



PGS HERITAGE

PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR SIX PROPOSED BLACK MOUNTAIN MINING PROSPECTING RIGHT APPLICATIONS, WITHOUT BULK SAMPLING, IN THE NORTHERN CAPE

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Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

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

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ACKNOWLEDGMENT OF RECEIPT

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

NEMA Regs (2014) - Appendix 6	Relevant section in report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page ii of Report – Contact details and company and Appendix A
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 4 – Objective
(cA) an indication of the quality and age of base data used for the specialist report;	Section 5 – Geological and Palaeontological history
(B) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 10
d) the date, duration and season of the site investigation and the relevance of the season to the outcome of the assessment;	N/A Desktop Study
e) a description of the methodology adopted in preparing the report or carrying out the specialized process inclusive of equipment and modeling used;	Section 8 Approach and Methodology
f) details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1 and 10
g) an identification of any areas to be avoided, including buffers;	Not identified, Section 10
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological history

NEMA Regs (2014) - Appendix 6	Relevant section in report
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 8.1 – Assumptions and Limitation
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Section 11
k) any mitigation measures for inclusion in the EMPr;	Section 1 and 11
l) any conditions for inclusion in the environmental authorization;	N/A
m) any monitoring requirements for inclusion in the EMPr or environmental authorization;	N/A
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorized; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 11
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable.
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable.
q) any other information requested by the competent authority.	Not applicable.
2) Where a government notice <i>gazetted</i> by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines

EXECUTIVE SUMMARY

Banzai Environmental was appointed by PGS Heritage (Pty) Ltd to conduct the **Palaeontological Desktop Assessment** (DIA) to assess **six** proposed Black Rock Mining Prospecting Right Applications, without bulk sampling in the Northern Cape. These applications include:

1. Gifkop Prospecting Right Application
2. Jaagers Plaat Prospecting Right Application
3. Wit Puts Prospecting Right Application
4. Tierklip Prospecting Right Application
5. Groot Kolk Prospecting Right Application
6. 6. Vaalhoek Prospecting Right Application

The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Impact Assessment (PIA) is key to detect the presence of fossil material within the planned development footprint. This DIA is thus necessary to evaluate the effect of the construction on the palaeontological resources.

The proposed Prospecting Right Application areas in the Northern Cape are completely underlain by basement bedrock of the Bushmanland Group of the Namaqua Metamorphic Province, igneous Karoo dolerite, as well as the Prins Albert and White Hill Formations (Ecca Group) of the Karoo Supergroup. Quaternary to Recent aeolian sediments of the Gordonia Formation (Kalahari Group), and alluvial calcretes and gravels are also present.

The **Gifkop** Prospecting right Application area is mainly underlain by the Kalahari Formation with isolated areas of the Dwyka Group, Karoo Dolerite, and Prins Albert Formation. The **Jaagers Plaat** Prospecting Right Application area is mainly underlain by the Kalahari and Prins Albert Formations with isolated outcrops of Karoo Dolerite and Whitehill Formation. The **Wit Puts** Prospecting Right Application is mainly underlain by the Prins Albert Formation in the central areas, with scattered areas of Karoo Dolerite, and a small Dwyka outcrop in the north. The **Tierklip** Prospecting Right Application consists mainly in the Dwyka Group and the Prins Albert Formation with isolated areas of Karoo Dolerite and Vaalhoek Granite. The **Groot Kolk** Prospecting Right Application area is mainly underlain by the Dwyka Group with small isolated outcrops of De Kruis Group and Bayswater Metamorphic rocks. The **Vaalhoek** Prospecting Right Application is mainly underlain by the Dwyka Group with small isolated outcrops of Karoo Dolerite, Vaalhoek Granite, Grappies rocks as well as a very small area of Prins Albert Formation in the eastern corner.

According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Kalahari Group is low, the igneous rocks of the Bushmanland and Karoo Dolerite is Insignificant or zero while the Ecca sediments of the Karoo Supergroup

have a High Paleontological Sensitivity. According to the Impact Rating Tables the application areas of **Gifkop**; **Jaagers Plaat**; **Wit Puts** and **Tierklip** all have a Medium Impact rating before Mitigation while the **Groot Kolk** and **Vaalhoek** Application areas have a Low Impact rating.

If fossil remains are discovered during any phase of prospecting, either on the surface or exposed by further excavations, the **Chance Find Protocol** (which is to be included in the Environmental Management Plan) must be implemented by the ECO in charge of these developments. These discoveries must be secured (*in situ*) and the ECO will have to alert SAHRA so that appropriate mitigation (documentation and collection) can be undertaken. The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHR.

As only drilling is proposed for this project, It is considered that the Northern Cape Prospecting Right Applications are deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area if appropriate monitoring is implemented.

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Appendix A: CV

TERMINOLOGY AND ABBREVIATIONS

Archaeological resources

This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artifacts, human and hominid remains, and artificial features and structures;
- rock art is any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- features, structures, and artifacts associated with a military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influences its stability and future well-being, including:

- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

Fossil

Mineralized bones of animals, shellfish, plants, and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA:

- places, buildings, structures, and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

Holocene

The most recent geological time period which commenced 10 000 years ago.

Palaeontology

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

Abbreviations	Description
ASAP	Association of South African Professional Archaeologists
BRMO	Black Rock Mining operations
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DIA	Desktop Impact Assessment
ECO	Environmental Control Officer
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late Stone Age

Abbreviations	Description
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PIA	Palaeontological Impact Assessment
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

1 INTRODUCTION

The subsidiary of Vedanta, Black Mountain Mining (BMM), wishes to apply for five Prospecting Rights (PRs) in the Northern Cape Province of South Africa (Figure 1-12). Black Mountain Mining (Pty.) Ltd. (BMM) includes two mines namely the Black Mountain Mine and the Gamsberg Mine. These zinc-lead mines are in the Northern Cape Province, South Africa. The Black Mountain Mine has been productive for over three decades while the Gamsberg Mine only began operation in 2015.

Generally, mining operations in the region have been under severe economic stress over the past few years, while Black Mountain, managed by the Vedanta Group, continues to be a prosperous producer of zinc, copper and silver as well as lead. In 2007, mining accounted for 21.3% of the total employment in the Northern Cape with more than 1500 employees, of which nearly 80% are local (from the Bushmanland and Namaqualand regions of the Northern Cape).

This desktop assessment will include the following **six (6)** prospecting right applications, without bulk sampling namely **1) Gifkop, 2) Jaagers Plaat, 3) Wit Puts, 4) Tierklip, 5) Groot Kolk and 6) Vaalhoek Prospecting Right Applications.**

1.1 Black Mountain Mine

The Black Mountain mine is located 113km north-east of Springbok and boasts an annual production of c.30kt of zinc in concentrate, c.50kt of lead in concentrate, c.3kt of copper in concentrate and c.50 tonnes of silver. Black Mountain's underground operations mine a polymetallic orebody, producing concentrates from a sequential flotation plant. With Broken Hill Deeps and Swartberg ore bodies, Black Mountain has considerable potential for mine expansion. However, the expansion will only be made once project feasibility has been proved. Black Mountain mine is a 25 trackless, mechanised underground mine of intermediate depth. The primary mining method is Cut & Fill.

Black Mountain is also the largest private employer in this region of the Northern Cape and has been a stable employer for the last three decades, with potential to continue providing significant employment for another twenty years. The well-established infrastructure available at the dedicated mining town of Aggeneys is a significant advantage. It is predicted that the life of Black Mountain mine will last until 2020 and beyond. Thus, the mine will remain profitable and an important economic driver in the region for many years to come¹.

¹ Information provided by EMS

1.2 Gamsberg Mine

Gamsberg is one of the largest zinc deposits in the world (although discovered more than 40 years ago) and was held undeveloped by its various owners before Vedanta acquired it from Anglo American in 2011. It has a reserve and resource of more than 214Mt and an estimated life of mine (LoM) of 30+ years. Gamsberg's development forms part of Vedanta's long-term commitment to the development of the Northern Cape. Phase 1 of this investment, which is worth US\$400 million, is now complete.

In Phase 1 – which has a LoM of 13 years – four-million tonnes a year of ore will be produced from Gamsberg's open pit and 250,000t/y of concentrate from its concentrator plant.

Phase 2 – an investment of a further US\$350 to US\$400 million – would see ore mined increase to 8mtpa and production of zinc-in-concentrate to 450,000 tonnes and in a modular fashion ultimately, to 600,000tpa.

When Gamsberg is fully developed with its future phases of growth, it will be one of the world's top 5 zinc mines. The project's current reserve and resource is 214Mt with a grade of between 6% and 6.5% zinc¹.

1.2.1 Background Information

The mine will use a phased approach and the work program will be divided into several successive divisions. After each succession, results will be evaluated and reported on. These results will indicate if the projects proceed and the way forward. The next phase will only proceed when the results obtained for the previous section were satisfactory. Only after finalizing surface work and surveys of phase 1 the details of the drilling program will be available. An amended program will only be submitted for the DMR's approval when a new ore body is found at an earlier stage in development and more information becomes available. During the prospecting program no bulk sampling work will be carried out. Initial prospecting will be conducted by the company itself, and the in-house geologist will be responsible to conduct and oversee the work. Drilling will be subcontracted to a local drilling company. The following methods will be utilized for prospecting.

(i) DESCRIPTION OF PLANNED NON-INVASIVE ACTIVITIES: (Actions do not disturb prospecting land e.g. aeromagnetic surveys, aerial photography, desktop studies, etc)

(ii) DESCRIPTION OF PLANNED INVASIVE ACTIVITIES: (Activities will disturb land e.g. sampling, drilling, bulk sampling, etc)

Rehabilitation of drill sites will be conducted according to an approved Environmental Management Plan.

¹ Information provided by EMS

(iii) DESCRIPTION OF PRE-/FEASIBILITY STUDIES (Activities includes but are not limited to: initial, geological modelling, resource determination, possible future funding models, etc)

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty-four years. She has extensive experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 13 years. She has been conducting PIAs since 2014.

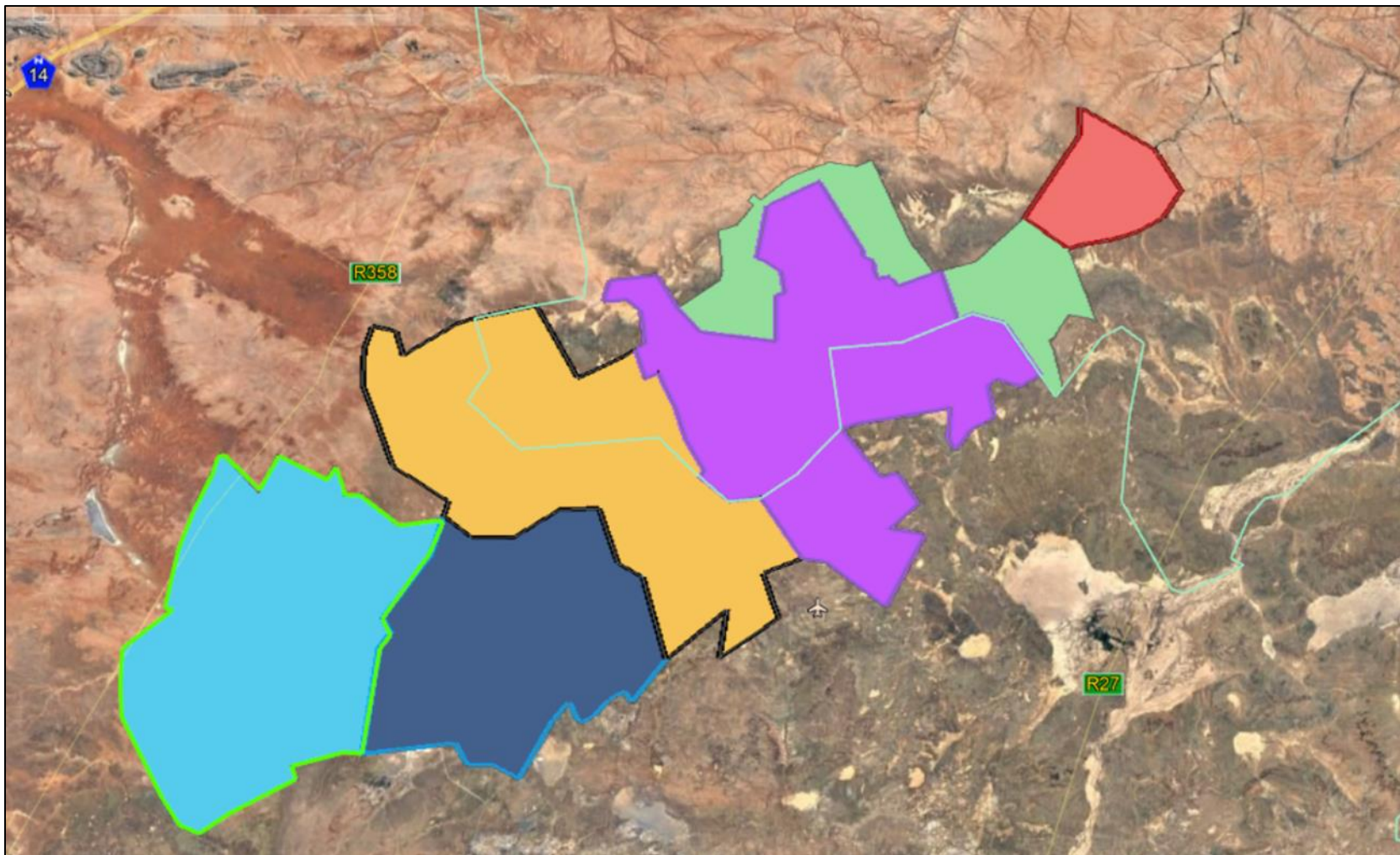


Figure 1: Google Earth Image (2018) indicating the locality of the six prospecting application areas near Aggeneys in the Northern Cape.



Figure 2: Google Earth Image (2018) indicating the locality of the Gifkop Prospecting Right Application in the Northern Cape.

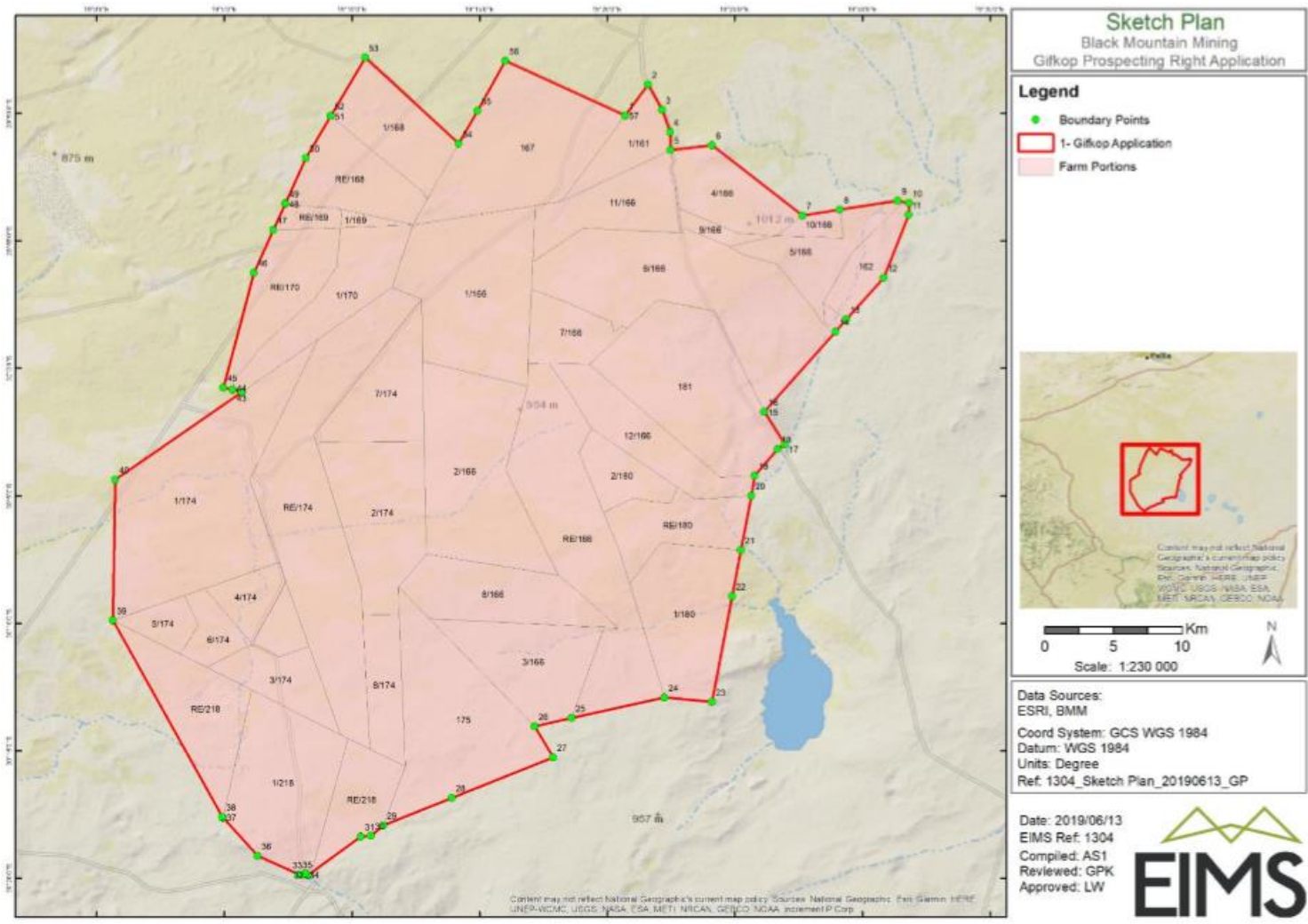


Figure 3: Gifkop Application. Map provided by EIMS.

