eggshell (OES) beads and other ornaments, undecorated/decorated OES fragments, flasks/flask fragments, bone tools (sometimes with decoration), fishing equipment, rock art, and ceramics in the final phase.

    - **Ceramic or Final Later Stone Age**
        - Generally < 2 thousand years ago
        - MIS 1
        - Contemporaneous with, and broadly similar to, final Later Stone Age, but includes ceramics
        - Economy may be associated with hunter-gatherers or herders

      Technological characteristics
        - Stone tool assemblages are often microlithic
        - In some areas they are dominated by long end scrapers and few backed microliths; in others formal tools are absent or rare
        - Grindstones are common, ground stone artefacts, stone bowls and boat-shaped grinding grooves may occur
        - Includes grit- or grass-tempered pottery
        - Ceramics can be coarse, or well-fired and thin-walled; some times with lugs, spouts and conical bases; sometimes with decoration; sometimes shaped as bowls
        - Ochre is common
        - Ostrich eggshell (OES) is common
        - Metal objects, glass beads and glass artefacts also occur

    - **Final Later Stone Age**
        - 100 – 4000 years ago
        - MIS 1
        - Hunter-gatherer economy

      Technological characteristics
        - Much variability can be expected
        - Variants include macrolithic (similar to Smithfield [Sampson 1974]) and/or microlithic (similar to Wilton) assemblages
        - Assemblages are mostly informal (Smithfield)
        - Often characterised by large untrimmed flakes (Smithfield)

- Sometimes microlithic with scrapers, blades and bladelets, backed tools and adzes (Wilton-like)
- Worked bone is common
- OES is common
- Ochre is common
- Iron objects are rare
- Ceramics are absent

- **Wilton**

- 4000 – 8000 years ago
- MIS 1
- At some sites continues into the final Later Stone Age as regional variants (e.g. Wilton Large Rock Shelter and Cave James)

Technological characteristics

- Fully developed microlithic tradition with numerous formal tools
- Highly standardised backed microliths and small convex scrapers (for definition
- of standardisation see Eerkens & Bettinger 2001)
- OES is common
- Ochre is common
- Bone, shell and wooden artefacts occur

- **Oakhurst**

- 7000 – 12 000 years ago
- MIS 1
- Includes Albany, Lockshoek and Kuruman as regional variants

Technological characteristics

- Flake based industry
- Characterised by round, end, and D-shaped scrapers and adzes
- Wide range of polished bone tools
- Few or no microliths

- **Robberg**

- 12 000 to 18 000 years ago
- MIS 2

Technological characteristics

- Characterised by systematic bladelet (<26mm) production and the occurance of outils ecailles or scaled pieces
- Significant numbers of unretouched bladelets and bladelet cores
- Few formal tools
- Some sites have significant macrolithic elements

- **Early Late Stone Age**
  - 18 000 – 40 000 years ago

- MIS 2-3
- Informal designation
- Also known as transitional MSA-LSA
- Overlapping in time with final Middle Stone Age

Technological Characteristics

- Characterised by unstandardised, often microlithic, pieces and includes the bipolar technique
- Described at some sites, but not always clear whether assemblages represent a real archaeological phase or a mixture of LSA/MSA artefacts

Middle Stone Age

- Age Range: 20 000 – 30 000 years ago
- General characteristics: Levallois or prepared core techniques (for definitions see Van Peer 1992; Boeda 1995; Pleurdeau 2005) occur in which triangular flakes with convergent dorsal scars, often with faceted striking platforms, are produced. Discoidal systems (for definition see Inizan et al. 1999) and intentional blade production from volumetric cores (for definition see Pleurdeau 2005) also occur; formal tools may include unifacially and bifacially retouched points, backed artefacts, scrapers, and denticulates (for definition see Bisson 2000); evidence of hafted tools; occasionally includes marine shell beads, bone points, engraved ochre nodules, engraved OES fragments, engraved bone fragments, and grindstones.
- In the sequence below we highlight differences or characteristics that may be used to refine interpretations depending on context.

- **Final Middle Stone Age**
- 20 000 – 40 000 years ago
- MIS 3
- Informal designation partly based on the Sibudu sequence

Technological characteristics

- Characterised by high regional variability that may include, e.g. bifacial tools, bifacially retouched points, hollow-based points
- Triangular flake and blade industries (similar to Strathalan and Melikane)
- Small bifacial and unifacial points (similar to Sibudu and Rose Cottage Cave)
- Sibudu point characteristics: short, stout, lighter in mass com pared to points from the Sibudu technocomplex, but heavier than those from the Still Bay
- Can be microlithic
- Can include bipolar technology
- Could include backed geometric shapes such as segments, as well as side scrapers

Sibudu

- 45 000 – 58 000 years ago
- MIS 3
- Previously published as informal late Middle Stone Age and post-Howieson's Poort at Sibudu

- Formerly known post-Howieson's Poort, MSA 3 generally, and MSA III at Klasies River

Technological characteristics

- Most points are produced using Levallois technique
- Most formal retouch aimed at producing unifacial points
- Sibudu unifacial point (type fossil) characteristics: faceted platform; shape is somewhat elongated with a mean length of 43.9 mm), a mean breadth of 26.8 mm and mean thickness of 8.8 mm (L/B ratio 1.7); their mean mass is 11.8 g (Mohapi, 2012)
- Some plain butts
- Rare bifacially retouched points
- Some side scrapers are present
- Backed pieces are rare

- **Howieson's Poort**
- 58 000 – 66 000 years ago
- MIS 3-4

Technological characteristics

- Characterised by blade technology
- Includes small (<4 cm) backed tools, e.g. segments, scrapers, trapezes and backed blades
- Some denticulate blades
- Pointed forms are rare or absent

- **Still Bay**
  - 70 000 – 77 000 years ago
  - MIS 4-5a

Technological characteristics

- Characterised by thin (<10 mm), bifacially worked foliate or lanceolate points
- Semi-circular or wide-angled pointed butts
- Could include blades and finely serrated points (Lombard et al. 2010)

- **Pre-Still Bay**
  - 72 000 – 96 000 years ago
  - MIS 4-5

Technological characteristics

- Characteristics currently being determined / studied

- **Mossel Bay**
  - 77 000 to —105 000 years ago
  - MIS 5a-4
  - Also known as MSA II at Klasies River or MSA 2b generally

Technological characteristics

- Characterised by recurrent unipolar Levallois point and blade reduction

- Products have straight profiles; percussion bulbs are prominent and often splintered or ring-cracked
- Formal retouch is infrequent and restricted to sharpening the tip orshaping the butt

- **Klasies River**
  - 105 000 to —130 000 years ago
  - MIS 5d-5e
  - Also referred to as MSA I at Klasies River or MSA 2a generally

Technological characteristics

- Recurrent blade and convergent flake production
- End products are elongated and relatively thin, often with curved profiles
- Platforms are often small with diffused bulbs
- Low frequencies of retouch
- Denticulate pieces

- **Early Middle Stone Age**
  - Suggested age MIS 6 to MIS 8 (130 000 to —300 000 years ago)
  - Informal designation

Technological characteristics

- This phase needs future clarification regarding the designation of cultural material and sequencing
- Includes discoidal and Levallois flake technologies, blades from volumetric cores and a generalised toolkit

- **Earlier Stone Age**
  - Age range: >200 000 to 2 000 000 years ago
  - General characteristics: early stages include simple flakes struck from cobbles, core and pebble tools; later stages include intentionally shaped handaxes, cleavers and picks; final or transitional stages have tools that are smaller than the preceding stages and include large blades.
  - In the sequence below we highlight differences or characteristics that may be used to refine interpretations depending on context.