Table 1: Properties within which the application falls (information provided by EIMS)

Nr	Registered Land Description	Magisterial District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
1	Farm Doels Vley 161 Portion 1	Calvinia Rd	2002,856118	T11976/2002	C0150000000001 6100001
2	Farm Wiel Kolk 162 Portion 0	Calvinia Rd	1723,804067	T42497/2004CTN	C0150000000001 6200000
3	Farm Gifkop 166 Portion 0 RE	Calvinia Rd	9900,733147	T33330/2008	C0150000000001 6600000
4	Farm Gifkop 166 Portion 1	Calvinia Rd	8571,290413	T49679/1991CTN	C0150000000001 6600001
5	Farm Gifkop 166 Portion 2	Calvinia Rd	8598,744804	T44479/2001CTN	C0150000000001 6600002
6	Farm Gifkop 166 Portion 3 RE	Calvinia Rd	4797,919502	T31072/1969CTN	C0150000000001 6600003
7	Farm Gifkop 166 Portion 4 RE	Calvinia Rd	3215,062565	T4968/1969	C0150000000001 6600004
8	Farm Gifkop 166 Portion 5 RE	Calvinia Rd	2772,254526	T11974/2002CTN	C0150000000001 6600005
9	Farm Gifkop 166 Portion 6	Calvinia Rd	11333,04917	T1633/2018	C0150000000001 6600006
10	Farm Gifkop 166 Portion 7	Calvinia Rd	2168,292651	T10760/2012CTN	C0150000000001 6600007
11	Farm Gifkop 166 Portion 8	Calvinia Rd	4523,208891	T84902/2007CTN	C0150000000001 6600008
12	Farm Gifkop 166 Portion 9	Calvinia Rd	554,960605	T4968/1969	C0150000000001 6600009
13	Farm Gifkop 166 Portion 10	Calvinia Rd	565,77058	T11974/2002CTN	C0150000000001 6600010
14	Farm Gifkop 166 Portion 11	Calvinia Rd	3564,825963	T39084/2000	C0150000000001 6600011
15	Farm Gifkop 166 Portion 12	Calvinia Rd	3771,057983	T33330/2008	C0150000000001 6600012
16	Farm Paul Se Vley 167 Portion 0	Calvinia Rd	8237,317651	T62188/2002	C0150000000001 6700000
17	Farm Tweeling 168 Portion 0	Calvinia Rd	3647,09889	T46509/2011	C0150000000001 6800000
18	Farm Tweeling 168 Portion 1	Calvinia Rd	3679,449156	Unknown	C0150000000001 6800001
19	Farm Annex Koffie Meul 169 Portion 1	Calvinia Rd	299,662049	T12/2005	C0150000000001 6900001
20	Farm Koffie Meul 170 Portion 0 RE	Calvinia Rd	3697,617482	T92055/1994	C0150000000001 7000000
21	Farm Koffie Meul 170 Portion 1	Calvinia Rd	4007,591845	T12/2005	C0150000000001 7000001
22	Farm Kapsvlei 174 Portion 0 RE	Calvinia Rd	12122,93286	T23295/1976CTN	C0150000000001 7400000
23	Farm Kapsvlei 174 Portion 1	Calvinia Rd	12135,63083	T51683/1986CTN	C0150000000001 7400001

Nr	Registered Land Description	Magisterial District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
24	Farm Kapsvlei 174 Portion 2	Calvinia Rd	6038,50704	Unknown	C0150000000017400002
25	Farm Kapsvlei 174 Portion 3 RE	Calvinia Rd	2391,011479	T64404/2009	C0150000000017400003
26	Farm Kapsvlei 174 Portion 4	Calvinia Rd	1472,643465	T67149/2002	C0150000000017400004
27	Farm Kapsvlei Portion 5	Calvinia Rd	1147,322511	T51684/1986	C0150000000017400005
28	Farm Kapsvlei 174 Portion 6	Calvinia Rd	2327,361793	T64404/2009	C0150000000017400006
29	Farm Kapsvlei 174 Portion 7	Calvinia Rd	3776,592667	T84533/1992	C0150000000017400007
30	Farm Kapsvlei 174 Portion 8	Calvinia Rd	2323,931687	T84533/1992	C0150000000017400008
31	Farm Blaauw Pan 175 Portion 0	Calvinia Rd	8382,488799	T9011/1981CTN	C0150000000017500000
32	Farm Hoepel 180 Portion 0 RE	Calvinia Rd	3283,250155	T11332/2012	C0150000000018000000
33	Farm Hoepel 180 Portion 1	Calvinia Rd	5639,188171	T9853/1990CTN	C0150000000018000001
34	Farm Hoepel 180 Portion 2	Calvinia Rd	1868,732534	T33330/2008	C0150000000018000002
35	Farm Groot Zevenfontein West 181 Portion 0	Calvinia Rd	8448,556192	T10760/2012CTN	C0150000000018100000
36	Farm Lospers Plaats 218 Portion 0 RE	Calvinia Rd	4491,872035	T32740/1982CTN	C0150000000021800000
37	Farm Lospers Plaats 218 Portion 0 RE	Calvinia Rd	2695,115949	T32740/1982CTN	C0150000000021800000
38	Farm Lospers Plaats 218 Portion 1	Calvinia Rd	6660,830913	T3878/2018	C0150000000021800001
	TOTAL AREA (HA)		177 468		

Table 2: Gifkop Application: Minerals to be prospecting for (information provided by EIMS)

ITEM	DETAIL
Type of mineral(s)	Ferrous & base metals: Cu – Copper
Type of minerals continued	Ferrous & base metals: Fe- Iron
Type of minerals continued	Ferrous & base metals: Pb -Lead
Type of minerals continued	Ferrous & base metals: Zn - Zinc
Type of minerals continued	Ferrous & base metals: Mn - Manganese
Type of minerals continued	Precious metals: Ag - Silver
Type of minerals continued	Precious metals: Au - Gold
Type of minerals continued	Ferrous & base metals: Ni - Nickel
Type of minerals continued	Ferrous & base metals: Mo – Molybdenum

Table 3: Relevant base metal deposits at the Gifkop Application

DEPOSIT NAME	COMMODITY	TYPE CODE	FARM
Broken Hill & Broken Hill Deeps	Lead, zinc, copper and silver	B	Zuurwater 62/4 Aggeneys 56/1
Swartberg	Lead, zinc, copper and silver	B	Zuurwater 62/4
Gamsberg	Zinc and lead	B	Gams 60/1 Bloemhoek 61/1



Figure 4: Google Earth Image (2018) indicating the locality of the Jaegers Plaats Prospecting Right Application in the Northern Cape

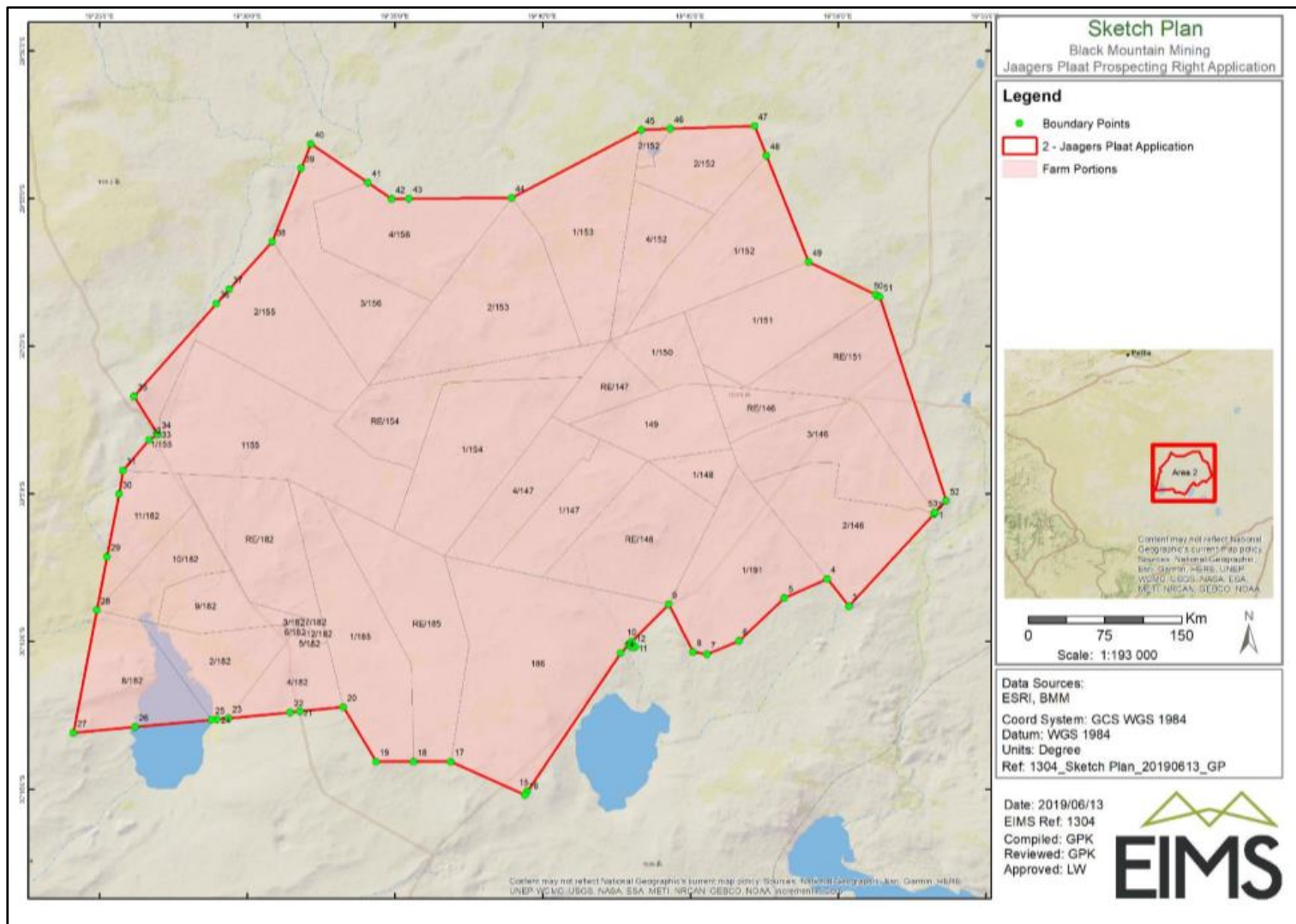


Figure 5: Jaegers Plaat Application. Map provided by EIMS.

Table 4: Properties within which the Jaegers Plaat Application falls (information provided by EIMS)

Nr.	Registered Land Description	Magisterial District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
1	Farm Weltevreden 146 Portion 0 RE	Calvinia Rd	1299,453691	T31987/2014CTN	C01500000000014600000
2	Farm Weltevreden 146 Portion 2	Calvinia Rd	3926,586066	T104436/1999	C01500000000014600002
3	Farm Weltevreden 146 Portion 3	Calvinia Rd	3762,126742	T54118/1989CTN	C01500000000014600003
4	Farm Klein Brand Pens 147 Portion 0 RE	Calvinia Rd	1390,743997	T55777/1988CTN	C01500000000014700000
5	Farm Klein Brand Pens 147 Portion 1 RE	Calvinia Rd	2715,210142	T86919/1998CTN	C01500000000014700001
6	Farm Klein Brand Pens 147 Portion 4	Calvinia Rd	2702,072374	T21212/1978	C01500000000014700004
7	Farm Lemoendoorn 148 Portion 0 RE	Calvinia Rd	4514,496053	T1252/1981	C01500000000014800000
8	Farm Lemoendoorn 148 Portion 1	Calvinia Rd	905,693438	T1252/1981	C01500000000014800001
9	Farm Blouputs 149 Portion 0	Calvinia Rd	2573,096312	T56673/2002CTN	C01500000000014900000
10	Farm Groot Brand Pens 150 Portion 1 RE	Calvinia Rd	1493,3018	T55777/1988CTN	C01500000000015000001
11	Farm Granaat Bosch Kolk 151 Portion 0 RE	Calvinia Rd	4453,884349	T25921/1986	C01500000000015100000
12	Farm Granaat Bosch Kolk 151 Portion 1	Calvinia Rd	4327,719526	T51250/2009CTN	C01500000000015100001
13	Farm Abrahams Kop 152 Portion 1	Calvinia Rd	4220,008433	T51251/2009	C01500000000015200001
14	Farm Abrahams Kop 152 Portion 2	Calvinia Rd	263,05238	T82745/2001CTN	C01500000000015200002
15	Farm Abrahams Kop 152 Portion 2	Calvinia Rd	2528,160884	T82745/2001CTN	C01500000000015200002
16	Farm Abrahams Kop 152 Portion 4	Calvinia Rd	2384,544464	T105180/2000CTN	C01500000000015200004
17	Farm Nutiep 153 Portion 1	Calvinia Rd	4808,37246	T105180/2000CTN	C01500000000015300001
18	Farm Nutiep 153 Portion 2	Calvinia Rd	6106,832579	T11972/2002	C01500000000015300002
19	Farm Jaegers Plaat 154 Portion 0 RE	Calvinia Rd	3346,950002	T409/2003CTN	C01500000000015400000
20	Farm Jaegers Plaat 154 Portion 1	Calvinia Rd	5577,4439	T11977/2002	C01500000000015400001
21	Farm Groot Zevenfontein East 155 Portion 1	Calvinia Rd	53,010402	T17706/1951	C01500000000015500001
22	Farm Groot Zevenfontein East 155 Portion 2	Calvinia Rd	5449,897835	T9372/1985CTN	C01500000000015500002
23	Farm Abiquas Kolk Oost 156 Portion 3 RE	Calvinia Rd	4581,880721	T85701/1999	C01500000000015600003
24	Farm Abiquas Kolk Oost 156 Portion 4	Calvinia Rd	4546,483651	T74859/1990	C01500000000015600004

Nr.	Registered Land Description	Magisterial District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
25	Farm Dik Pens 182 Portion 0 RE	Calvinia Rd	3991,96617	T34187/1996	C0150000000018200000
26	Farm Dik Pens 182 Portion 2 RE	Calvinia Rd	2567,8786	T15673/1956	C0150000000018200002
27	Farm Dik Pens 182 Portion 3	Calvinia Rd	50,124671	T16948/1977CTN	C0150000000018200003
28	Farm Dik Pens 182 Portion 4	Calvinia Rd	1842,300209	T16948/1977CTN	C0150000000018200004
29	Farm Dik Pens 182 Portion 5	Calvinia Rd	46,339945	Unknown	C0150000000018200005
30	Farm Dik Pens 182 Portion 6	Calvinia Rd	51,269516	Unknown	C0150000000018200006
31	Farm Dik Pens 182 Portion 7	Calvinia Rd	3,786603	Unknown	C0150000000018200007
32	Farm Dik Pens 182 Portion 8	Calvinia Rd	3436,687791	T46045/1990	C0150000000018200008
33	Farm Dik Pens 182 Portion 9	Calvinia Rd	1801,0099	T7468/1962	C0150000000018200009
34	Farm Dik Pens 182 Portion 10	Calvinia Rd	2101,832234	T46045/1990	C0150000000018200010
35	Farm Dik Pens 182 Portion 11	Calvinia Rd	2104,318691	T99592/1997CTN	C0150000000018200011
36	Farm Dik Pens 182 Portion 12	Calvinia Rd	95,217776	T16948/1977CTN	C0150000000018200012
37	Farm Water Kuil 185 Portion 0 RE	Calvinia Rd	5256,948423	T17521/2004	C0150000000018500000
38	Farm Water Kuil 185 Portion 1	Calvinia Rd	5209,377283	T98195/2002	C0150000000018500001
39	Farm Dwaggas West 186 Portion 0	Calvinia Rd	9854,817947	T15138/2005CTN	C0150000000018600000
40	Farm Dwaggas Oost 190 Portion 1	Calvinia Rd	7,15319	T19413/1960	C0150000000019000001
41	Farm Hyes 191 Portion 1	Calvinia Rd	5034,154349	T74929/2003CTN	C0150000000019100001
42	Farm Bloulei 1155 Portion 0	Calvinia Rd	8083,847178	T14596/1988CTN	C01500000000115500000
TOTAL AREA (HA)			129 407		

Table 5: *Jaegers Plaat Application*: Minerals to be prospecting for (information provided by EIMS)

ITEM	DETAIL
Type of mineral(s)	Ferrous & base metals: Cu – Copper
Type of minerals continued	Ferrous & base metals: Fe- Iron
Type of minerals continued	Ferrous & base metals: Pb -Lead
Type of minerals continued	Ferrous & base metals: Zn - Zinc
Type of minerals continued	Ferrous & base metals: Mn - Manganese
Type of minerals continued	Precious metals: Ag - Silver
Type of minerals continued	Precious metals: Au - Gold
Type of minerals continued	Ferrous & base metals: Ni - Nickel
Type of minerals continued	Ferrous & base metals: Mo – Molybdenum

Table 6: *Relevant base metal deposits at Jaager Plaat*

DEPOSIT NAME	COMMODITY	TYPE CODE	FARM
Broken Hill & Broken Hill Deepes	Lead, zinc, copper and silver	B	Zuurwater 62/4 Aggeneys 56/1
Swartberg	Lead, zinc, copper and silver	B	Zuurwater 62/4
Gamsberg	Zinc and lead	B	Gams 60/1 Bloemhoek 61/1

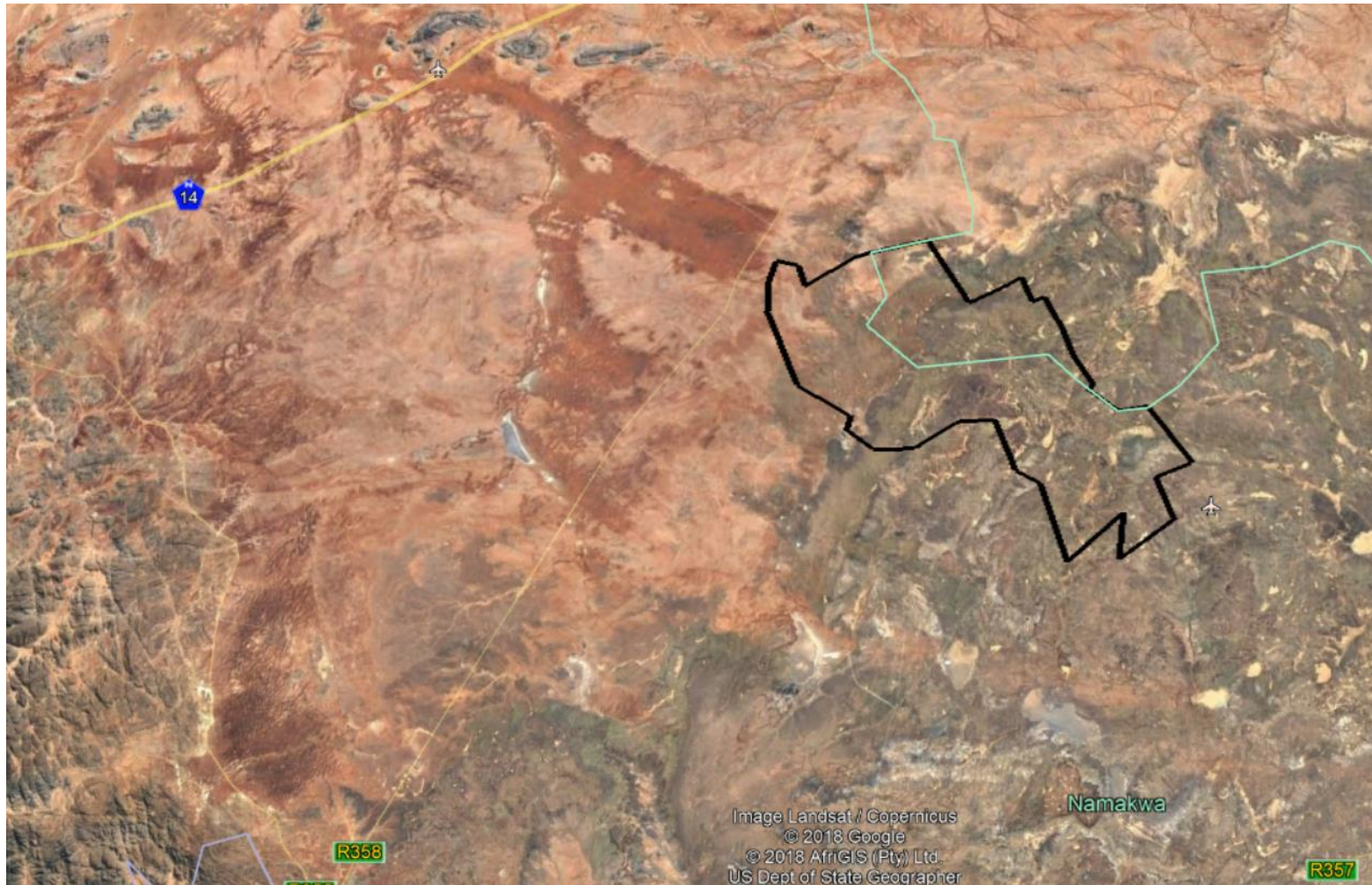


Figure 6: Google Earth Image (2018) indicating the locality of the Wit Puts Prospecting Right Application in the Northern Cape

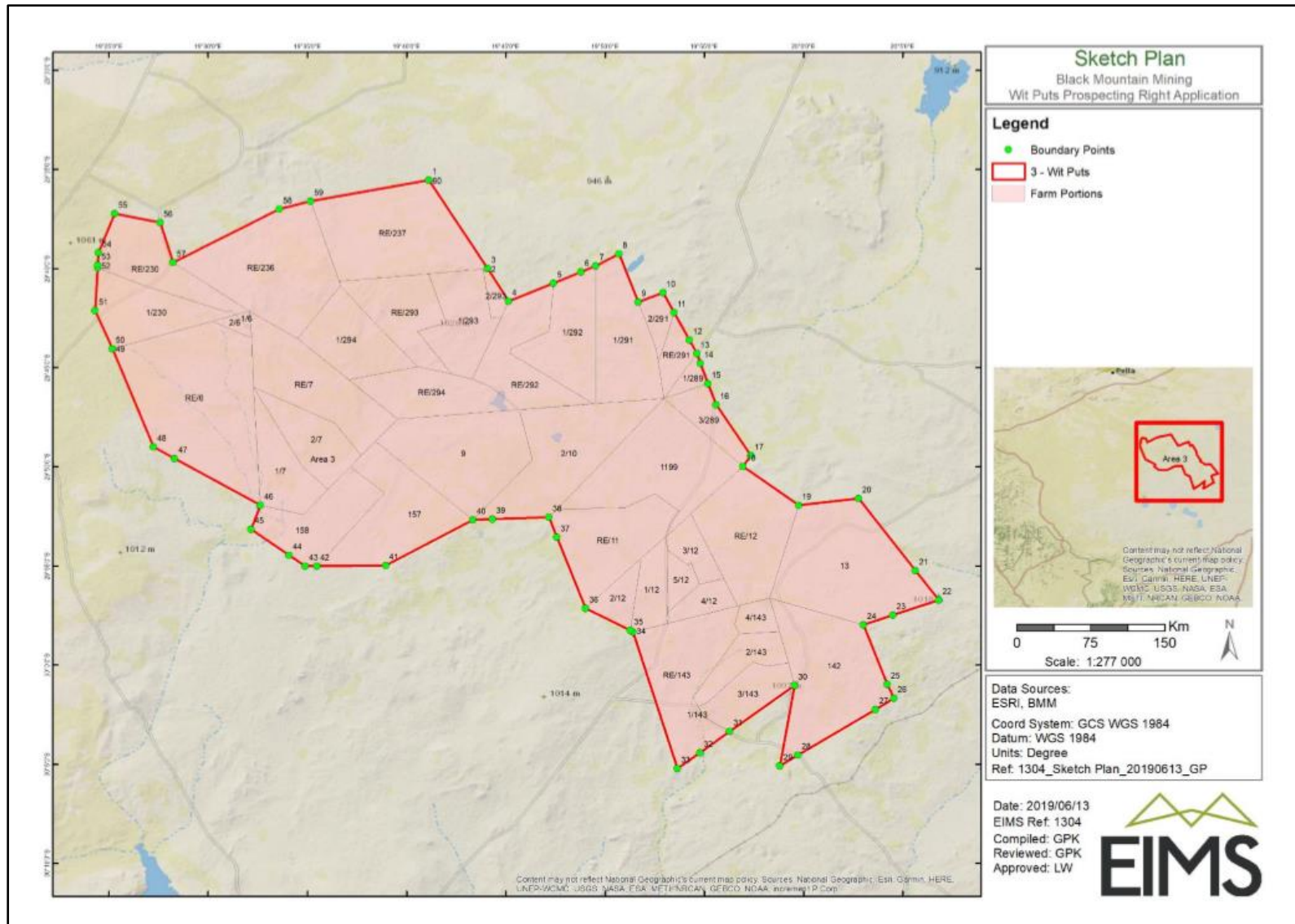


Figure 7: Wit Puts Application. Map provided by EIMS.

Table 7: Properties within which the Wit Puts Application falls (information provided by EIMS)

		I District		Deed/Diagram Deed	
1	Farm Nieuw Jaars 6 Portion 0 RE	Calvinia Rd	12928,51143	T423/1996CTN	C0150000000000600000
2	Farm Nieuw Jaars 6 Portion 1 RE	Calvinia Rd	106,35445	T32947/1979CTN	C0150000000000600001
3	Farm Nieuw Jaars 6 Portion 2	Calvinia Rd	282,51192	T95792/2000CTN	C0150000000000600002
4	Farm Koebas Hoek 7 Portion 0 RE	Calvinia Rd	6287,71959	T101542/2007CTN	C0150000000000700000
5	Farm Koebas Hoek 7 Portion 1 RE	Calvinia Rd	3192,963485	T76578/2012CTN	C0150000000000700001
6	Farm Koebas Hoek 7 Portion 2	Calvinia Rd	3232,650177	T15601/1985CTN	C0150000000000700002
7	Farm Wit Puts 9 Portion 0	Calvinia Rd	7830,549328	Unknown	C0150000000000900000
8	Farm Boks Kolk 10 Portion 2	Calvinia Rd	7752,468326	T82745/2001CTN	C0150000000001000002
9	Farm Zout Dwaggas 11 Portion 0 RE	Calvinia Rd	5778,754484	T24140/1977CTN	C0150000000001100000
10	Farm Gurreys 12 Portion 0 RE	Calvinia Rd	6724,354994	T43980/1987CTN	C0150000000001200000
11	Farm Gurreys 12 Portion 1 RE	Calvinia Rd	1862,176627	T27625/2002CTN	C0150000000001200001
12	Farm Gurreys 12 Portion 2	Calvinia Rd	1323,010938	Unknown	C0150000000001200002
13	Farm Gurreys 12 Portion 3 RE	Calvinia Rd	1431,27379	T23270/1976CTN	C0150000000001200003
14	Farm Gurreys 12 Portion 4	Calvinia Rd	1242,586144	T43980/1987CTN	C0150000000001200004
15	Farm Gurreys 12 Portion 5	Calvinia Rd	889,590938	T23270/1976CTN	C0150000000001200005
16	Farm Hou Hou 13 Portion 0	Calvinia Rd	10108,00581	T23270/1976CTN	C0150000000001300000
17	Farm Teriris 142 Portion 0	Calvinia Rd	8527,132152	T36260/2004CTN	C01500000000014200000
18	Farm Onap 143 Portion 0 RE	Calvinia Rd	6713,466657	T16844/1997CTN	C01500000000014300000
19	Farm Onap 143 Portion 1	Calvinia Rd	1,711307	T4570/1925CTN	C01500000000014300001
20	Farm Onap 143 Portion 2 RE	Calvinia Rd	2083,661739	T8553/2013CTN	C01500000000014300002
21	Farm Onap 143 Portion 3	Calvinia Rd	2594,860708	T39074/2005CTN	C01500000000014300003
22	Farm Onap 143 Portion 4	Calvinia Rd	889,303181	T43980/1987CTN	C01500000000014300004
23	Farm Karesses 157 Portion 0	Calvinia Rd	6513,991031	T74859/1990CTN	C01500000000015700000
24	Farm Izaks Puts 158 Portion 0	Calvinia Rd	4482,539852	T23007/1982CTN	C01500000000015800000
25	Farm Soutdwaggas 1199 Portion 0	Calvinia Rd	8124,067635	Unknown	C015000000000119900000
26	Farm Burtons-Vlei 230 Portion 0 RE	Calvinia Rd	4328,445271	T32947/1979CTN	C03600000000023000000

Nr	Registered Land Description	Magisteria I District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
27	Farm Burtons-Vlei 230 Portion 1	Calvinia Rd	4164,211965	T95792/2000CT N	C03600000000023000001
28	Farm Klercks Goubeep 236 Portion 0	Calvinia Rd	9224,931233	T46708/1995CT N	C03600000000023600000
29	Farm Baiang Putsen 237 Portion 0	Calvinia Rd	9102,438223	T67184/1992CT N	C03600000000023700000
30	Farm Ysis 289 Portion 1 RE	Calvinia Rd	560,956382	T55001/1984CT N	C03600000000028900001
31	Farm Ysis 289 Portion 3	Calvinia Rd	1842,672858	T55001/1984CT N	C03600000000028900003
32	Farm Ramans Kolk 291 Portion 0 RE	Calvinia Rd	1214,132963	T55001/1984CT N	C03600000000029100000
33	Farm Ramans Kolk 291 Portion 1	Calvinia Rd	5469,985336	T55000/1984CT N	C03600000000029100001
34	Farm Ramans Kolk 291 Portion 2 RE	Calvinia Rd	913,512887	T55001/1984CT N	C03600000000029100002
35	Farm Bossie Kom 292 Portion 0 RE	Calvinia Rd	4667,909982	T21286/1989CT N	C03600000000029200000
36	Farm Bossie Kom 292 Portion 1	Calvinia Rd	4747,531828	T51889/2000CT N	C03600000000029200001
37	Farm Half Kroon 293 Portion 0 RE	Calvinia Rd	4133,777771	T51889/2000CT N	C03600000000029300000
38	Farm Half Kroon 293 Portion 1	Calvinia Rd	4091,527565	T51889/2000CT N	C03600000000029300001
39	Farm Half Kroon 293 Portion 2	Calvinia Rd	495,717382	T21286/1989CT N	C03600000000029300002
40	Farm Wolf Kop 294 Portion 0 RE	Calvinia Rd	4100,068116	T42498/2004CT N	C03600000000029400000
41	Farm Wolf Kop 294 Portion 1	Calvinia Rd	4167,492678	T11247/2006CT N	C03600000000029400001
	TOTAL AREA (HA)		174 126		

Table 8: Wit puts minerals Application: Minerals to be prospecting for (information provided by EIMS)

ITEM	DETAIL
Type of mineral(s)	Ferrous & base metals: Cu – Copper
Type of minerals continued	Ferrous & base metals: Fe- Iron
Type of minerals continued	Ferrous & base metals: Pb -Lead
Type of minerals continued	Ferrous & base metals: Zn - Zinc
Type of minerals continued	Ferrous & base metals: Mn - Manganese
Type of minerals continued	Precious metals: Ag - Silver
Type of minerals continued	Precious metals: Au - Gold
Type of minerals continued	Ferrous & base metals: Ni - Nickel
Type of minerals continued	Ferrous & base metals: Mo – Molybdenum

Table 9: Relevant base metal deposits at Wit Puts

DEPOSIT NAME	COMMODITY	TYPE CODE	FARM
Broken Hill & Broken Hill Deeps	Lead, zinc, copper and silver	B	Zuurwater 62/4 Aggeneys 56/1
Swartberg	Lead, zinc, copper and silver	B	Zuurwater 62/4
Gamsberg	Zinc and lead	B	Gams 60/1 Bloemhoek 61/1

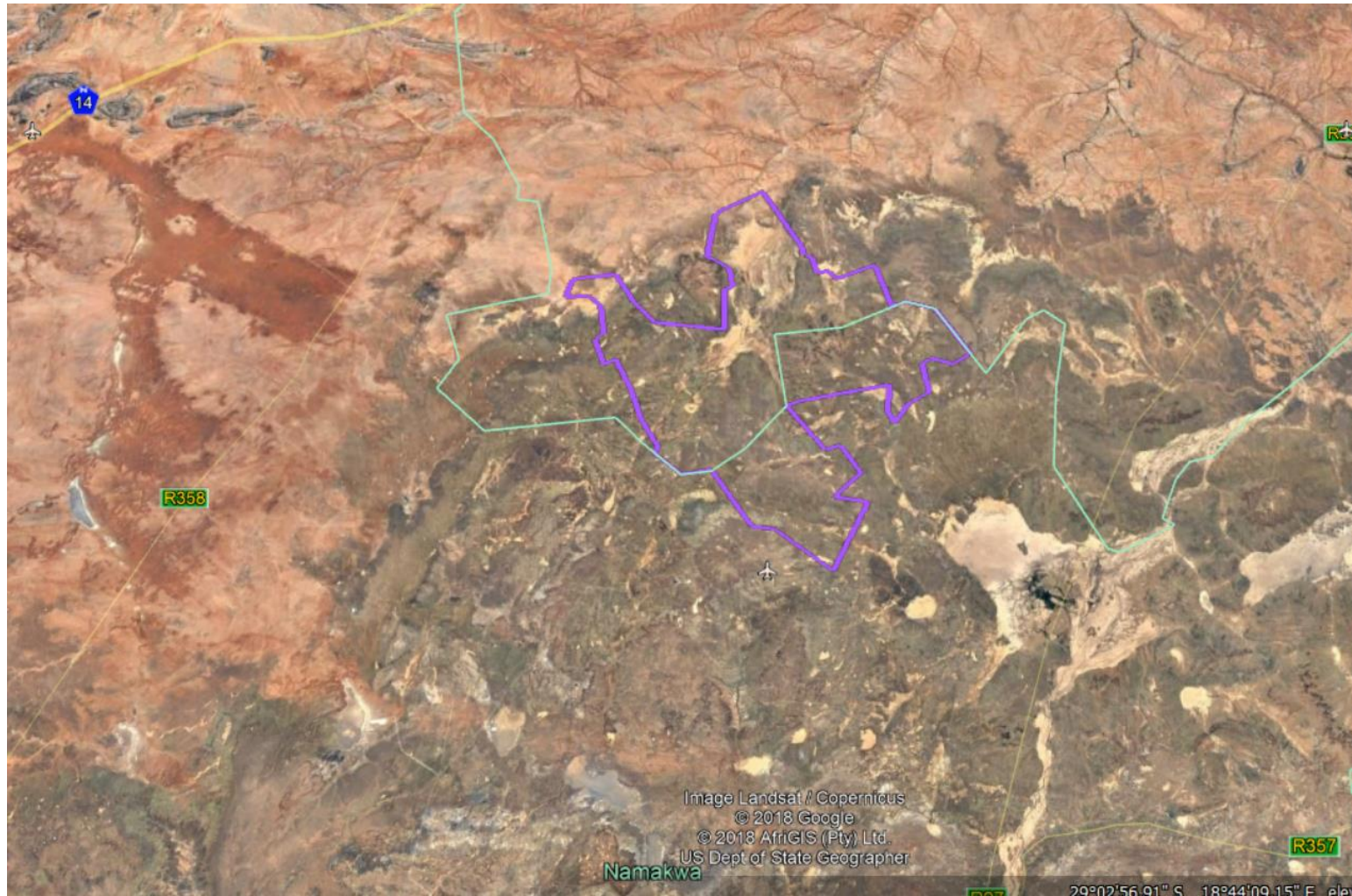


Figure 8: Google Earth Image (2018) indicating the locality of the Tierklip Prospecting Right Application in the Northern Cape

Table 10: Properties within which the Tierklip Application falls (information provided by EIMS)