- **ESA-MSA transition**
- 200 to —600 thousand years ago
- MIS 7-15

Technological characteristics

- Described at some sites as Fauresmith or Sangoan
- Relationships, descriptions, issues of mixing and ages yet to be clarified
- Fauresmith assemblages have large blades, points, Levallois technology, and the remaining ESA components have small bifaces
- The Sangoan contains small bifaces (<100 mm), picks, heavy and light-duty denticulated and notched scrapers
- The Sangoan is less well described than the Fauresmith

- **Acheulean**
  - 300 thousand to —1.5 million years ago
  - MIS 8-50

Technological characteristics

- Bifacially worked handaxes and cleavers, large flakes > 10 cm
- Some flakes with deliberate retouch, sometimes classifiedas scrapers
- Gives impression of being deliberately shaped, but could indicate result of knapping strategy
- Sometimes shows core preparation
- Generally found in disturbed open-air locations

- **Oldowan**
  - 1.5 to >2 million years ago
  - MIS 50-75

Technological characteristics

- Cobble, core or flake tools with little retouch and no flaking to predetermined patterns
- Hammerstones, manuports, cores
- Polished bone fragments/tools

Iron Age Sequence

In the northern regions of South Africa at least three settlement phases have been distinguished for early prehistoric agropastoralist settlements during the **Early Iron Age** (EIA). Diagnostic pottery assemblages can be used to infer group identities and to trace movements across the landscape. The first phase of the Early Iron Age, known as **Happy Rest** (named after the site where the ceramics were first identified), is representative of the Western Stream of migrations, and dates to AD 400 - AD 600. The second phase of **Diamant** is dated to AD 600 - AD 900 and was first recognized at the eponymous site of Diamant in the western Waterberg. The third phase, characterised by herringbone-decorated pottery of the **Eiland** tradition, is regarded as the final expression of the Early Iron Age (EIA) and occurs over large parts of the North West Province, Northern Province, Gauteng and Mpumalanga. This phase has been dated to about AD 900 - AD 1200. These sites are usually located on low-lying spurs close to water.

The **Late Iron Age** (LIA) settlements are characterised by sites without stone walls (Early Moloko settlements such as Icon (AD 1350 – 1500) and stone-walled sites such as Madikwe (AD 1500 – 1700) and Buispoort (AD 1700 – 1800) situated on defensive hilltops. This occupation phase has been linked to the arrival of ancestral Tswana speakers and in the northern regions of South Africa with associated sites dating between the sixteenth and seventeenth centuries AD. The terminal LIA is represented by late 18th/early 19th century settlements with multichrome Moloko pottery commonly attributed to the Sotho-Tswana. These settlements can in many instances be correlated with oral traditions on population movements during which African farming communities sought refuge in mountainous regions during the processes of disruption in the northern interior of South Africa, resulting from the so-called *difaqane* (or m*fecane*).

Most of the archaeological sites occurring in the region are dated to the later (stone walled) phase of the Late Iron Age (c. AD 1640 - AD 1830s) also known as the Late Moloko. These sites all conform to a general settlement layout that forms part of a certain worldview. As such, the livestock enclosures are situated in the central area of a settlement. The court (kgotla) is also located in this central area and is associated with men (men are usually also buried here). The surrounding scalloped walling is where the houses are situated and is associated with women. This type of settlement layout is generally known as the Central Cattle Pattern (CCP).

Historical Context

Vereeniging was founded in 1892 and its early growth is mostly associated with the nearby coal mines. The city is known for being the location where the Treaty of Vereeniging ending the Second Anglo-Boer War (1899–1902) was negotiated. During this conflict, a concentration camp was set up by the British military in the area in September 1900, and by October 1901 housed 185 men, 330 women, and 452 children. Most inmates lived in bell-tents but there was a dispensary and a school. Today, the site of the concentration camp has been replaced by the Maccauvlei Golf Course.

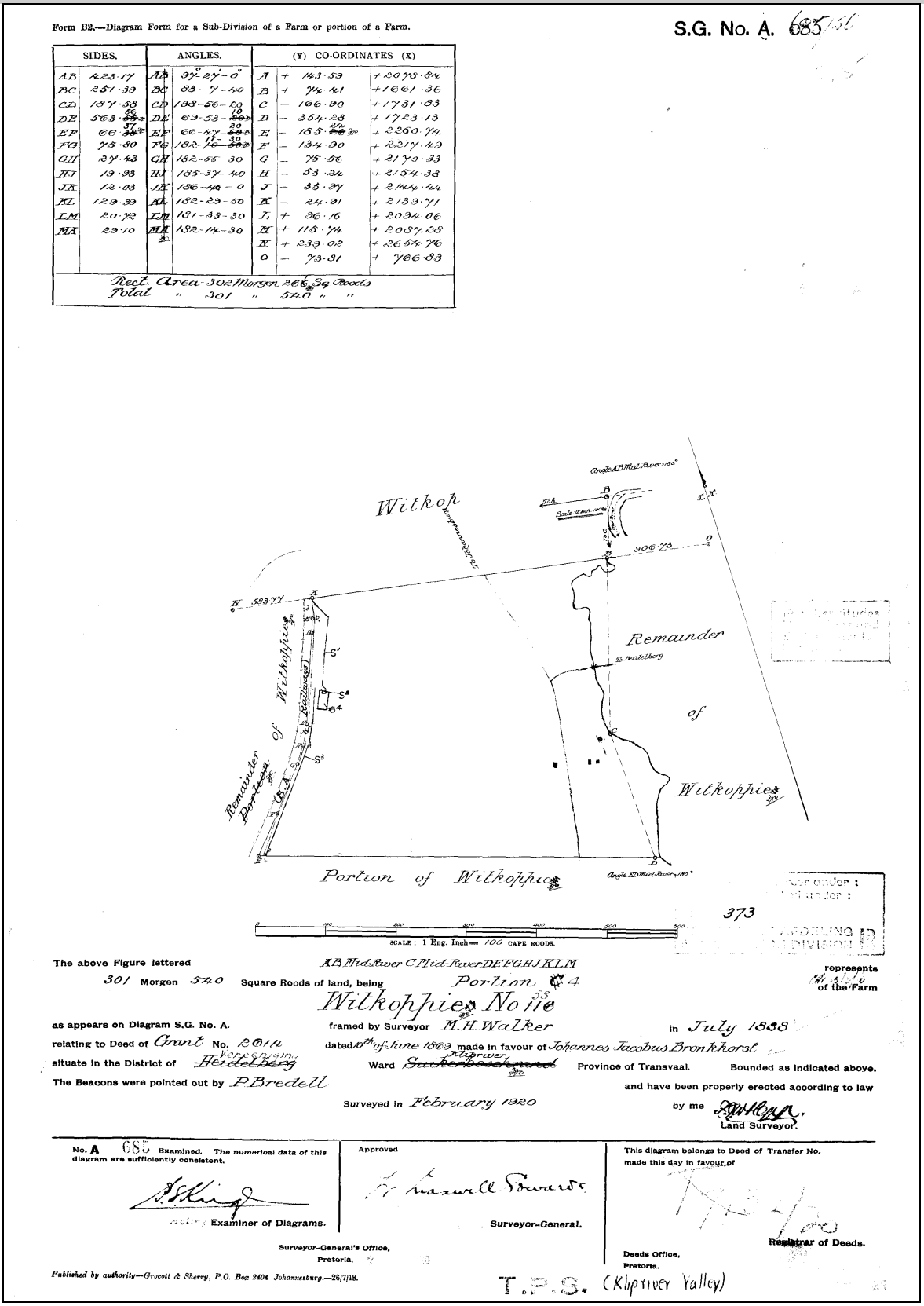
The area around Vereeniging has an extremely rich and long history and archaeological depth. The town was founded in 1892 mainly due to the mining of coal.

During the South African War (1899 – 1902) Vereeniging and environs played a pivotal role. Several of the battles took place in the area and a British concentration camp was also erected near the town. The Treaty of Vereeniging was also signed here after the war.
Several archaeological sites are known in the area:

- Redan Rock Art site consists of approximately 244 panels of engravings (north-east of Vereeniging (on the farm Kookfontein 545 IQ: Declared National Monument in 1971)
- Klip River Terrace is a rich Stone Age site situated to the north of Vereeniging.