Nr.	Registered Land Description	Magisterial District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
1	Farm Loog Kolkjes 195 Portion 4	Kenhardt Rd	1695,541253	T76872/1998CTN	C03600000000019500004
2	Farm Geel Vloer 196 Portion 0 RE	Kenhardt Rd	6388,716298	T32084/2014CTN	C03600000000019600000
3	Farm Geel Vloer 196 Portion 1	Kenhardt Rd	6495,72027	T32083/2014CTN	C03600000000019600001
4	Farm Hendrik Zyn Puts 240 Portion 0 RE	Kenhardt Rd	5937,038478	T69407/2015CTN	C03600000000024000000
5	Farm Hendrik Zyn Puts 240 Portion 3	Kenhardt Rd	5592,531803	T32299/1996CTN	C03600000000024000003
6	Farm Hendrik Zyn Puts 240 Portion 7	Kenhardt Rd	3069,23921	T4059/1997CTN	C03600000000024000007
7	Farm Brosdoorns Annex 242 Portion 0 RE	Kenhardt Rd	3779,114231	T96126/2002CTN	C03600000000024200000
8	Farm Brosdoorns Annex 242 Portion 1	Kenhardt Rd	3723,132824	T96127/2002CTN	C03600000000024200001
9	Farm Brosdoorns Annex 242 Portion 2	Kenhardt Rd	3792,754523	T41356/1988CTN	C03600000000024200002
10	Farm Brosdoorns Annex 242 Portion 3	Kenhardt Rd	3758,354959	T93751/2005CTN	C03600000000024200003
11	Farm Dagab 282 Portion 0 RE	Kenhardt Rd	2895,332837	T107940/2000CTN	C03600000000028200000
12	Farm Dagab 282 Portion 2	Kenhardt Rd	743,42116	T107940/2000CTN	C03600000000028200002
13	Farm De Paarden Vleyen 283 Portion 0 RE	Kenhardt Rd	7297,452848	T52179/2003CTN	C03600000000028300000
14	Farm De Paarden Vleyen 283 Portion 2	Kenhardt Rd	2557,950064	T59522/2008CTN	C03600000000028300002
15	Farm De Paarden Vleyen 283 Portion 3 RE	Kenhardt Rd	7311,383444	T28241/2002CTN	C03600000000028300003
16	Farm De Paarden Vleyen 283 Portion 4	Kenhardt Rd	2,279856	T64504/2010CTN	C03600000000028300004
17	Farm Koranna Kolken 284 Portion 2 RE	Kenhardt Rd	2767,258409	T73814/1992CTN	C03600000000028400002
18	Farm Koranna Kolken 284 Portion 3 RE	Kenhardt Rd	1398,347791	T60270/1989CTN	C03600000000028400003
19	Farm Koranna Kolken 284 Portion 4	Kenhardt Rd	2766,353335	T49042/1988CTN	C03600000000028400004
20	Farm Koranna Kolken 284 Portion 5	Kenhardt Rd	2779,152907	T73814/1992CTN	C03600000000028400005
21	Farm Koranna Kolken 284 Portion 6	Kenhardt Rd	2774,510498	T41357/1988CTN	C03600000000028400006

Nr.	Registered Land Description	Magisterial District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
22	Farm Koranna Kolken 284 Portion 7	Kenhardt Rd	2808,393233	T112445/1997CTN	C03600000000028400007
23	Farm Koranna Kolken 284 Portion 8	Kenhardt Rd	1399,755636	T60270/1989CTN	C03600000000028400008
24	Farm Tyger Kolk 286 Portion 1	Kenhardt Rd	6513,215404	T9930/2016CTN	C03600000000028600001
25	Farm Tierklip 287 Portion 0 RE	Kenhardt Rd	3824,554934	T63458/1991CTN	C03600000000028700000
26	Farm Tierklip 287 Portion 1	Kenhardt Rd	4105,883653	T27803/2014CTN	C03600000000028700001
27	Farm Tierklip 287 Portion 2	Kenhardt Rd	3986,88955	T8698/2012CTN	C03600000000028700002
28	Farm Tierklip 287 Portion 3	Kenhardt Rd	3864,303082	T63458/1991CTN	C03600000000028700003
29	Farm Corgas 288 Portion 0 RE	Kenhardt Rd	1550,993638	T19766/1966CTN	C03600000000028800000
30	Farm Corgas 288 Portion 1	Kenhardt Rd	1097,405028	T54668/2014CTN	C03600000000028800001
31	Farm Corgas 288 Portion 2	Kenhardt Rd	827,575974	T54668/2014CTN	C03600000000028800002
32	Farm Corgas 288 Portion 3	Kenhardt Rd	2093,705186	T54668/2014CTN	C03600000000028800003
33	Farm Corgas 288 Portion 4	Kenhardt Rd	1208,533245	T54668/2014CTN	C03600000000028800004
34	Farm Corgas 288 Portion 5	Kenhardt Rd	1847,942913	T9930/2016CTN	C03600000000028800005
35	Farm Ysis 289 Portion 0 RE	Kenhardt Rd	3460,975441	T21976/1977CTN	C03600000000028900000
36	Farm Ysis 289 Portion 2 RE	Kenhardt Rd	2516,077576	T14248/1957CTN	C03600000000028900002
37	Farm Ysis 289 Portion 4	Kenhardt Rd	1224,537064	T35410/2007CTN	C03600000000028900004
38	Farm Makkies Plaats 290 Portion 0 RE	Kenhardt Rd	2567,205047	T49914/1981CTN	C03600000000029000000
39	Farm Makkies Plaats 290 Portion 1	Kenhardt Rd	4314,771455	T10968/2009CTN	C03600000000029000001
40	Farm Makkies Plaats 290 Portion 2	Kenhardt Rd	1331,822886	T48093/1983CTN	C03600000000029000002
41	Farm Ramans Kolk 291 Portion 3	Kenhardt Rd	911,425182	T55001/1984CTN	C03600000000029100003
42	Farm Koic 295 Portion 0 RE	Kenhardt Rd	5105,389027	T91639/1994CTN	C03600000000029500000
43	Farm Koic 295 Portion 1	Kenhardt Rd	4638,917471	T91639/1994CTN	C03600000000029500001
44	Farm Nanibies 296 Portion 0 RE	Kenhardt Rd	6249,006579	T91639/1994CTN	C03600000000029600000
45	Farm Nanibies 296 Portion 1 RE	Kenhardt Rd	3117,041098	T91639/1994CTN	C03600000000029600001

Nr.	Registered Land Description	Magisterial District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
46	Farm Nanibies 296 Portion 2 RE	Kenhardt Rd	1551,574551	T91639/1994CTN	C03600000000029600002
47	Farm Nanibies 296 Portion 3	Kenhardt Rd	1575,832314	T91639/1994CTN	C03600000000029600003
48	Farm Schansklip 297 Portion 0	Kenhardt Rd	9892,946319	T6475/1987CTN	C03600000000029700000
49	Farm Zoo Afs Puts 299 Portion 1 RE	Kenhardt Rd	785,885346	T48561/2013CTN	C03600000000029900001
50	Farm Zoo Afs Puts 299 Portion 1	Kenhardt Rd	2711,26684	T48561/2013CTN	C03600000000029900001
51	Farm Zoo Afs Puts 299 Portion 5	Kenhardt Rd	36,442582	T56301/1998CTN	C03600000000029900005
52	Farm Na 327 Portion 2	Kenhardt Rd	21,668427	T61257/1998CTN	C03600000000032700002
53	Farm Na 327 Portion 3	Kenhardt Rd	24,948437	T61258/1998CTN	C03600000000032700003
54	Farm Na 327 Portion 6	Kenhardt Rd	3795,781318	T79044/2008CTN	C03600000000032700006
55	Farm Kabiep 388 Portion 1	Kenhardt Rd	5510,955644	T25847/2009CTN	C03600000000038800001
56	Farm Na 423 Portion 0	Kenhardt Rd	6033,031312	T79045/2008CTN	C03600000000042300000
	Total Area (HA)		180001		

Table 11: Tierklip Application minerals Application: Minerals to be prospecting for (information provided by EIMS)

ITEM	DETAIL
Type of mineral(s)	Ferrous & base metals: Cu – Copper
Type of minerals continued	Ferrous & base metals: Fe- Iron
Type of minerals continued	Ferrous & base metals: Pb -Lead
Type of minerals continued	Ferrous & base metals: Zn - Zinc
Type of minerals continued	Ferrous & base metals: Mn - Manganese
Type of minerals continued	Precious metals: Ag - Silver
Type of minerals continued	Precious metals: Au - Gold
Type of minerals continued	Ferrous & base metals: Ni - Nickel
Type of minerals continued	Ferrous & base metals: Mo – Molybdenum
Locality (Direction and distance from nearest town)	The area is located approximately 100 to 170 kilometers South East of the town of Aggeneys and 173 kilometers South West of the town of Upington, Namaqualand District, Northern Cape Province.
Extent of the area required for prospecting	The area is approximately 180 001 Ha (one hundred and eighty thousand and one hectares)
Geological formation	The target geological formation is the Bushmanland Sequence

Table 12: Relevant base metal deposits at Tierklip

DEPOSIT NAME	COMMODITY	TYPE CODE	FARM
Broken Hill & Broken Hill Deeps	Lead, zinc, copper and silver	<u>B</u>	Zuurwater 62/4 Aggeneys 56/1
Swartberg	Lead, zinc, copper and silver	<u>B</u>	Zuurwater 62/4
Gamsberg	Zinc and lead	<u>B</u>	Gams 60/1 Bloemhoek 61/1

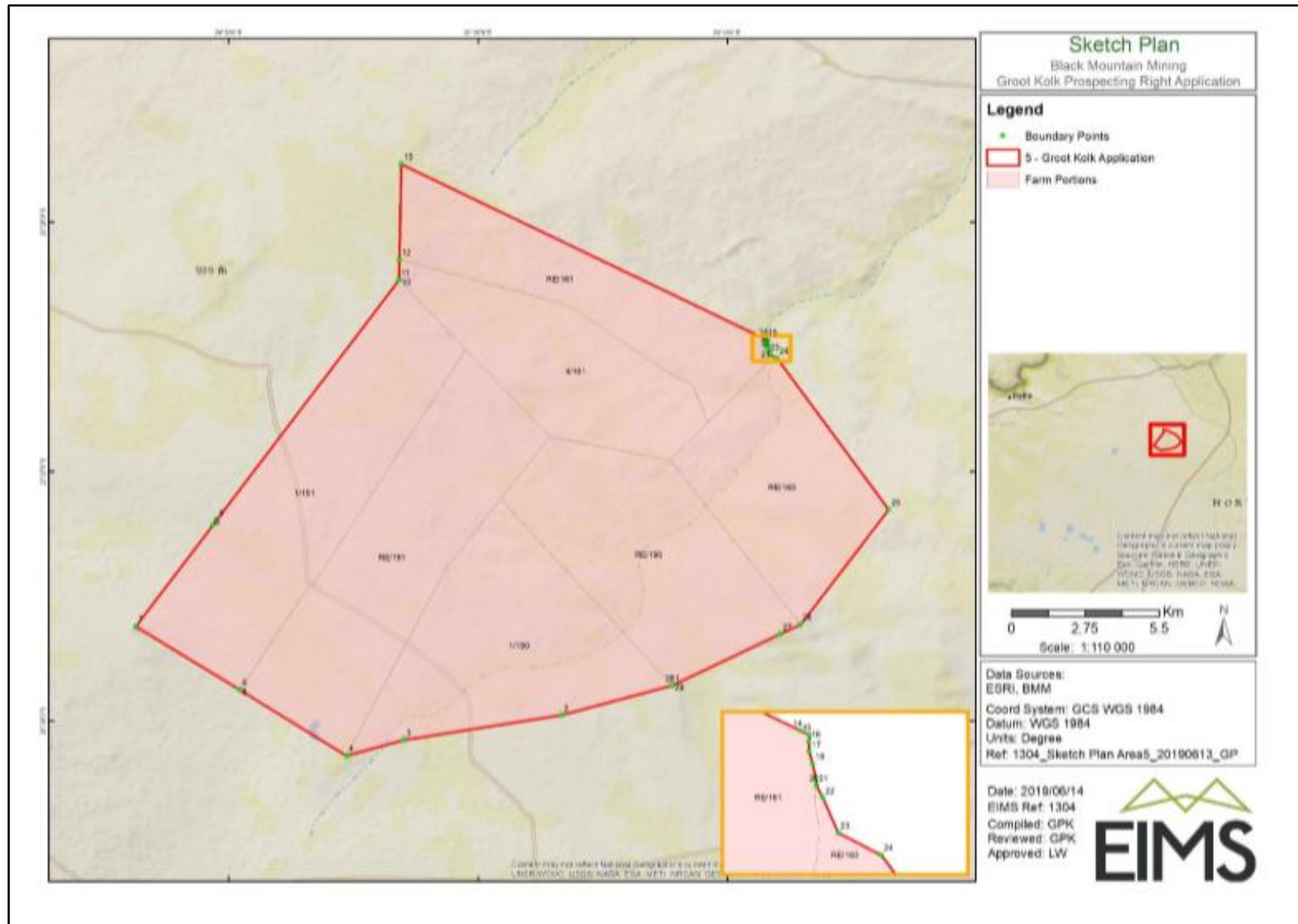


Figure 11: Groot Kolk Applications. Map provided by EIMS.

Table 13: Properties within which the Groot Kolk Applications falls (information provided by EIMS)

Nr	Registered Land Description	Magisterial District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
1	Farm De Tuin Noord 161 Portion 0 RE	Kenhardt Rd	3316,5747 75	T57793/2016CTN	C0360000000001610 0000
2	Farm De Tuin Noord 161 Portion 4	Kenhardt Rd	3322,7914 47	T57792/2016CTN	C0360000000001610 0004
3	Farm De Tuin Zuid 163 Portion 0 RE	Kenhardt Rd	3471,2925 09	T24554/1971CTN	C0360000000001630 0000
4	Farm Groot Kolk 190 Portion 0 RE	Kenhardt Rd	4565,2858 21	T67338/2007CTN	C0360000000001900 0000
5	Farm Groot Kolk 190 Portion 1	Kenhardt Rd	4629,0741 62	T55618/1996	C0360000000001900 0001
6	Farm Annex Groot Kolk 191 Portion 0 RE	Kenhardt Rd	5322,1307 01	T1681/1987CTN	C0360000000001910 0000
7	Farm Annex Groot Kolk 191 Portion 1	Kenhardt Rd	5523,3617 77	T23349/1986	C0360000000001910 0001
	TOTAL AREA (HA)		30 150,5		

Table 14: Groot Kolk Applications minerals Application: Minerals to be prospecting for (information provided by EIMS)

ITEM	DETAIL
Type of mineral(s)	Ferrous & base metals: Cu – Copper
Type of minerals continued	Ferrous & base metals: Fe- Iron
Type of minerals continued	Ferrous & base metals: Pb -Lead
Type of minerals continued	Ferrous & base metals: Zn - Zinc
Type of minerals continued	Ferrous & base metals: Mn - Manganese
Type of minerals continued	Precious metals: Ag - Silver
Type of minerals continued	Precious metals: Au - Gold
Type of minerals continued	Ferrous & base metals: Ni - Nickel
Type of minerals continued	Ferrous & base metals: Mo – Molybdenum
Locality (Direction and distance from nearest town)	The area is located approximately 187 kilometers South West of the town of Upington and 193 km kilometers South East of the town of Aggeneys, Namaqualand District, Northern Cape Province.
Extent of the area required for prospecting	The area is approximately 30 150,5 Ha (Thirty Thousand One Hundred and Fifty Hectares)
Geological formation	The target geological formation is the Bushmanland Group

Table 15: Relevant base metal deposits

DEPOSIT NAME	COMMODITY	TYPE CODE	FARM
Broken Hill & Broken Hill Deeps	Lead, zinc, copper and silver	<u>B</u>	Zuurwater 62/4 Aggeneys 56/1
Swartberg	Lead, zinc, copper and silver	<u>B</u>	Zuurwater 62/4
Gamsberg	Zinc and lead	<u>B</u>	Gams 60/1 Bloemhoek 61/1

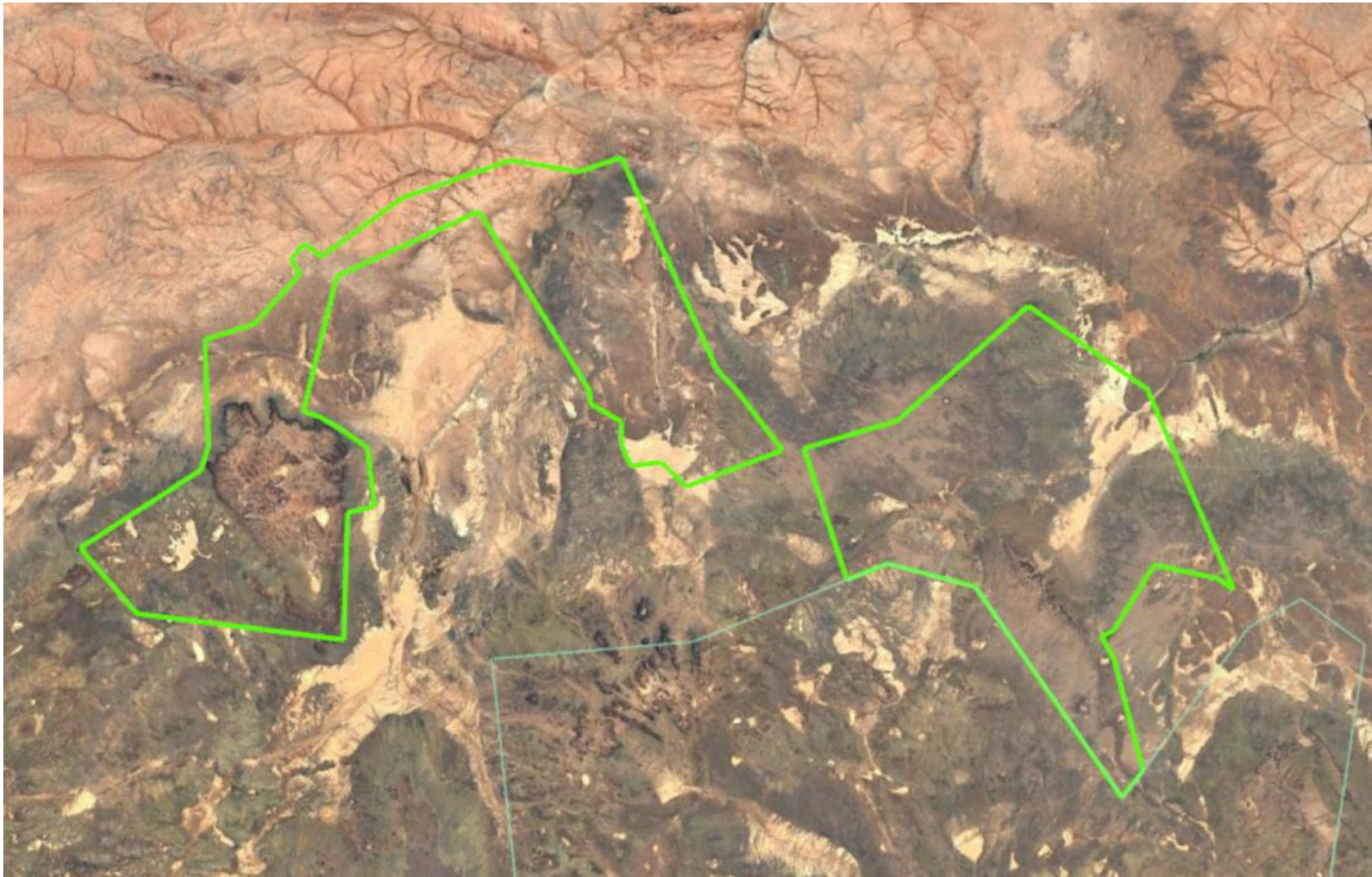


Figure 12: Google Earth Image (2018) indicating the locality of the Vaalhoek Prospecting Right Application in the Northern Cape

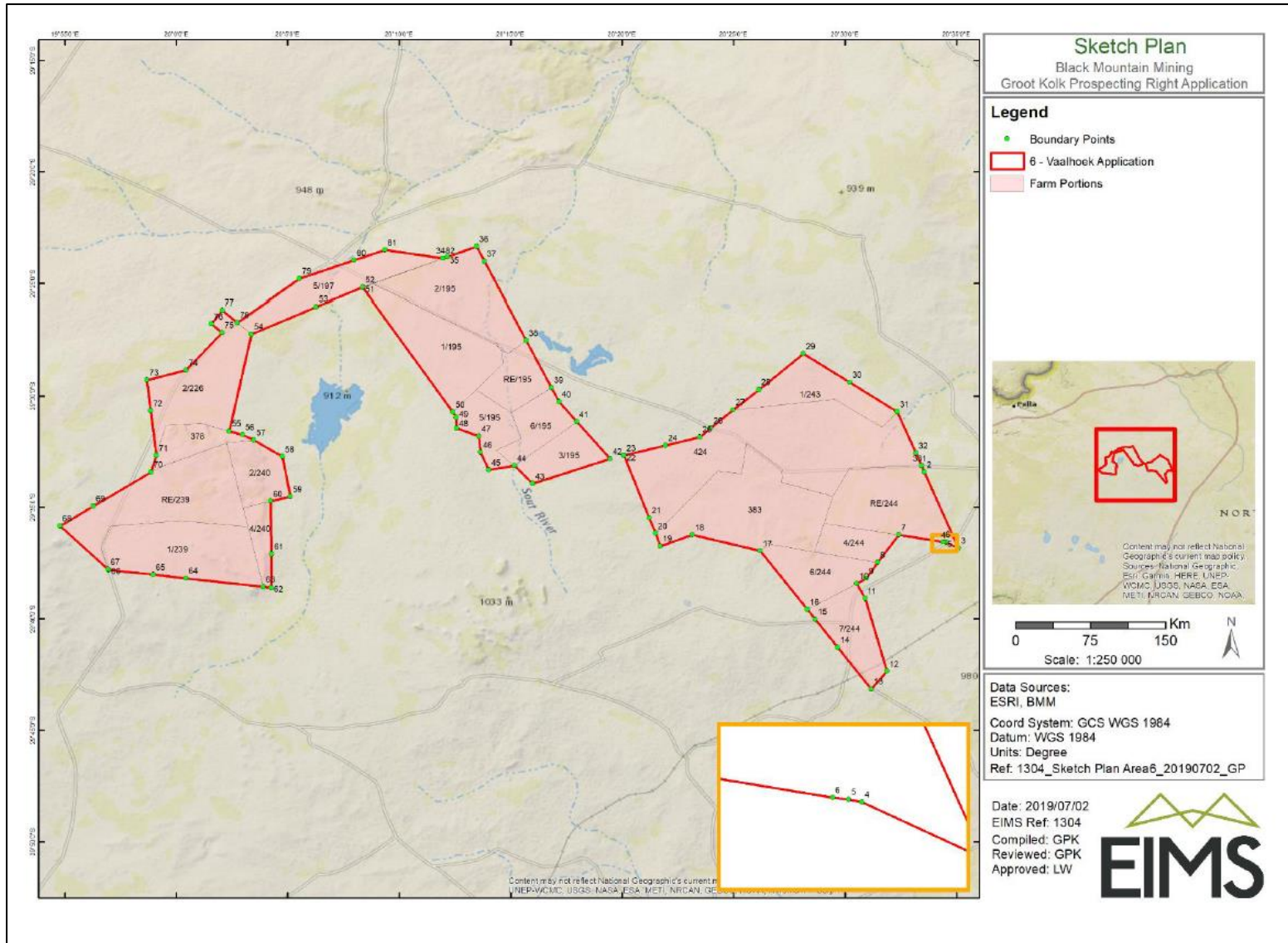


Figure 13: Vaalhoek Prospecting Right Application area. Map provided by EIMS

Table 16: Properties within which the Vaalhoek Application area falls (information provided by EIMS)

Nr	Registered Land Description	Magisteria I District	Extent (Ha)	Title Deed/Diagram Deed	SG Code
1	Farm Loog Kolkjes 195 Portion 0 RE	Kenhardt	1688.3822	T13926/2006CTN	C03600000000019500000
2	Farm Loog Kolkjes 195 Portion 1	Kenhardt	4261.466378	T69406/2015CTN	C03600000000019500001
3	Farm Loog Kolkjes 195 Portion 2	Kenhardt	4232.2797	T13926/2006CTN	C03600000000019500002
4	Farm Loog Kolkjes 195 Portion 3	Kenhardt	1715.919782	T18092/1999CTN	C03600000000019500003
5	Farm Loog Kolkjes 195 Portion 5	Kenhardt	1730.030602	T76872/1998CTN	C03600000000019500005
6	Farm Loog Kolkjes 195 Portion 6	Kenhardt	1698.47877	T18092/1999CTN	C03600000000019500006
7	Farm Adjoining Geelvloer 197 Portion 5	Kenhardt	3040.694649	T75653/1989CTN	C03600000000019700005
8	Farm T Caimoeps Laagte 226 Portion 2	Kenhardt	4240.160157	T75661/1989CTN	C03600000000022600002
9	Farm Zeven Paard 239 Portion 0	Kenhardt	5612.339875	T455/2000CTN	C03600000000023900000
10	Farm Zeven Paard 239 Portion 1	Kenhardt	4955.428821	T103111/2006CTN	C03600000000023900001
11	Farm Hendrik Zyn Puts 240 Portion 2	Kenhardt	1801.725102	T455/2000CTN	C03600000000024000002
12	Farm Hendrik Zyn Puts 240 Portion 4	Kenhardt	931.828297	T103111/2006CTN	C03600000000024000004
13	Farm Boomen Rivier 243 Portion 1	Kenhardt	2616.718309	T42465/2011CTN	C03600000000024300001
14	Farm Jagt Kolk 244 Portion 0 RE	Kenhardt	4112.1485	T64503/2010	C03600000000024400000
15	Farm Jagt Kolk 244 Portion 4	Kenhardt	1286.29	T64503/2010	C03600000000024400004
16	Farm Jagt Kolk 244 Portion 6	Kenhardt	2390.242789	T106053/2000CTN	C03600000000024400006
17	Farm Jagt Kolk 244 Portion 7	Kenhardt	2372.748603	T106054/2000CTN	C03600000000024400007
18	Farm Vaalhoek 378 Portion 0	Kenhardt	1352.423261	T455/2000CTN	C03600000000037800000
19	Farm Farm 383 Portion 0	Kenhardt	6257.414131	T64504/2010CTN	C03600000000038300000
20	Farm Plaas 424 Portion 0	Kenhardt	10695.66135	T90097/2002CTN	C03600000000042400000
	TOTAL AREA (HA)		66042		

Table 17: Vaalhoek Application: Minerals to be prospecting for (information provided by EIMS)

ITEM	DETAIL
Type of mineral(s)	Ferrous & base metals: Cu – Copper
Type of minerals continued	Ferrous & base metals: Fe- Iron
Type of minerals continued	Ferrous & base metals: Pb -Lead
Type of minerals continued	Ferrous & base metals: Zn - Zinc
Type of minerals continued	Ferrous & base metals: Mn - Manganese
Type of minerals continued	Precious metals: Ag - Silver
Type of minerals continued	Precious metals: Au - Gold
Type of minerals continued	Ferrous & base metals: Ni - Nickel
Type of minerals continued	Ferrous & base metals: Mo – Molybdenum

Table 18: Relevant base metal deposits at the Vaalhoek Application

DEPOSIT NAME	COMMODITY	TYPE CODE	FARM
Broken Hill & Broken Hill Deeps	Lead, zinc, copper and silver	<u>B</u>	Zuurwater 62/4 Aggeneys 56/1
Swartberg	Lead, zinc, copper and silver	<u>B</u>	Zuurwater 62/4
Gamsberg	Zinc and lead	<u>B</u>	Gams 60/1 Bloemhoek 61/1

3 LEGISLATION

3.1 National Heritage Resources Act (25 of 1999)

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

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

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

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- the construction of a bridge or similar structure exceeding 50 m in length;
- any development or other activity which will change the character of a site—
- (exceeding 5 000 m² in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m² in extent;
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4 OBJECTIVE

The objective of a Palaeontological Desktop Assessment is to determine the impact of the development on potential palaeontological material at the site.

According to the “SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports” the aims of the PIA are: 1) to **identify** the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to assess the **palaeontological importance** of the formations 3) to determine

the **impact** on fossil heritage, and 4) to **recommend** how the developer ought to protect or mitigate damage to fossil heritage.

When a palaeontological desktop study is compiled, the potentially fossiliferous rocks present are established from 1:250 000 geological maps. The topography of the development is identified by 1:50 000 topography maps and Google Earth Images. The following available data is used to identify fossil heritage within each rock section namely, the PalaeoMap from SAHRIS, previous palaeontological impact studies conducted in the same region and databases of various institutions which identify fossils found near the development. The palaeontological status of each rock is calculated and the possible impact of the development on fossil heritage is determined by a) the palaeontological importance of the rocks, b) the quantity of bedrock removed and c) the type of development.

When the development footprint has a **moderate to high sensitivity, a field-based assessment** is necessary. Recommendations for any further studies or mitigation are made by using both the desktop and the field survey of the exposed rock. Destructive impacts on fossils only occur during the construction phase and the excavations will change the current topography. With construction fossils may be destructed or permanently sealed-in at or below the ground surface. The fossils will then no longer be accessible for scientific research.

Mitigation comprises the collection and recording of fossils and may precede construction or occur during construction when potentially fossiliferous bedrock is exposed. It is important to note that preceding the excavation of any fossil heritage a permit from SAHRA must be obtained and the material will have to be housed in a permitted institution. When correct mitigation measures are applied, a positive impact as possible because our knowledge of local palaeontological heritage may be increased.

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;
- Adherence to all appropriate best practice guidelines, relevant legislation and authority requirements;
- Provide a thorough overview of all applicable legislation, guidelines;
- Cumulative impact identification and assessment as a result of other renewable energy (RE) developments in the area (including; a cumulative environmental impact table(s) and statement, review of the specialist reports undertaken for other Renewable Energy developments and an indication of how the recommendations, mitigation measures and conclusion of the studies have been considered);
- Identification sensitive areas to be avoided (including providing shapefiles/kmls);
- Assessment of the significance of the proposed development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:

- Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
 - Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.
 - Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.
- Comparative assessment of alternatives (infrastructure alternatives have been provided):
 - Recommend mitigation measures in order to minimise the impact of the proposed development; and
 - Implications of specialist findings for the proposed development (e.g. permits, licenses etc).

Specific Requirements:

- Describe and map the palaeontological heritage features of the site and surrounding area. This is to be based on desk-top reviews, fieldwork, available databases, findings from other palaeontological heritage studies in the area, where relevant. Include reference to the grade of heritage feature and any heritage status the feature may have been awarded.
- Assess the impacts and provide mitigation measures to include in the environmental management plan.
- Map palaeontological heritage sensitivity for the site. Clearly show any “no-go” areas in terms of heritage (i.e. “very high” sensitivity) and provide recommended buffers or set-back distances.
- Identify and assess potential impacts from the project on palaeontology, as required by heritage legislation.
- Provide an updated sensitivity map for the six Black Mountain Prospecting Right application areas.
- Assess the project alternatives provided, including the no-go alternative

5 GEOLOGICAL AND PALAEOLOGICAL HISTORY

The proposed applications are situated in the semi-arid, flat-lying terrain of the northern part of the Bushmanland Plateau, Northern Cape Province (Figure 13- 23). The proposed Prospecting Right Applications is completely underlain by basement bedrock of the Bushmanland Group of the Namaqua Metamorphic Province; igneous Karoo dolerite, as well as the Prins Albert and Whitehill Formations (Ecca Group) of the Karoo Supergroup. Quaternary to Recent aeolian sediments of the Gordonia Formation (Kalahari Group), and alluvial calcretes and gravels are also present.

According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Kalahari Group is low. The igneous rocks of the Bushmanland and Karoo Dolerite is insignificant or zero while the Ecca sediments of the Karoo Supergroup have a high Paleontological Sensitivity.

Bushmanland Group

Inselbergs and ridges are common in this area and consists of bedrock granites, gneisses and metamorphic rocks of the Namaqua Metamorphic Province, Aggeneys Subgroup of the Bushmanland Group. The Aggeneys Subgroup is a meta-volcanosedimentary sequence that overlies the gneiss of the Gladkop Suite (approximately 1800 Ma). The Bushmanland Group was deposited between 1640 and 1200 Ma, in an environment similar to the present-day Red Sea where active geothermal venting is depositing base metals in clayey muds collecting in hollows on the sea floor (Bailie et al, 2007). The Bushmanland Group sediments were thus deformed and metamorphosed and are thus **unfossiliferous**. Gamsberg is presently a concave synform (sedimentary layers in a concave formation) feature folded into the granitic gneiss. Superimposing the bedrock on the plains are considerable younger deposits where fossils only occur sporadically (Pether, 2013). These sediments will be affected by the mining activities.

Dwyka Group, Karoo Supergroup

The Gifkop, Wit Puts, Tierklip and Groot Kolk Application sites are also underlain by glacial sediments of the Permo-Carboniferous Dwyka Group (Mzibane Formation). This Group is the oldest deposit in the Karoo Supergroup. South Africa was covered by an ice sheet during the Dwyka. These deposits were deposited in a cold, glacially dominated environment and consists mainly of gravelly sediments with subordinate varved shales and mudstones with scraped and faceted pebbles. The retreating glacier deposited dark-grey tillite. The Dwyka is known for its rich assemblage of dropstones of various sizes. The Mzinane Formation are generally of low palaeontological sensitivity. The Permo-Carboniferous Dwyka Group is known for its track ways also known as Ichnofacies that was formed by fish and arthropods. Fossilized faeces or coprolites have also been recovered. Body fossils consists of gastropods, invertebrates and marine fish, as well as fossil plants. A rich diversity of conifers, cordaitaleans, glossopterids, ginkgoaleans, pollens and spores have been described from this Group while ferns, horsetails and lycopods, are also found. Fossils recorded from the Mzibane Formation

include interglacial trace fossils, petrified woods, palynomorphs, and possible stromatolites, which Almond (2018) speculated to be false.

The Ecca Group of the Karoo Basin is also present in all the proposed development applications except the Groot Kolk Application area. The Ecca Group consists of 16 formations of which the Prins Albert and Whitehill formations is the most extensive. The Prins Albert Formation is limited to the south western half of the Karoo Basin and in the past known as "Upper Dwyka Shales."

The Prince Albert Formation consists of marine to hyposaline basin plain mudrocks that occur with minor volcanic ashes, iron stones and phosphates. Post-glacial mudrocks is present at the base of the Prince Albert Formation. The fossil assemblage of the Prince Albert Formation is known for its rich assemblages of plant fossils known as the *Glossopteris* flora. This includes petrified wood, roots and palynomorphs which include spores and acritarchs. In rare cases body fossils of insects have been recovered. Moderately diverse trace fossil assemblages can be present of which many can be assigned to fish or non-marine arthropod groups like crustaceans, king crabs and predatory water scorpions. These invertebrates could have reached lengths of two meters or more.

This trace fossil assemblage of the non-marine *Mermia* Ichnofacies, is dominated by the ichnogenera *Umfolozia* (arthropod trackways) and *Undichna* (fish swimming trails). Fish coprolites have also been described from this formation. A low diversity marine invertebrate (bivalves, brachiopods, nautiloids), palaeoniscoid fish, sharks and protozoans have been uncovered. There is also a possibility that stromatolites and oolites are preserved. Well-preserved skeletons of the well-known aquatic mesosaurids have been uncovered while amphibians are also recorded from the uppermost Ecca beds.