Also note that Suikerbosrand Nature Reserve (some 20 km to the east) is well known for its rich Late Iron Age stone-walled settlements such as Kweneng (Sadr 2019).

Addendum 2: Surveyor General Farm Diagram



Form B2.—Diagram Form for a Sub-Division of a Farm or portion of a Farm.

S.G. No. A. 685/51

SIDES.		ANGLES.		(Y) CO-ORDINATES (X)		
AB	423·17	AB	37°-23′-0″	A	+ 143·53	+ 2078·84
BC	251·39	BC	88-7-40	B	+ 74·41	+ 1661·36
CD	187·58	CD	193-56-20	C	− 166·90	+ 1731·83
DE	563·37	DE	63-53-10	D	− 354·28	+ 1723·13
EF	66·36	EF	66-47-20	E	− 155·26	+ 2260·74
FG	73·80	FG	182-10-30	F	− 134·90	+ 2217·43
GH	27·43	GH	182-55-30	G	− 75·56	+ 2170·33
HJ	13·93	HJ	185-37-40	H	− 53·34	+ 2154·38
JK	12·03	JK	186-46-0	J	− 38·37	+ 2144·44
KL	129·39	KL	182-29-50	K	− 24·31	+ 2139·71
LM	20·18	LM	181-33-30	L	+ 36·16	+ 2094·06
MA	23·10	MA	182-14-30	M	+ 115·74	+ 2087·28
				N	+ 233·02	+ 2654·76
				O	− 73·81	+ 766·83

Rect. Area 302 Morgen 266 Sq Roods
Total " 301 " 540 " "

The above Figure lettered A B Mid.River C Mid.River D E F G H J K L M represents 301 Morgen 540 Square Roods of land, being Portion 4 of the Farm Witkoppies No 116

as appears on Diagram S.G. No. A. framed by Surveyor M.H. Walker in July 1888

relating to Deed of Grant No. 2014 dated 10th of June 1869 made in favour of Johannes Jacobus Bronkhorst

situate in the District of Heidelberg Ward Suikerbosrand Province of Transvaal. Bounded as indicated above.

The Beacons were pointed out by P Bredell and have been properly erected according to law

Surveyed in February 1920 by me Land Surveyor.

No. A 685 Examined. The numerical data of this diagram are sufficiently consistent.

Examiner of Diagrams.

Approved

Surveyor-General.

Surveyor-General's Office, Pretoria.

This diagram belongs to Deed of Transfer No. made this day in favour of

Registrar of Deeds.

Deeds Office, Pretoria.

Published by authority—Grocott & Sherry, P.O. Box 2404 Johannesburg.—26/7/18.

T.P.S. (Klipriver Valley)

Figure 20: Surveyor General's sketch of Farm Witkoppie 373 IR which was first surveyed in 1920

Addendum 3: Palaeontological Report

Brick making plant at Henley on Klip
City of Ekurhuleni Metropolitan Municipality, Gauteng Province
Farm: Portion 4 Witkoppie 373-IR
Fourie, H. Dr heidicindy@yahoo.com
012 322 7632/079 940 6048
Palaeontological Impact Assessment: Phase 1: Field Study
Commissioned by: Francois P. Coetzee
On behalf of SRK Consulting,
99 van Deventer Road,
Pierre van Reyneveld,
0157
Ref: Pending
2021/03/02

Irrigasie Formasie – Plant fossil (H. Fourie)

B. Executive summary

Outline of the development project: Francois Coetzee has facilitated the appointment of Dr H. Fourie, a palaeontologist, to undertake a Palaeontological Impact Assessment (PIA), Phase 1: Field Study of the proposed Brick Making Plant at Henley on Klip on Portion 4 Farm Witkoppie 373-IR in the Ekurhuleni Metropolitan Municipality, Gauteng Province.

The applicant, SA Block (Pty) Ltd proposes to expand its production, but on new premises closer to its customer base. A brick making plant will be constructed outside the mining area under 1 500 m^2 roof with a small storage area ± 5 000 m^2 with temporary building structures of a 100 m^2 as offices, bathroom facilities, and stores.

The Project includes one locality Option (Figure 2):

Option 1: A roughly rectangular area outlined in red with an open area to the east, Davids Road to the south, the Witkopdorp (Daleside) directly to the north, and Bokmakierie Road to the west. The area is approximately ±6 600 m^2 in size.

Legal requirements:-

The **National Heritage Resources Act (Act No. 25 of 1999) (NHRA)** requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. The Republic of South Africa (RSA) has a remarkably rich fossil record that stretches back in time for some 3.5 billion years and must be protected for its scientific value. Fossil heritage of national and international significance is found within all provinces of the RSA. South Africa's unique and non-renewable palaeontological heritage is protected in terms of the National Heritage Resources Act. According to this act, palaeontological resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.
The main aim of the assessment process is to document resources in the development area and identify both the negative and positive impacts that the development brings to the receiving environment. The PIA therefore identifies palaeontological resources in the area to be developed and makes recommendations for protection or mitigation of these resources.
For this study, resources such as geological maps, scientific literature, institutional fossil collections, satellite images, aerial maps and topographical maps were used. It provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations (if any) for further specialist palaeontological input where this is considered necessary.
A Palaeontological Impact Assessment is generally warranted where rock units of **LOW to VERY HIGH** palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed area is unknown. The specialist will inform whether further monitoring and mitigation are necessary.

Types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (Act No.25 of 1999):
(i) (i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.
This report adheres to the guidelines of Section 38 (1) of the National Heritage Resources Act (Act No. 25 of 1999).
Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; (b) the construction of a bridge or similar structure exceeding 50 m in length; (c) any development or other activity which will change the character of a site (see Section 38); (d) the re-zoning of a site exceeding 10 000 m² (1 ha) in extent; (e) or any other category of development provided for in regulations by SAHRA or a PHRA authority.

This report (**1c)** aims to provide comment and recommendations on the potential impacts that the proposed development project / mining (if applicable) could have on the fossil heritage of the area and to state if any mitigation or conservation measures are necessary.

Outline of the geology and the palaeontology:
The geology was obtained from map 1:100 000, Geology of the Republic of South Africa (Visser 1984) and 1:250 000, 2628 East Rand (Keyser *et al.* 1986).

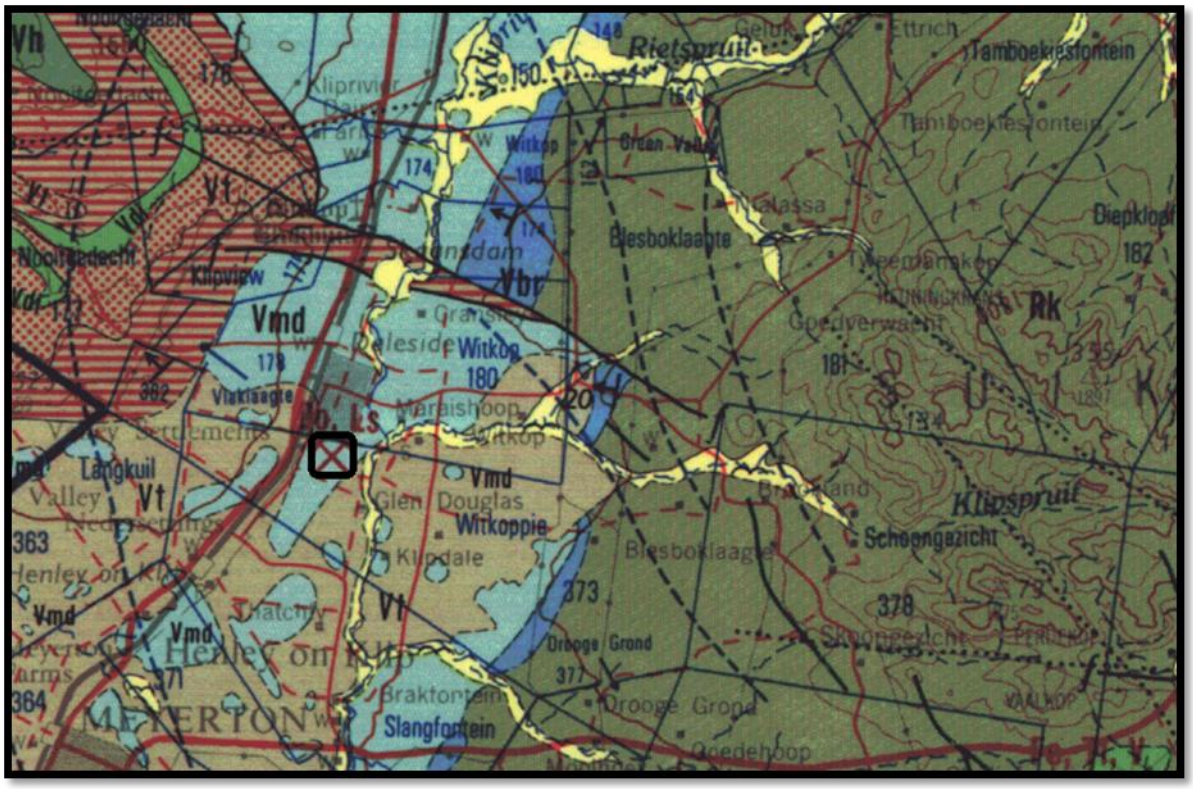


Figure 3: The geology of the development area.
Legend to map and short explanation.
Pv – Sandstone, shale, coal beds (brown). Vryheid Formation, Ecca Group, Karoo Supergroup. Permian.
Vt – Ferruginous shale; ferruginous quartzite (dark brown). Time Ball Hill Formation, Pretoria Group, Transvaal Supergroup. Vaalian.
Vmd – Dolomite, chert (blue). Malmani Subgroup, Chuniespoort Group, Transvaal Supergroup. Vaalian.
Vbr – Quartzite, conglomerate, shale (dark blue). Black Reef Formation, Transvaal Supergroup. Vaalian.
------ – (blue) Lineament (Landsat, aeromagnetic).
------ - Concealed geological boundary.
⊥16˚ – Strike and dip of bed.
□ – Proposed development (blocked in black).

The Chuniespoort Group is made up of chemical and biochemical sediments such as dolomite, chert, limestone and banded iron formation, carbonaceous shale is also present. At the top of the Malmani Subgroup is the Duitschland Formation underlain by the Penge and Monte Christo Formations. Sandstone is mostly absent. Cave formation in the dolomite is a major concern in developing areas, especially in the 1500m thick dolomite of the Malmani Subgroup. Chemical sediments such as fine-grained limestone and dolomite is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites.

Palaeontology - Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of sedimentary strata the palaeontological sensitivity can generally be **LOW** to **VERY HIGH**, and here locally **HIGH** for the Malmani Subgroup, Chuniespoort Group (SG 2.2 SAHRA APMHOB, 2012).

Chemical sediments such as fine-grained limestone and dolomite of the Malmani Subgroup is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. These Early Proterozoic Transvaal stromatolitic dolomites formed and released free oxygen at around 2900 – 2400 Ma. Stromatolites are common in the Malmani dolomites, accepted to be the fossil remnants of the simplest single-celled organisms. They are finely layered, concentric, mound-like structures formed by microscopic algal organisms (Norman and Whitfield 2006).

Summary of findings (**1d**): The Phase 1: Field Palaeontological Impact Assessment was undertaken in February 2021 in summer in hot and dry conditions (**1c)** during the official Level 3 of the Covid-19 lockdown, and the following is reported:

Field Observation – The property is not too large with good visible outcrops, but no fossils on the surface. It is covered with a berm, some mine dumps, a gravel road, grass, weeds, trees and bushes. The property is very disturbed and present in an industrial and agricultural area.

The Project includes one locality Option (Figure 2):
Option 1: A roughly rectangular area outlined in red with an open area to the east, Davids Road to the south, the Witkopdorp (Daleside) directly to the north, and Bokmakierie Road to the west. The area is approximately ±6 600 m^2 in size.

The only Option presented is situated on the Malmani Subgroup, Chuniespoort Group, Transvaal Supergroup.

Recommendation:
The potential impact of the development on fossil heritage is **HIGH** and therefore a Phase 1: Field Survey was necessary for this development. A Phase 2: Mitigation is recommended if fossils are found during development activities (according to SAHRA protocol). For a Chance Fossil Find, the Protocol is attached.

Concerns/threats (**1g**) to be added to the EMPr:

1. Threats to the National Heritage are earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of the fossils by development, vehicle traffic, prospecting, mining, and human disturbance.
2. Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden. An appropriate Protocol and Management plan is attached for the Environmental Control Officer (Appendix 2).

The recommendations are (**1ni, 1niA,1nii)**:

1. Mitigation may be needed (Appendix 2) if fossils are found.
2. No consultation with parties was necessary. The Environmental Control Officer must familiarise him- or herself with the formations present and its fossils.
3. The development may go ahead, but the ECO must survey for fossils before and or after clearing, blasting, drilling or excavating.
4. The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities. For a chance find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation.

5. Care must be taken during the dolomite risk assessment as stromatolites may be present (according SANS 1936-1 (2012)) not to destroy any stromatolites.

Stakeholders: Developer – SA Block (Pty) Ltd.
Environmental – Francois P. Coetzee for SRK Consulting. 99 van Deventer Road, Pierre van Reyneveld, 0157. Tel: 082 707 7338.
Landowner – SA Block (Pty) Ltd.

D. Background information on the project

Report

This report is part of the environmental impact assessment process under the National Environmental Management Act, as amended (Act No. 107 of 1998) (NEMA) and includes Appendix 6 (May 2019) of the Environmental Impact Assessment Regulations (see Appendix 2). It is also in compliance with The Minimum Standards for Palaeontological Components of Heritage Impact Assessment Reports (**2)**, SAHRA, APMHOB, Guidelines 2012, Pp 1-15.

Outline of development

This report discusses and aims to provide the applicant with information regarding the location of palaeontological material that will be impacted by the development. In the construction phase, it may be necessary for the applicant to apply for the relevant permit from the South African Heritage Resources Agency (SAHRA / PHRA) if a fossil is unearthed.

The applicant, SA Block (Pty) Ltd proposes to expand its production, but on new premises closer to its customer base. A brick making plant will be constructed outside the mining area under 1 500 m^2 roof with a small storage area ± 5 000 m^2 with temporary building structures of a 100 m^2 as offices, bathroom facilities, and stores.
The Project includes the following related infrastructure (**1f)**:

- Temporary buildings.
- Parking bays.
- Storage area,
- Plant.

Local benefits of the proposed development include benefits to the local economy through possible job creation, poverty alleviation, food security, and local supplier procurement during the construction phase as well as during the operational phase of the development.