Karoo Dolerite Suite.

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

Quaternary Deposits

Quaternary to Recent aeolian sediments of the Gordonina Formation (Kalahari Group), and alluvial calcretes and gravels are present along shallow drainage lines and around pans and is of generally low palaeontological sensitivity. These sediments are also encountered near the surface in the study area.

The **Kalahari deposits** is approximately Ca 65 – 2.5 million years old (Ma).

The Cenozoic Kalahari Group is the most widespread body of terrestrial sediments in southern Africa. The Cenozoic sands and calcretes of the Kalahari Group range in thickness from a few metres to more than 180m (Partridge et al., 2006). The youngest formation of the Kalahari group is the Gordonia Formation which is generally termed Kalahari sand and comprises of red aeolian sands that covers most of the Kalahari Group sediments. The pan sediments of the area originated from the Gordonia Formation and contains white to brown fine-grained silts, sands and clays. Some of the pans consist of clayey material mixed with evaporates that shows seasonal effects of shallow saline groundwaters. Quaternary alluvium, aeolian sands, surface limestone, silcrete, and terrace gravels are also included in the Kalahari Group (Kent 1980)

The fossil assemblages of the Kalahari are generally very low in diversity and occur over a wide range and thus the palaeontological diversity of this Group is low. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods and trace fossils.

All the Geological Maps were drawn by QGIS Desktop 2.18.28. Note that in each map a brown colour in the legend is not labelled but this is allocated to the younger strata of the Kalahari Group deposits of the central interior and the uppermost, superficial deposits form the surface of the plains which are Quaternary to Recent in age.

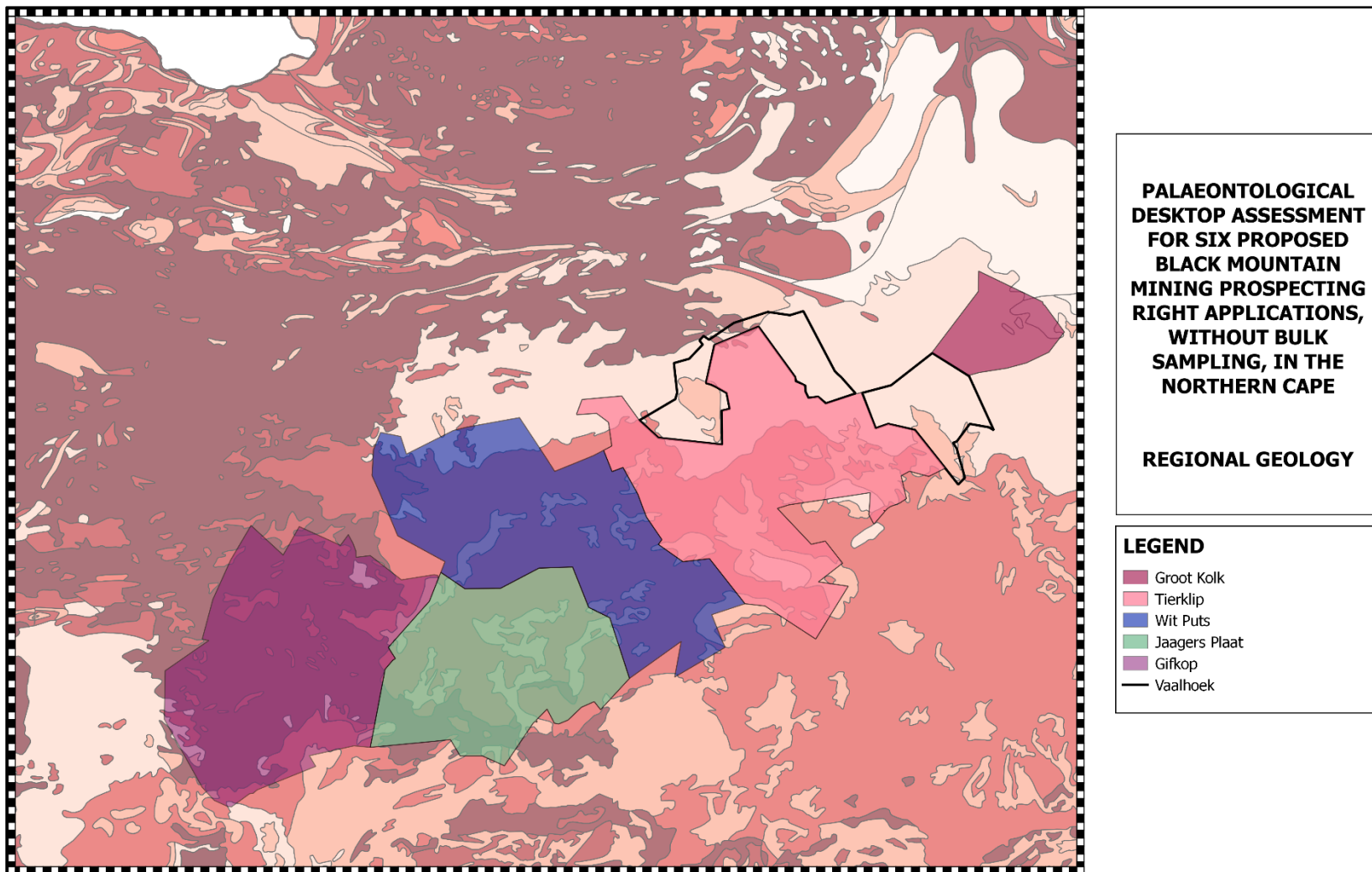


Figure 14: Surface geology of the six proposed Prospecting Right Applications in the Northern Cape. Map was drawn by QGIS Desktop 2.18.28

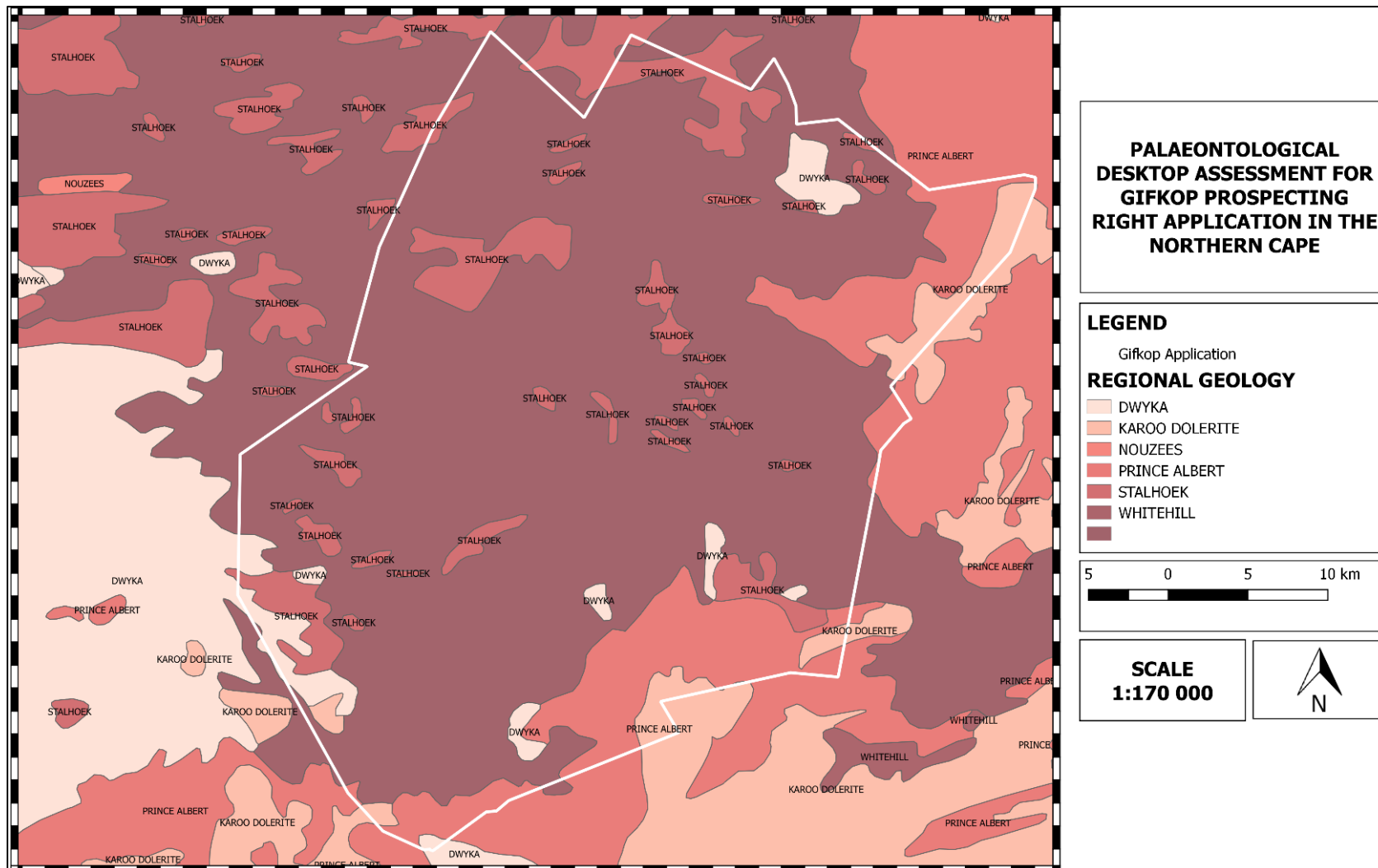


Figure 15: Surface geology of the proposed Gifkop Prospecting Right Applications in the Northern Cape. The proposed development is mainly underlain by the Kalahari Formation with isolated areas of the Dwyka Group, Karoo Dolerite, Stalhoek and Prins Albert Formations. Map was drawn by QGIS Desktop 2.18.28

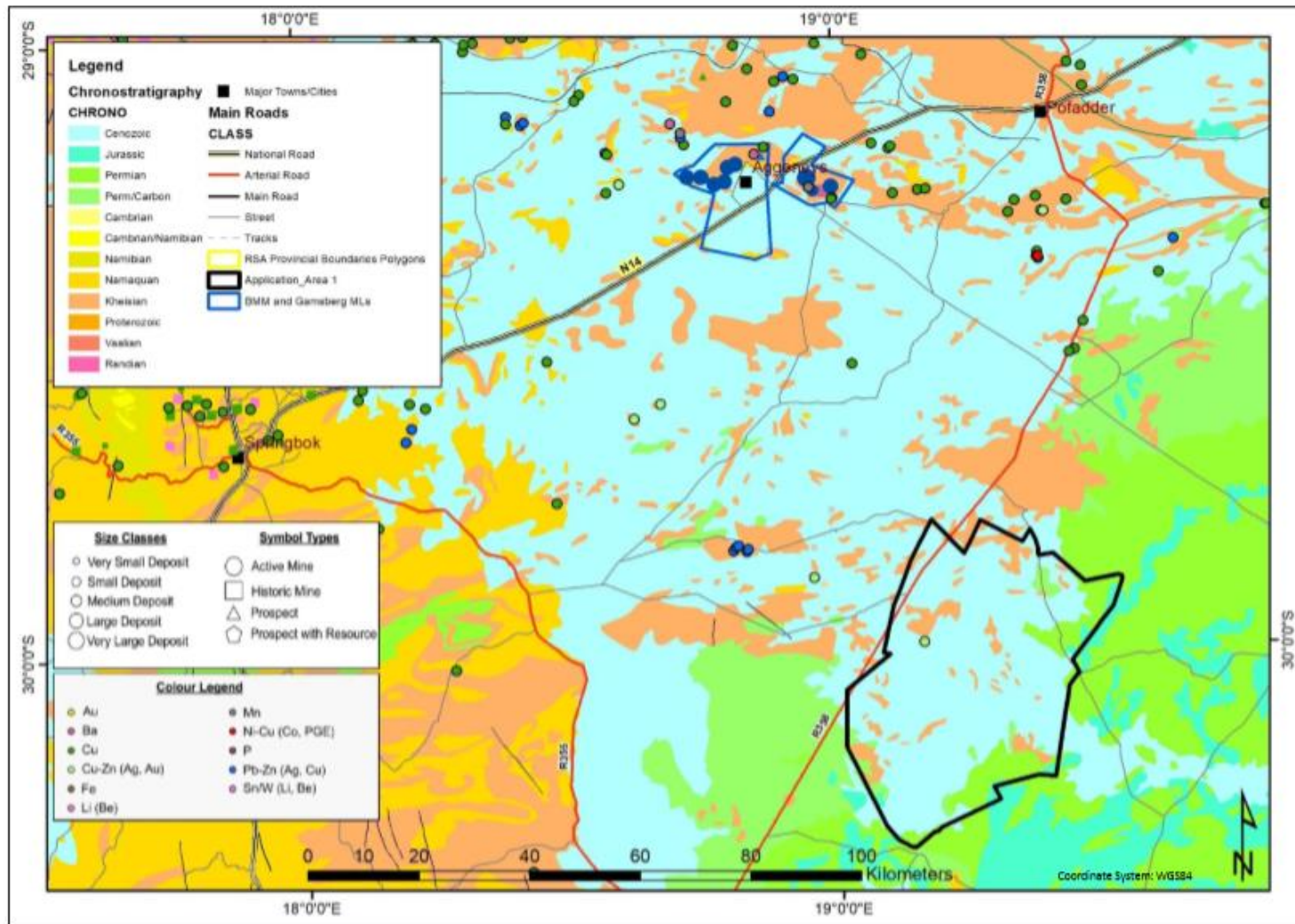


Figure 16: Geological Map of proposed Gifkop Prospecting Right Applications in the Northern Cape. Map Provided by EIMS

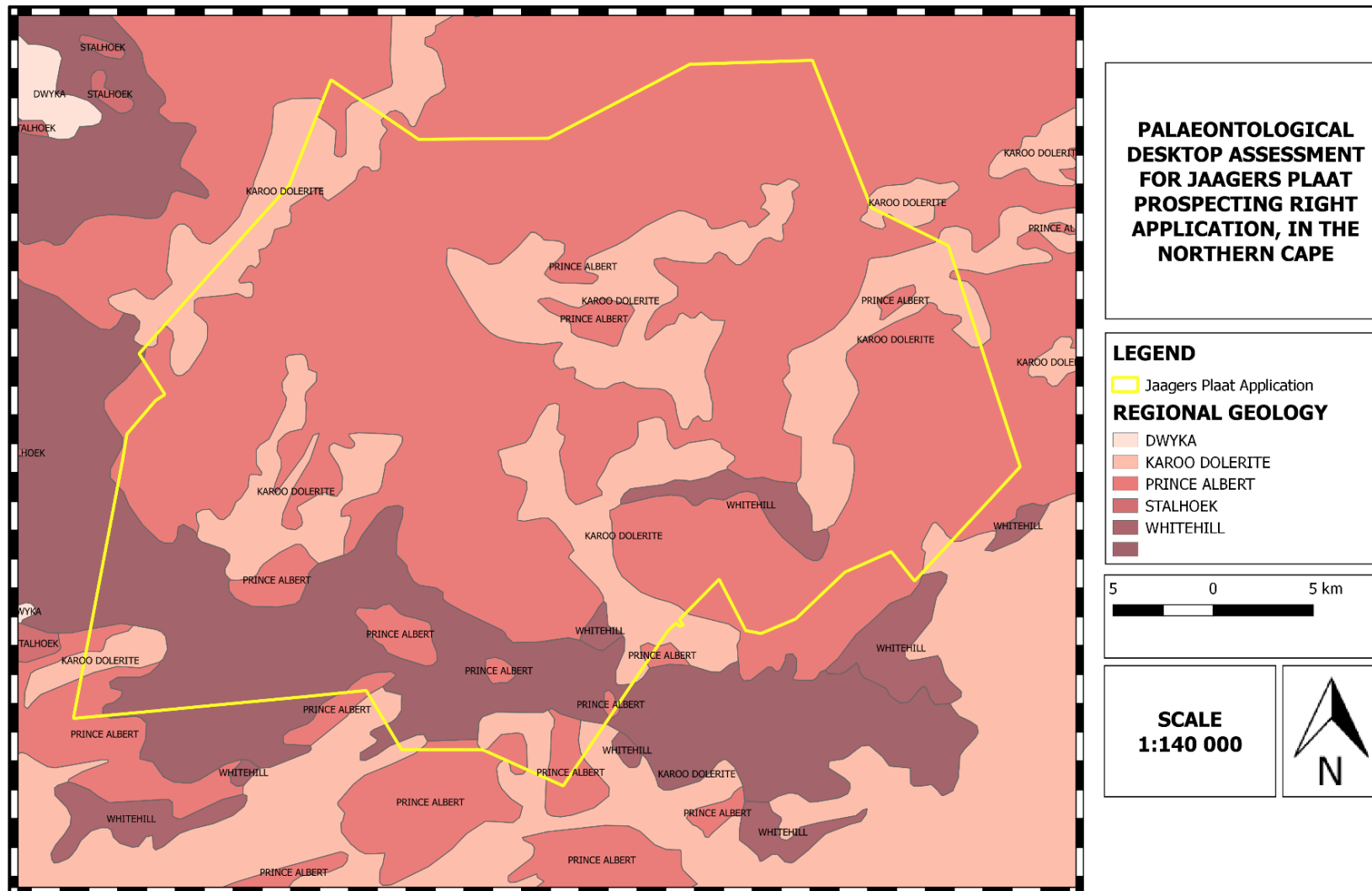


Figure 17: Surface geology of the proposed Jaagers Plat Prospecting Right Applications in the Northern Cape. This development area is mainly underlain by the Kalahari and Prins Albert Formations with isolated outcrops of Karoo Dolerite, Whitehill Formation. Map was drawn by QGIS Desktop