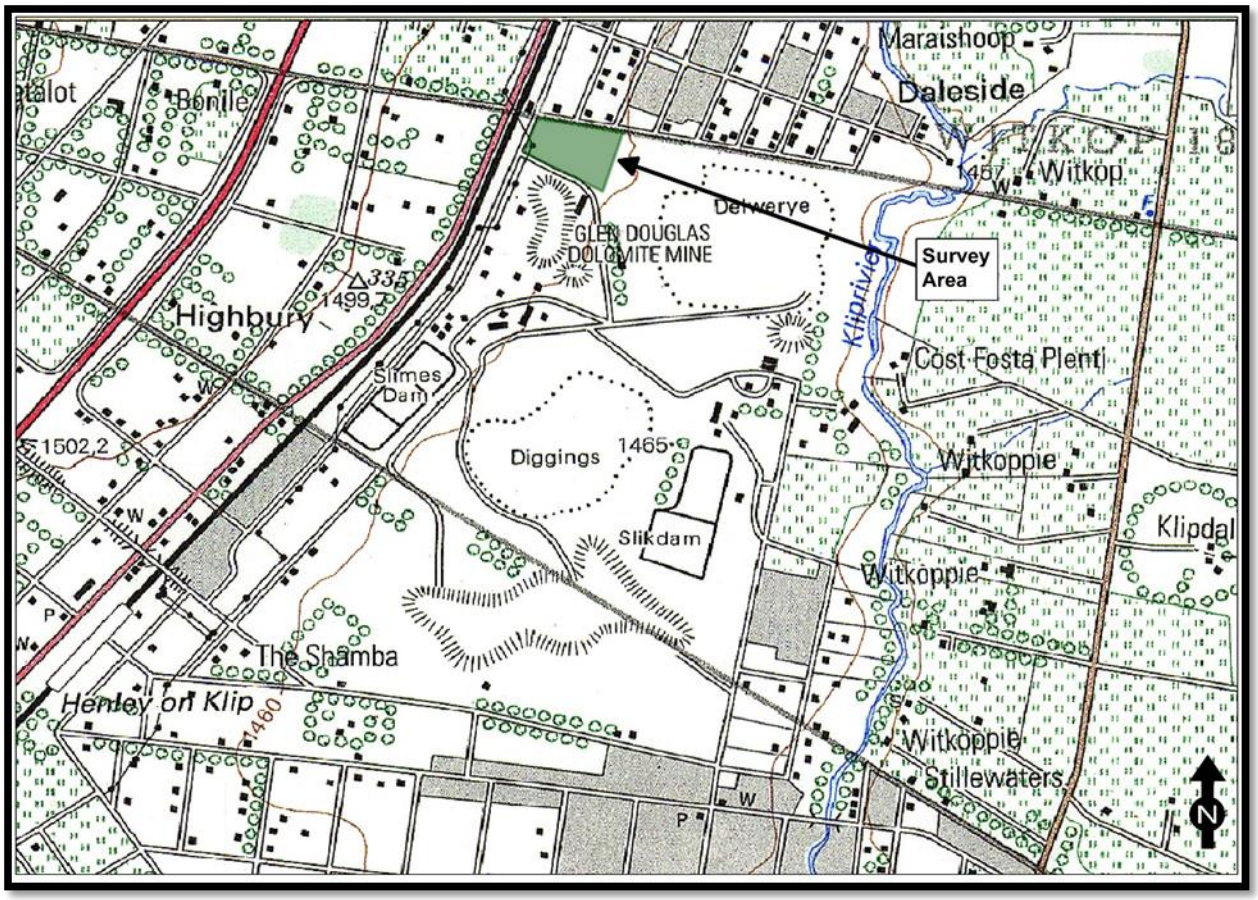


Figure 1: Topographic map (Coetzee)

The Project includes one locality Option (Figure 2):

Option 1: A roughly rectangular area outlined in red with an open area to the east, Davids Road to the south, the Witkopdorp (Daleside) directly to the north, and Bokmakierie Road to the west. The area is approximately ±6 600 m^2 in size.

Rezoning/ and or subdivision of land: No.

Name of developer and Environmental consultant: SA Block (Pty) Ltd and F. Coetzee for SRK Consulting.

Terms of reference: Dr H. Fourie is a palaeontologist commissioned to do a palaeontological impact assessment: field study to ascertain if any palaeontological sensitive material is present in the development area. This study will advise on the impact on fossil heritage mitigation or conservation necessary, if any.

Curriculum vitae – short (**1aii, 1aii)**: Dr Fourie obtained a Ph.D from the Bernard Price Institute for Palaeontological Research (now ESI), University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. She is currently employed by Ditsong: National Museum of Natural History as Curator of the fossil plant, invertebrate, amphibian, fish, reptile, dinosaur and Therapsid collections. For the past 13 years she carried out field work in the Eastern Mpumalanga Provinces. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 25 years.

Legislative requirements: South African Heritage Resources Agency (SAHRA) for issue of permits if necessary. National Heritage Resources Act (Act No. 25 of 1999). An electronic copy of this report must be supplied to SAHRA.

E. Description of property or affected environment

Location and depth:

The proposed construction of a brick making plant at Henley on Klip will be situated on Portion 4 Witkoppie 373-IR, in the Ekurhuleni Metropolitan Municipality, Gauteng Province.

Depth is determined by the related infrastructure to be developed and the thickness of the formation in the development area as well as depth of the foundations, footings and channels to be developed. Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to determine due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot. Geological maps do not provide depth or superficial cover, it only provides mappable surface outcrops. The depth can be verified with test pit results or drill cores and is determined by the depth of the building construction.

Figure 2: Google.Earth location map (Coetzee).

The Project includes one locality Option (Figure 2) near Meyerton:

Option 1: A roughly rectangular area outlined in red with an open area to the east, Davids Road to the south, the Witkopdorp (Daleside) directly to the north, and Bokmakierie Road to the west. The area is approximately ±6 600 m^2 in size.

F. Description of the Geological Setting

Description of the rock units:

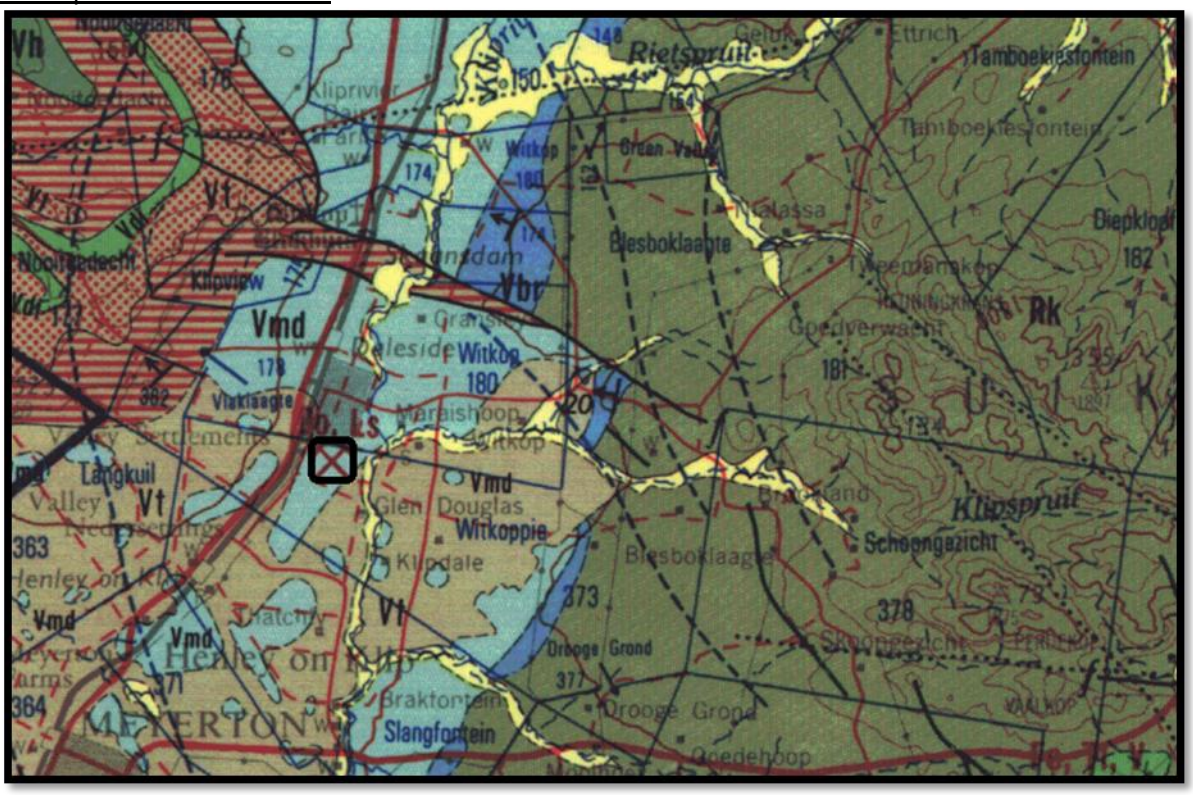


Figure 3: Excerpt of 1:250 000 Geological Map 2628 East Rand (Keyser *et al.* 1986) (**1h**).

Legend to map and short explanation.

Pv – Sandstone, shale, coal beds (brown). Vryheid Formation, Ecca Group, Karoo Supergroup. Permian.

Vt – Ferruginous shale; ferruginous quartzite (dark brown). Time Ball Hill Formation, Pretoria Group, Transvaal Supergroup. Vaalian.

Vmd – Dolomite, chert (blue). Malmani Subgroup, Chuniespoort Group, Transvaal Supergroup. Vaalian.

Vbr – Quartzite, conglomerate, shale (dark blue). Black Reef Formation, Transvaal Supergroup. Vaalian.

------ – (black) Lineament (Landsat, aeromagnetic).

------ - Concealed geological boundary.

⊥20˚ – Strike and dip of bed.

□ – Proposed development (blocked in black).

Mining Activities on Figure 3:

Do – Dolomite Ls - Limestone

The mining past and present has an influence on the development.

The Transvaal Supergroup fills an east-west elongated basin in the south-central part of the old Transvaal (now North – West, Gauteng and Mpumalanga) as far south as Potchefstroom. It is Vaalian in age, approximately 2600 Ma to 2100 Ma. A maximum thickness of the Transvaal Supergroup reaches 2000 m in the north-eastern section. The east-west elongated basin is filled with clastic, volcanic and chemical sedimentary rocks. Three groups based on lithological differences have been established: they are the Rooiberg, Pretoria and Chuniespoort Groups as well as other smaller groups

(Kent 1980, Snyman 1996). It is the Bushveld Complex that is responsible for the tilting of the Transvaal sediments and the heat of its intrusion having created andalusite crystals (Norman and Whitfield 2006). This Supergroup is underlain by the Ventersdorp, Witwatersrand and Pongola Supergroups, and the Dominion Group. Three prominent ridges are present from the oldest to the youngest, the Time Ball Hill, Daspoort and Magaliesberg Formations (Norman and Whitfield 2006).

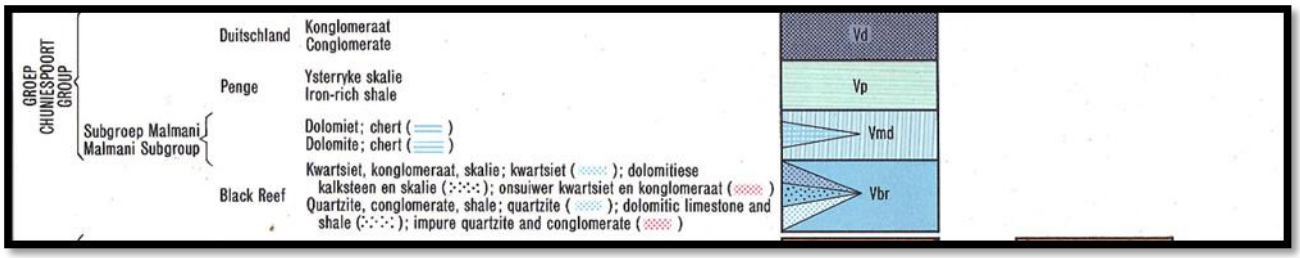


Figure 4: Lithostratigraphy (Walraven 1978).

The Chuniespoort Group is made up of chemical and biochemical sediments such as dolomite, chert, limestone and banded iron formation, carbonaceous shale is also present. At the top of the Malmani Subgroup is the Duitschland Formation underlain by the Penge and Monte Christo Formations. Sandstone is mostly absent. It is this formation that has great economic value for its lead, zinc, dolomite, and manganese (Kent 1980, Snyman 1996). Fluorspar, concrete aggregate, iron ore and manganese are also mined from this formation. Cave formation in the dolomite is a major concern in developing areas, especially in the 1500m thick dolomite of the Malmani Subgroup. Chemical sediments such as fine-grained limestone and dolomite is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. The Black Reef Formation is known for stromatolite carbonates and fossiliferous Late Cenozoic cave breccias similar to the Malmani dolomite.

The Black Reef Formation of the Transvaal Supergroup consists of quartzite with lenses of grit and conglomerate. Shale is always present, particularly near the top close to the contact with the overlying dolomite (Kent 1980). It is Vaalian in age and not very thick, only up to 500m in the north-east. It contains a fair amount of gold and the limestone is mined (Snyman 1996). The Black Reef Formation is known for stromatolite carbonates and fossiliferous Late Cenozoic cave breccias similar to the Malmani dolomite. Algal microfossils are reported from shales and are probably from diagenetic origin. Stromatolites are preserved in the subordinate carbonate rocks.

Vaalian to post-Mokolian diabase (di) intrusions occur throughout the area in the form of plates, sills and dykes. These plates are common in the Transvaal Supergroup and when present in the Pretoria Group they are referred to as the Transvaal diabase (Kent 1980, Visser 1989). The diabase sills of Bushveld age (Norman and Whitfield 2006) are typically fine-grained, green-grey with plagioclase and pyroxenes (Visser 1989).

Field Observation – The property is not too large with good visible outcrops, but no fossils on the surface. It is covered with a berm, some mine dumps, a gravel road, grass, weeds, trees and bushes. The property is very disturbed and present in an industrial and agricultural area.

Figure 5: The foundation of a building is present on site and possibly an old surfaced road.

Figure 6: View towards south-west corner of property.

Figure 7: View towards the south-east.

Figure 8: Chert on site.

Figure 9: Dolomite on site.

Figure 10: View in middle of site, very overgrown.

Figure 11: View in the south.

G. Background to Palaeontology of the area (1j)

Summary: When rock units of moderate to very high palaeontological sensitivity are present within the development footprint, a desk top and or field scoping (survey) study by a professional palaeontologist is usually warranted. The main purpose of a field scoping (survey) study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase may be required (SG 2.2 SAHRA AMPHOB, 2012).

One of the formations in the development area may contain fossils. Nixon *et al.* (1988) described the black shales south-west of Potchefstroom as consisting of overlapping laminated basal mounds which are stromatolitic as well as spheroidal possible planktonic fossil algae. These can range in size from 3.5 - 17 mm in height and up to 10 mm in diameter and can be present in the development area.

Chemical sediments such as fine-grained limestone and dolomite of the Malmani Subgroup is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. These Early Proterozoic Transvaal stromatolitic dolomites formed and released free oxygen at around 2900 – 2400 Ma. Stromatolites are common in the Malmani dolomites, accepted to be the fossil remnants of the simplest single-celled organisms. They are finely layered, concentric, mound-like structures formed by microscopic algal organisms (Norman and Whitfield 2006). Chert may contain fossils such as echinoids or sponges if nodular, although not common and is rated unlikely.

Figure 12: Photograph of a stromatolite (E. Butler).

Stromatolites are significant indicators of palaeoenvironments and provide evidence of algal growth between 2640 and 2432 million years ago (Groenewald and Groenewald 2014). Caves in the Malmani dolomite (Vmd) of the Transvaal Supergroup provided a refuge for man's distant ancestors (Norman and Whitfield 2006). These caves are also home to Middle and Late Stone Age cultures. The cave breccia in the Cradle of Humankind, near Johannesburg, yielded internationally renowned hominins such as *Australopithecus africanus and robustus* and extinct mammals and other fauna. The caves are actively being researched and excavated and this has led to many international collaborations. The caves are filled with sediments from the Kalahari Group.

In the rocks overlying the Black Reef Formation there is evidence for life on an abundant scale as cyanobacteria came to dominate the shallow sea forming stromatolites of varying shapes. Large, elongate stromatolite domes can be seen at Boetsap in the North West Province (McCarthy and Rubidge 2005) and the algal microfossils reported from the Time Ball Hill Formation shales are probably of diagenetic origin (Eriksson 1999).

Fossils will be present in caves, calctufa and pans and examples are a wide range of mammalian bones and teeth, tortoise remains, ostrich egg, non-marine mollusc shells, ostracods, diatoms, other micro fossils, trace fossils, stromatolites, plant remains and wood (Groenewald and Groenewald 2014).