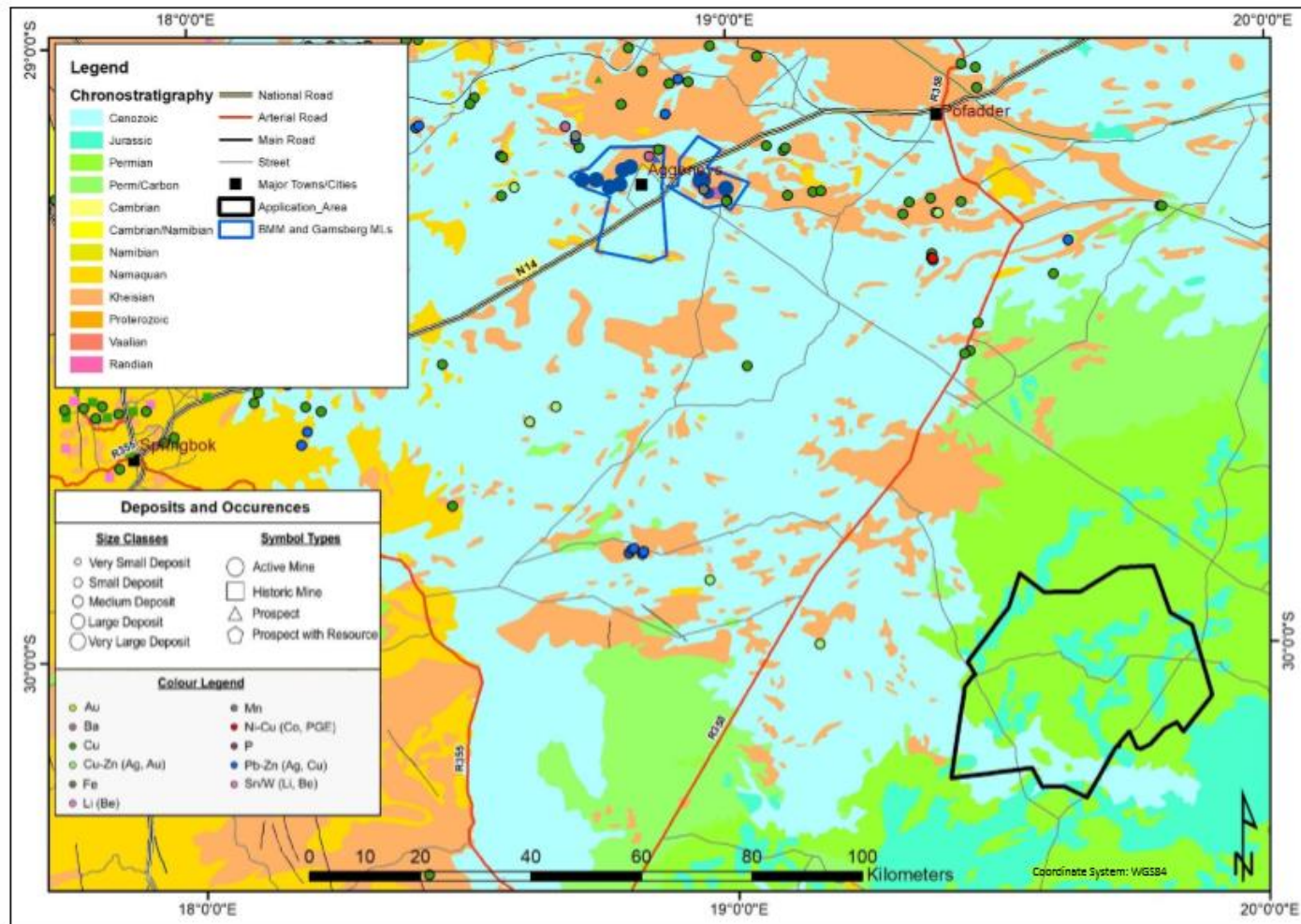


Figure 18: Geological Map of proposed Jaarers Plaats Prospecting Right Applications in the Northern Cape. Map Provided by EIMS

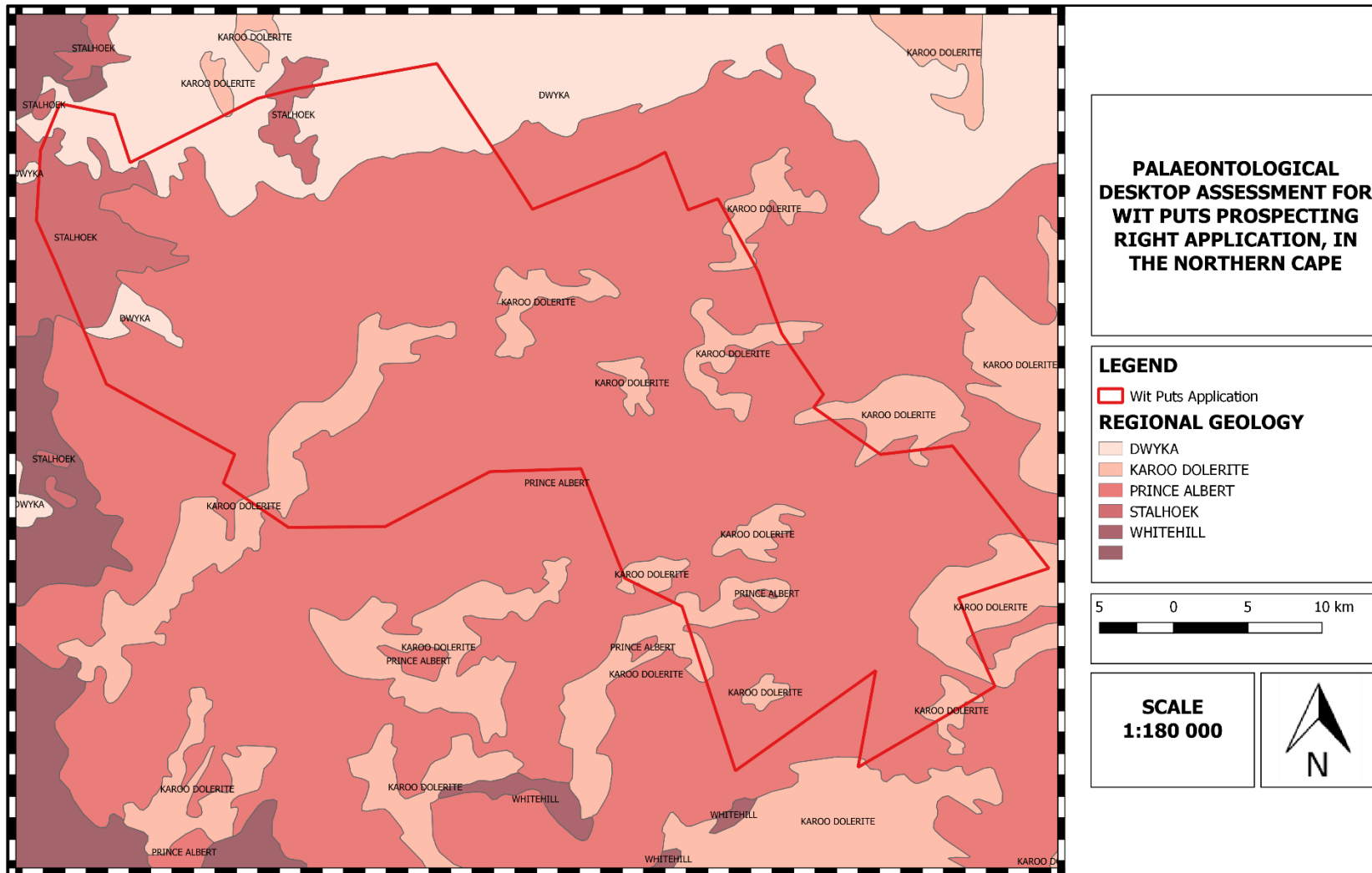


Figure 19: Surface geology of the proposed Wit Puts Prospecting Right Applications in the Northern Cape. The proposed development is primarily underlain by the Prins Albert Formation in the central areas, with scattered areas of Karoo Dolerite, a small area falls into the Dwyka in the north and Stalhoek in the eastern border. Map was drawn by QGIS Desktop

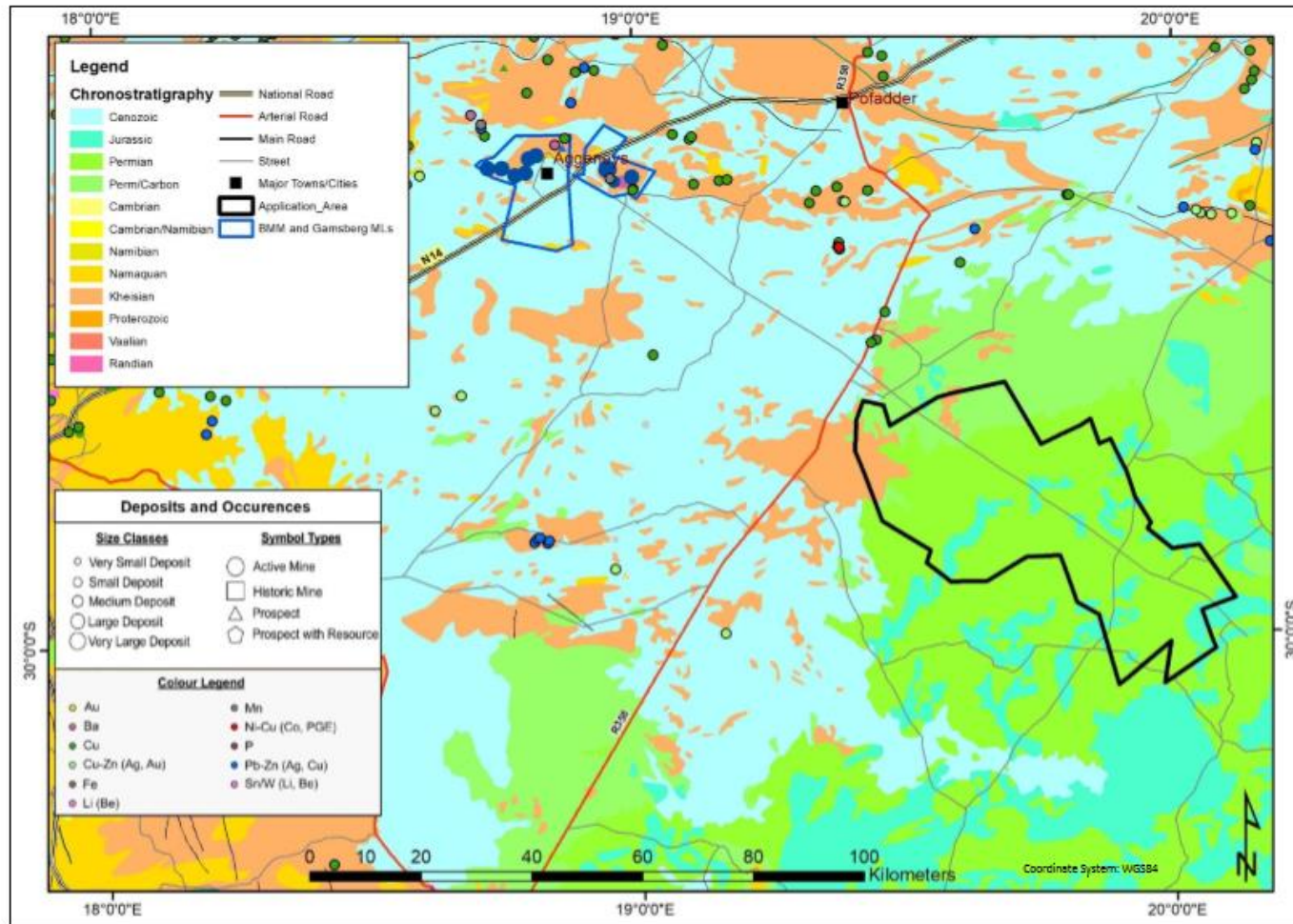


Figure 20: Geological Map of proposed Wit Puts Prospecting Right Applications in the Northern Cape. Map Provided by EIMS

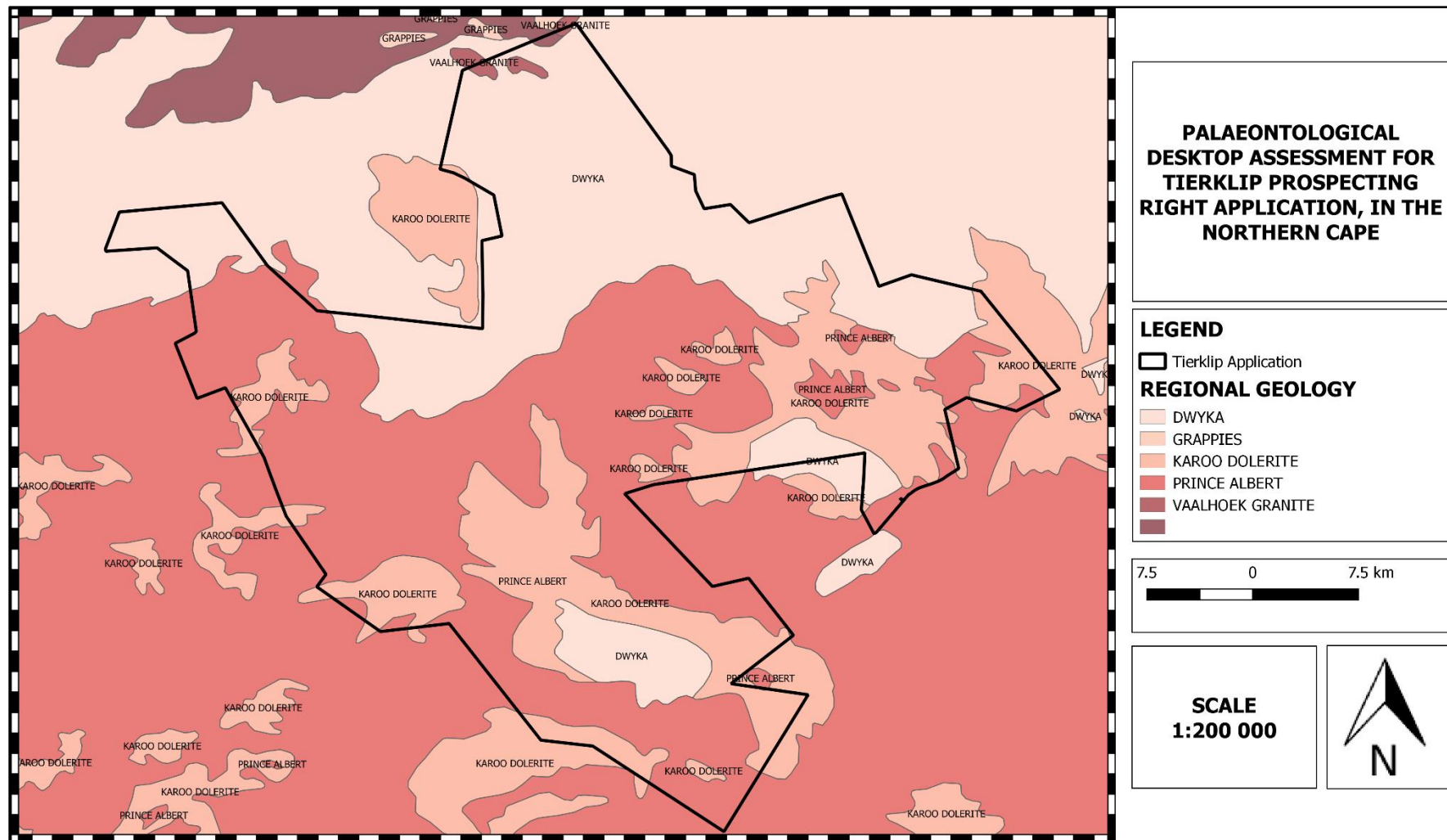


Figure 21: Surface geology of the proposed Tierklip Prospecting Right Applications in the Northern Cape. This development area falls mainly in the Dwyka Group and the Prins Albert Formation with isolated areas of Karoo Dolerite and Vaalhoek Granite. Map was drawn by QGIS Desktop

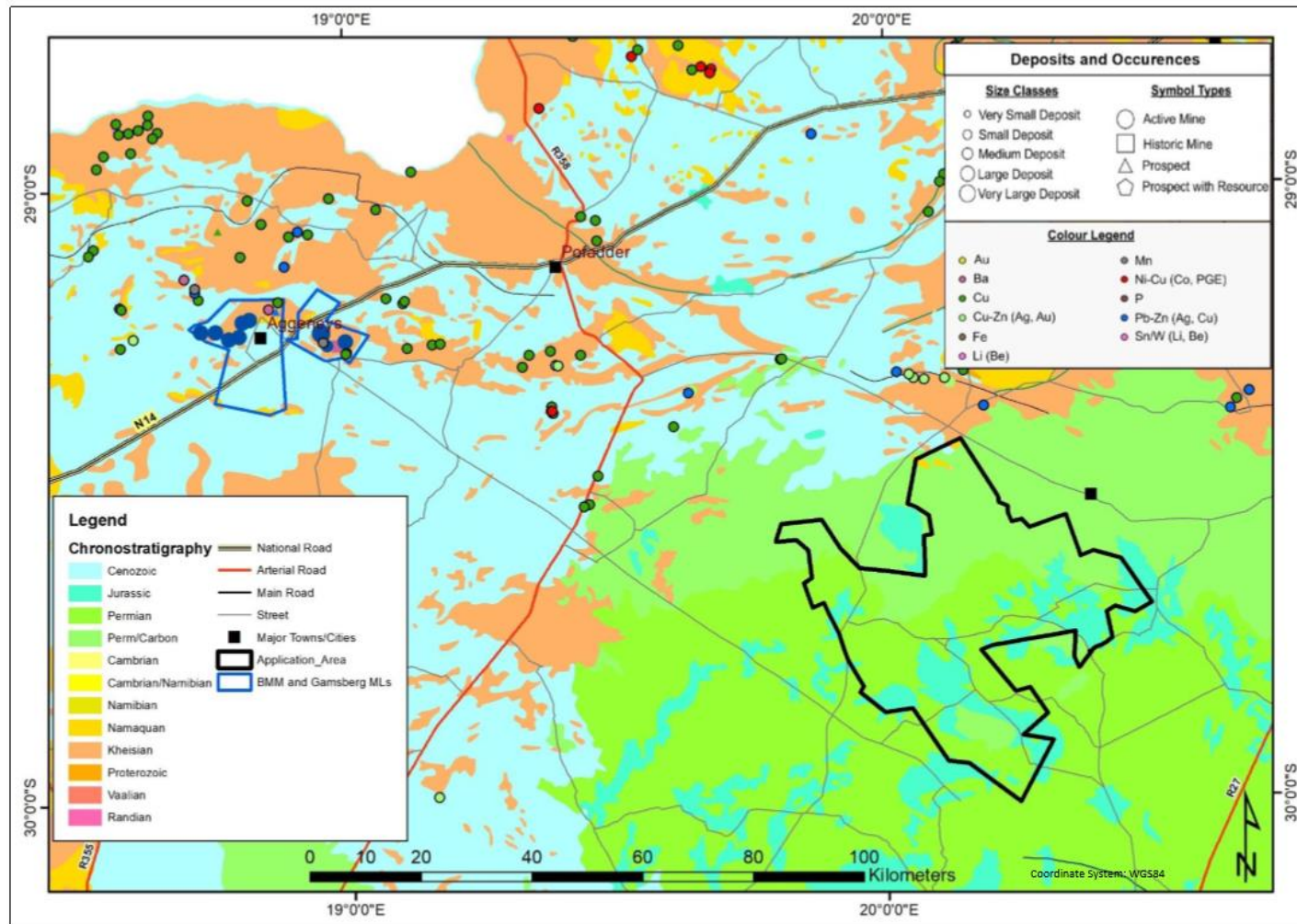


Figure 22: Geological Map of proposed Tierklip Prospecting Right Applications in the Northern. Map Provided by EIMS