Table 1: Taken form The Palaeotechnical Report (Groenewald and Groenewald 2014) (**1cA)**.

Duitschland (Vd)		Conglomerate	No fossils recorded	Good examples of stromatolites in Cradle of Humankind region ALERT FOR POTENTIALLY FOSSILIFEROUS LATE CAENOZOIC CAVE BRECCIAS WITHIN "TRANSVAAL DOLOMITE" OUTCROP AREA (breccias not individually mapped)
Penge (Vp)		Iron-rich shale	Stromatolites	
		Stromatolitic carbonates (limestones / dolomites), minor secondary cherts, mudrocks including carbonaceous shales	Range of shallow marine to intertidal stromatolites (domes, columns etc), organic-walled microfossils	
Black Reef (Vbr)		Siliciclastic sediments (mature sandstones plus minor mudrocks, conglomerates) deposited during a fluvial to shallow marine transition	Possible equivalent of Black Reef Fm in N. Cape (Vryburg Formation) contains stromatolitic carbonates	

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally **LOW** to **VERY HIGH**.

Table 2: Criteria used (Fossil Heritage Layer Browser/SAHRA) (**1cB)**.

Rock Unit	Significance/vulnerability	Recommended Action
Malmani Subgroup	**High**	Desktop Study and Phase 1: Field Assessment
Black Reef Formation	**Moderate**	Desktop Study and Phase 1 likely

Databases and collections: Ditsong: National Museum of Natural History. Evolutionary Studies Institute, University of the Witwatersrand (ESI).
Impact: **HIGH**. There may be significant fossil resources that may be impacted by the development (shale/dolomite).

The project includes one locality Option (Figure 2) with the above impact.
Option 1: A roughly rectangular area outlined in red with an open area to the east, Davids Road to the south, the Witkopdorp (Daleside) directly to the north, and Bokmakierie Road to the west. The area is approximately ±6 600 m^2 in size.

H. Description of the Methodology (1e)
The palaeontological impact assessment desktop study was undertaken in February 2021 during the official covid-19 lockdown. A Phase 1: Field Study includes a walk through and drive through of the affected portion and photographs (in 20 mega pixels) taken of the site with a digital camera (Canon PowerShot SX620HS). It may be necessary to use a Global Positioning System (GPS) (Garmin eTrex 10) to record outcrops if not covered with topsoil, subsoil, overburden, and vegetation. A literature survey is included and the study relied on literature, geological maps, google.maps, and google.earth images.

SAHRA Document 7/6/9/2/1 requires track records/logs from archaeologists not palaeontologists as palaeontologists concentrate on outcrops which may be recorded on a GPS. Isolated occurrences of rocks usually do not constitute an outcrop. Fossils can occur in dongas, as nodules, in fresh rock exposures, and in riverbeds. Finding fossils require the experience and technical knowledge of the professional palaeontologist, but that does not mean that an amateur can't find fossils. The geology of the region is used to predict what type of fossil and zone will be found in any particular region. An archaeozoologist can be called upon to survey for more recent fossils in the Quaternary and Tertiary deposits, if present.

Assumptions and Limitations (**1e**):-
The accuracy and reliability of the report may be limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist.
2. Variable accuracy of geological maps and associated information.
3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.
5. Lack of rocky outcrops.
6. Inaccessibility of site.
7. Insufficient data from developer and exact lay-out plan for all structures (for this report all required data/information was provided).

A Phase 1 Palaeontological Impact Assessment: Field Study will include:

1. Recommendations for the future of the site.
2. Background information on the project.
3. Description of the property of affected environment with details of the study area.
4. Description of the geological setting and field observations.
5. Background to palaeontology of the area.
6. Heritage rating.
7. Stating of significance (Heritage Value).

A Phase 2 Palaeontological Impact Assessment: Mitigation will include:

1. Recommendations for the future of the site.
2. Description of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan.
6. Possible declaration as a heritage site or Site Management Plan.

The National Heritage Resources Act No. 25 of 1999 further prescribes -

Act No. 25 of 1999. National Heritage Resources Act, 1999.

The National Estate as: 3 (2) (f) archaeological and palaeontological sites, (i)(1) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens,

Heritage assessment criteria and grading used: (a) Grade 1: Heritage resources with qualities so exceptional that they are of special national significance;

(b) Grade 2: 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 (c) Grade 3: Other heritage resources worthy of conservation.

SAHRA is responsible for the identification and management of Grade 1 heritage resources.

Provincial Heritage Resources Authority (PHRA) identifies and manages Grade 2 heritage resources.

Local authorities identify and manage Grade 3 heritage resources.

No person may damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a provincially protected place or object without a permit issued by a heritage resources authority or local authority responsible for the provincial protection.

Archaeology, palaeontology and meteorites: Section 35.

(2) Subject to the provisions of subsection (8) (a), all archaeological objects, palaeontological material and meteorites are the property of the State.

> (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.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before a Phase 2 may be implemented.
The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.
Should further fossil material be discovered during the course of the development (*e. g.* during bedrock excavations), this must be safeguarded, where feasible *in situ,* and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (*e. g.* Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.
When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.
Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

I. Description of significant fossil occurrences

One of the formations in the development area may contain fossils. Nixon *et al.* (1988) described the black shales south-west of Potchefstroom as consisting of overlapping laminated basal mounds which are stromatolitic as well as spheroidal possible planktonic fossil algae. These can range in size from 3.5 - 17 mm in height and up to 10 mm in diameter and can be present in the development area.

Chemical sediments such as fine-grained limestone and dolomite of the Malmani Subgroup is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. These Early Proterozoic Transvaal stromatolitic dolomites formed and released free oxygen at around 2900 – 2400 Ma. Stromatolites are common in the Malmani dolomites, accepted to be the fossil remnants of the simplest single-celled organisms. They are finely layered, concentric, mound-like structures formed by microscopic algal organisms (Norman and Whitfield 2006). Chert may contain fossils such as echinoids or sponges if nodular, although not common and is rated unlikely.

Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to be determined due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot.

The threats to the National Palaeontological Heritage are:- earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, prospecting, mining activities, the sealing-in or destruction of fossils by development, vehicle traffic, and human disturbance. See Description of the Geological Setting (F) above.

J. Recommendation (1o,1p, 1q)

a. There is no objection (see Recommendation B) to the development, it was necessary to request a Phase 1 Palaeontological Impact Assessment: Field study to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity is **HIGH**. A Phase 2 Palaeontological Mitigation is only required if a Phase 1 Palaeontological Assessment identified a fossiliferous formation or surface fossils or if fossils are found during clearing, construction excavations, drilling and blasting. The Protocol for Chance Finds and Management Plan is attached (Appendix 2) for the ECO.
b. This project will benefit the environment, economy, and social development of the community.
c. Preferred choice: One Option is presented and possible (see Executive Summary).
d. The following should be conserved: if any palaeontological material is exposed during clearing, digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped, a 30 m no-go barrier constructed, and a palaeontologist should be called in to determine proper mitigation measures.
e. Consultation with parties was not necessary.
f. This report must be submitted to SAHRA together with the Heritage Impact Assessment.

Sampling and collecting:
Wherefore a permit is needed from the South African Heritage Resources Agency (SAHRA / PHRA).

a. Objections: Cautious. See heritage value and recommendation.
b. Conditions of development: See Recommendation.
c. Areas that may need a permit: Only if a fossil is unearthed.
d. Permits for mitigation: **SAHRA/PHRA**.

K. Conclusions

a. All the land involved in the development was assessed and none of the property is unsuitable for development (see Recommendation B).
b. All information needed for the Phase 1 Palaeontological Impact Assessment and Field scope was provided by the Consultant. All technical information was provided by F. Coetzee.
c. Areas that would involve mitigation and may need a permit from the South African Heritage Resources Agency are discussed.
d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling or blasting, SAHRA must be notified. All development activities must be stopped, a 30 m no-go barrier constructed and a palaeontologist should be called in to determine proper mitigation measures, especially for shallow caves.
e. Condition in which development may proceed: It is further suggested that a Section 37(2) agreement of the Occupational, Health and Safety Act 85 of 1993 is signed with the relevant contractors to protect the environment (fossils) and adjacent areas as well as for safety and security reasons.

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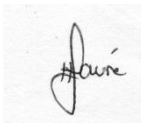
Declaration (disclaimer) (1b)

I, Heidi Fourie, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project for which I was appointed to do a palaeontological assessment. There are no circumstances that compromise the objectivity of me performing such work.

I accept no liability, and the client, by receiving this document, indemnifies me against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the use of the information contained in this document.

It may be possible that the PIA Desktop Study may have missed palaeontological resources in the project area as outcrops are not always present or visible due to vegetation while others may lie below the overburden of earth and may only be present once development commences.

This report may not be altered in any way and any parts drawn from this report must make reference to this report.



Heidi Fourie
2021/03/02

Appendix 1 (**1k,1l,1m**): **Protocol for Chance Finds and Management plan for EMP'r**

This section covers the recommended protocol for a Phase 2 Mitigation process as well as for reports where the Palaeontological Sensitivity is **LOW**; this process guides the palaeontologist / palaeobotanist on site and should not be attempted by the layman / developer. As part of the Environmental Authorisation conditions, an Environmental Control Officer (ECO) will be appointed to oversee the construction activities in line with the legally binding Environmental Management Programme (EMPr) so that when a fossil is unearthed they can notify the relevant department and specialist to further investigate. Therefore, the EMPr must be updated to include the involvement of a palaeontologist during the digging and excavation (ground breaking) phase of the development.

The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities.

- The protocol is to immediately cease all construction activities if a fossil is unearthed and contact SAHRA for further investigation.
- The area must be fenced-off with a 30 m barrier and the construction workers must be informed that this is a no-go area.
- If fossils were found, they must be placed in a safe area for further investigation.
- The ECO should familiarise him- or herself with the fossiliferous formations and its fossils.
- A site visit is recommended after drilling, excavations and blasting and the keeping of a photographic record. A regular monitoring presence over the period during which excavations are made, by a palaeontologist, is generally not practical, but can be done during ground breaking.
- The Evolutionary Studies Institute, University of the Witwatersrand has good examples of Ecca Group Fossils.
- The developer may be asked to survey the areas affected by the development and indicate on plan where the construction / development will take place. Trenches may have to be dug to ascertain how deep the sediments are above the bedrock (can be a few hundred metres). This will give an indication of the depth of the topsoil, subsoil, and overburden, if need be trenches should be dug deeper to expose the interburden.

Mitigation will involve recording, rescue and judicious sampling of the fossil material present in the layers sandwiched between the geological / coal layers (if present). It must include information on number of taxa, fossil abundance, preservational style, and taphonomy. This can only be done during mining or excavations. In order for this to happen, in case of coal mining operations, the process will have to be closely scrutinised by a professional palaeontologist / palaeobotanist to ensure that only the

coal layers are mined and the interlayers (siltstone and mudstone) are surveyed for fossils or representative sampling of fossils are taking place.

The palaeontological impact assessment process presents an opportunity for identification, access and possibly salvage of fossils and add to the few good fossil localities. Mitigation can provide valuable onsite research that can benefit both the community and the palaeontological fraternity.

A Phase 2 study is very often the last opportunity we will ever have to record the fossil heritage within the development area. Fossils excavated will be stored at a National Repository.

A Phase 2 Palaeontological Impact Assessment: Mitigation will include (SAHRA) -

1. Recommendations for the future of the site.
2. Description and purpose of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan and map.
6. Possible declaration as a heritage site or Site Management Plan.
7. Stakeholders.
8. Detailed report including the Desktop and Phase 1 study information.
9. Annual interim or progress Phase 2 permit reports as well as the final report.
10. Methodology used.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

The Palaeontological Society of South Africa (PSSA) does not have guidelines on excavating or collecting, but the following is suggested:

1. The developer needs to clearly stake or peg-out (survey) the areas affected by the mining (if applicable)/ construction/ development operations and dig representative trenches and if possible supply geological borehole data.
2. When clearing topsoil, subsoil or overburden and hard rock (outcrop) is found, the contractor / developer needs to stop all work.
3. A Palaeobotanist / palaeontologist (contact SAHRIS for list) must then inspect the affected areas and trenches for fossiliferous outcrops / layers. The contractor / developer may be asked to move structures, and put the development on hold.
4. If the palaeontologist / palaeobotanist is satisfied that no fossils will be destroyed or have removed the fossils, development and removing of the topsoil can continue.
5. After this process the same palaeontologist / palaeobotanist will have to inspect and offer advice through the Phase 2 Mitigation Process. Bedrock excavations for footings may expose, damage or destroy previously buried fossil material and must be inspected.
6. When permission for the development is granted, the next layer can be removed, if this is part of a fossiliferous layer, then with the removal of each layer of sediment, the palaeontologist / palaeobotanist must do an investigation (a minimum of once a week).
7. At this stage the palaeontologist / palaeobotanist in consultation with the developer / mining company must ensure that a further working protocol and schedule is in place. Onsite training should take place, followed by an annual visit by the palaeontologist / palaeobotanist.

Fossil excavation if necessary, during Phase 2:

1. Photography of fossil / fossil layer and surrounding strata.
2. Once a fossil has been identified as such, the task of extraction begins.

3. It usually entails the taking of a GPS reading and recording lithostratigraphic, biostratigraphic, date, collector and locality information.
4. Use Paraloid (B-72) as an adhesive and protective glue, parts of the fossil can be kept together (not necessarily applicable to plant fossils).
5. Slowly chipping away of matrix surrounding the fossil using a geological pick, brushes and chisels.
6. Once the full extent of the fossil / fossils is visible, it can be covered with a plaster jacket (not necessarily applicable to plant fossils).
7. Chipping away sides to loosen underside.
8. Splitting of the rock containing palaeobotanical material should reveal any fossils sandwiched between the layers.

SAHRA Documents:
Guidelines to Palaeontological Permitting Policy.
Minimum Standards: Palaeontological Component of Heritage Impact Assessment reports.
Guidelines for Field Reports.
Palaeotechnical Reports for all the Provinces.

Appendix 2: Table of Appendix 6 requirements.

Section in Report	**Point in Act**	**Requirement**
B	1(c)	Scope and purpose of report
B	1(d)	Duration, date and season
B	1(g)	Areas to be avoided
D	1(ai)	Specialist who prepared report
D	1(aii)	Expertise of the specialist
F Figure 3	1(h)	Map
B	1(ni)(niA)	Authorisation
B	1(nii)	Avoidance, management, mitigation and closure plan
G Table 1	1(cA)	Quality and age of base data
G Table 2	1(cB)	Existing and cumulative impacts
D	1(f)	Details or activities of assessment
G	1(j)	Description of findings
H	1(e)	Description of methodology
H	1(i)	Assumptions
J	1(o)	Consultation
J	1(p)	Copies of comments during consultation
J	1(q)	Information requested by authority
Declaration	1(b)	Independent declaration
Appendix 2	1(k)	Mitigation included in EMPr
Appendix 2	1(l)	Conditions included in EMPr
Appendix 2	1(m)	Monitoring included in EMPr
D	2	Protocol or minimum standard

Appendix 3: **Impact Summary**

The development footprint is situated on the Malmani Subgroup with a high palaeontological sensitivity. The Nature of the impact is the destruction of Fossil Heritage. Loss of fossil heritage will have a negative impact. The probability of the impact occurring is improbable. The expected duration of the impact is assessed as potentially permanent. Only the site will be affected. In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be permanent. The loss of resources occurs but natural cultural and social processes continue, albeit in a modified manner. With Mitigation the impact will be low and the cumulative impact is low. Impacts on palaeontological heritage during the construction and preconstruction phase could potentially occur but are regarded as having a low/minor possibility. The significance of the impact occurring will be low.