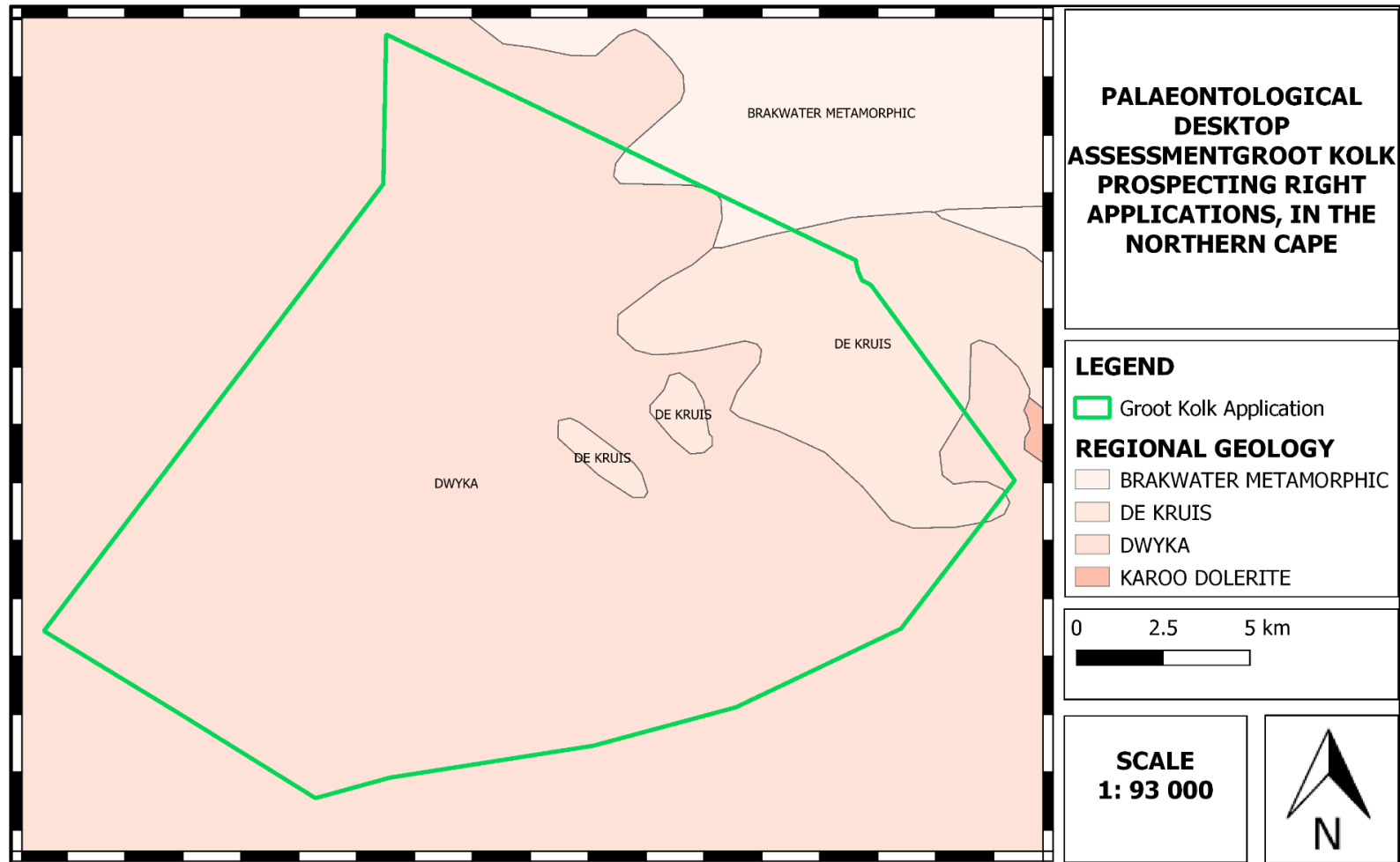


Figure 23: Surface geology of the proposed Groot Kolk Prospecting Right Applications in the Northern Cape. This development area is mainly underlain by the Dwyka Group with small isolated outcrops of De Kruis Group and Bayswater Metamorphic rocks. Map was drawn by QGIS Desktop

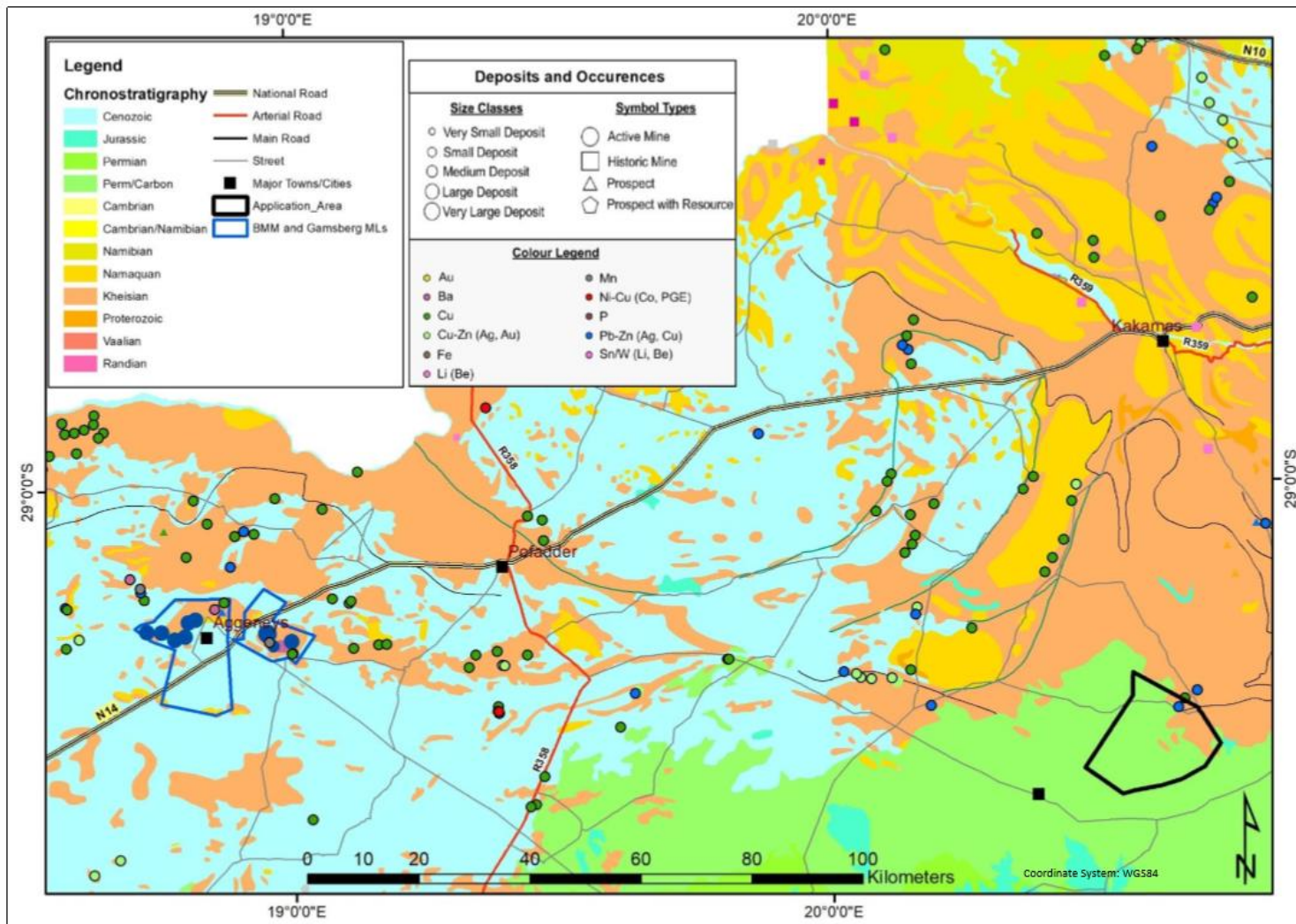


Figure 24: Geological Map of proposed Groot Kolk Prospecting Right Applications in the Northern Cape in the Northern Cape. Map Provided by EIMS

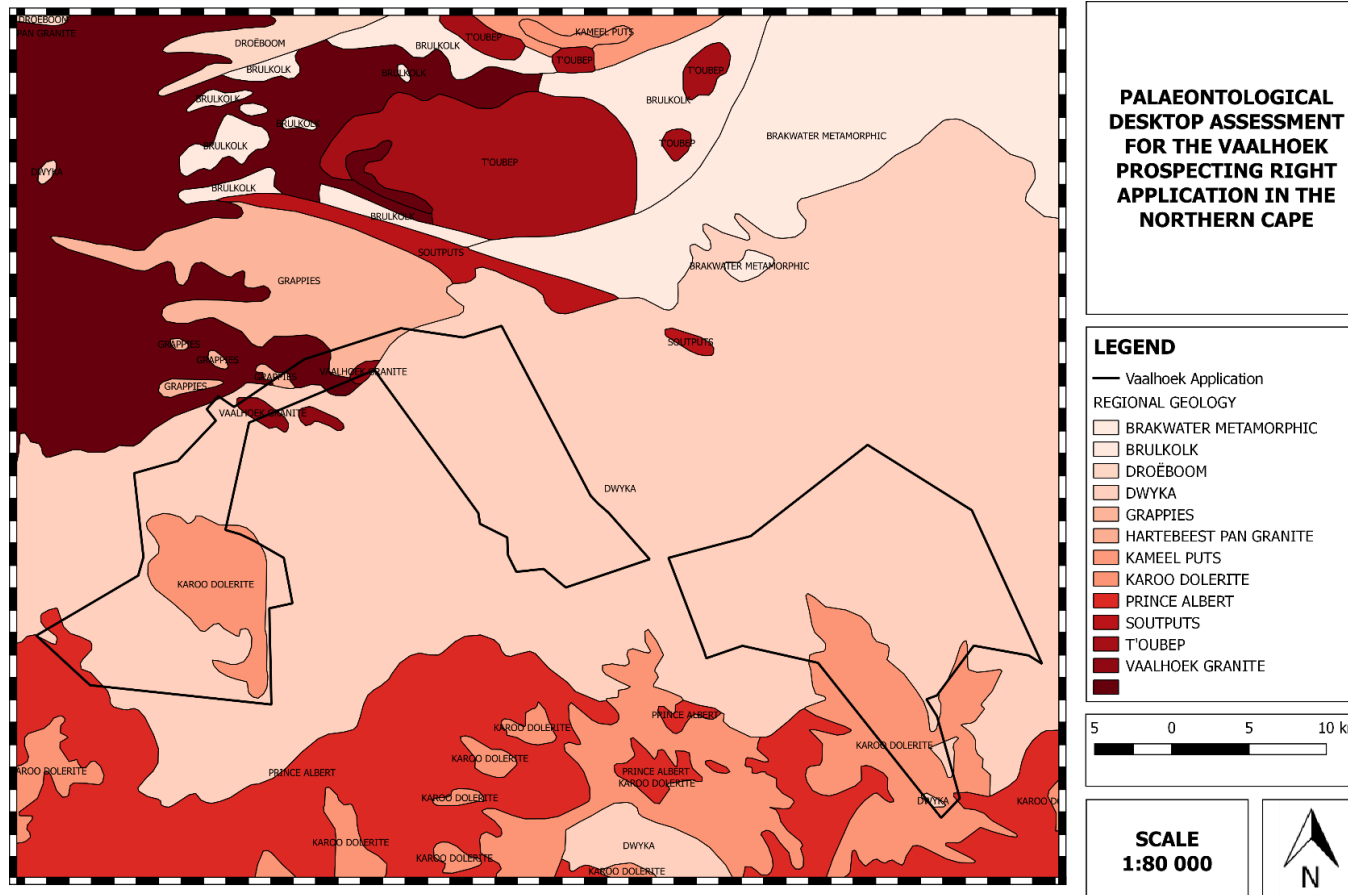


Figure 25: Surface geology of the proposed Vaalhoek Prospecting Right Applications in the Northern Cape. This development area is mainly underlain by the Dwyka Group with small isolated outcrops of Karoo Dolerite, Vaalhoek Granite, Grappies rocks as well as a small area of Prins Albert Formation in the eastern corner. Map was drawn by QGIS Desktop

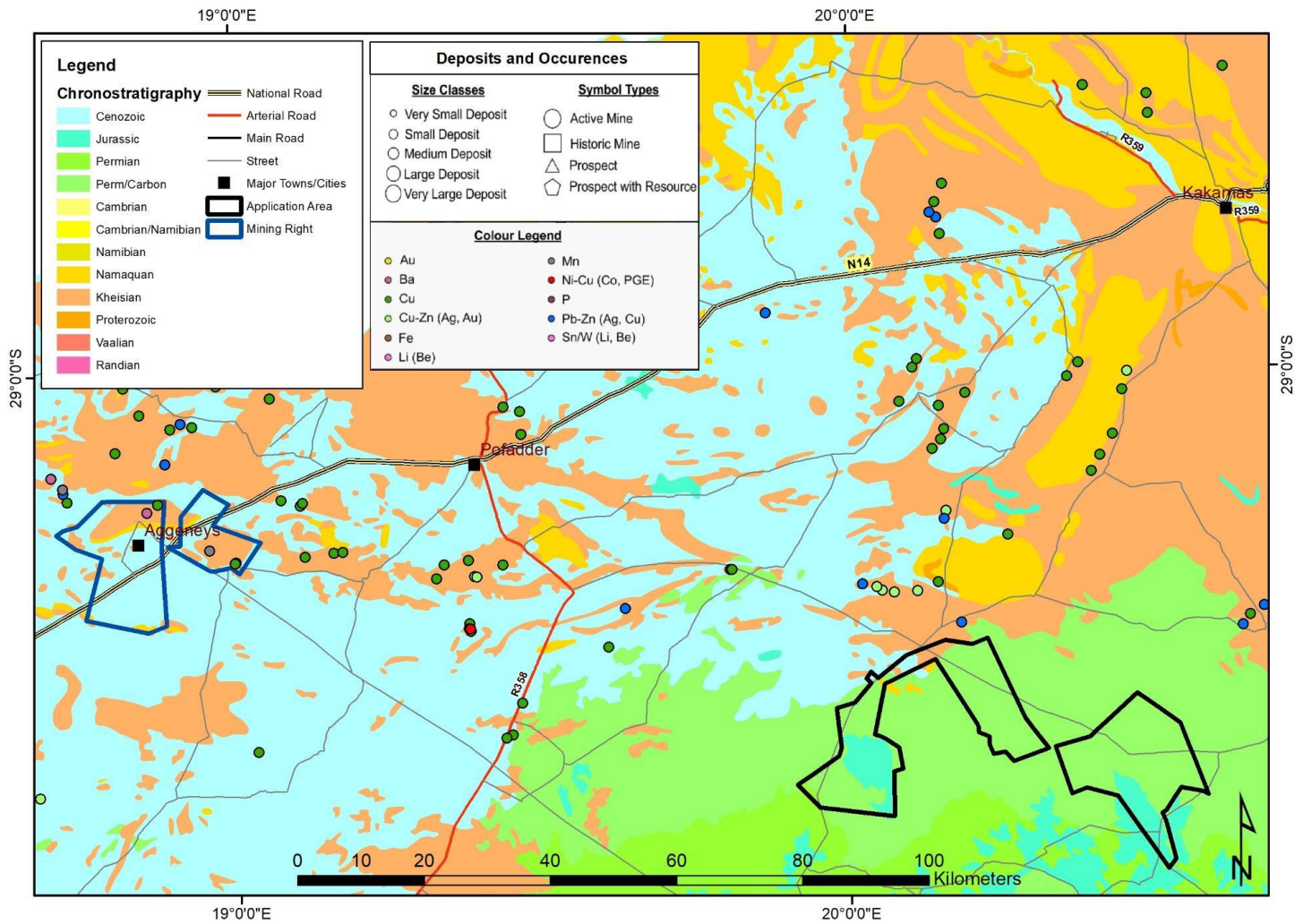


Figure 26: Geological Map of proposed Groot Kolk Prospecting Right Applications in the Northern Cape in the Northern Cape. Map Provided by EIMS

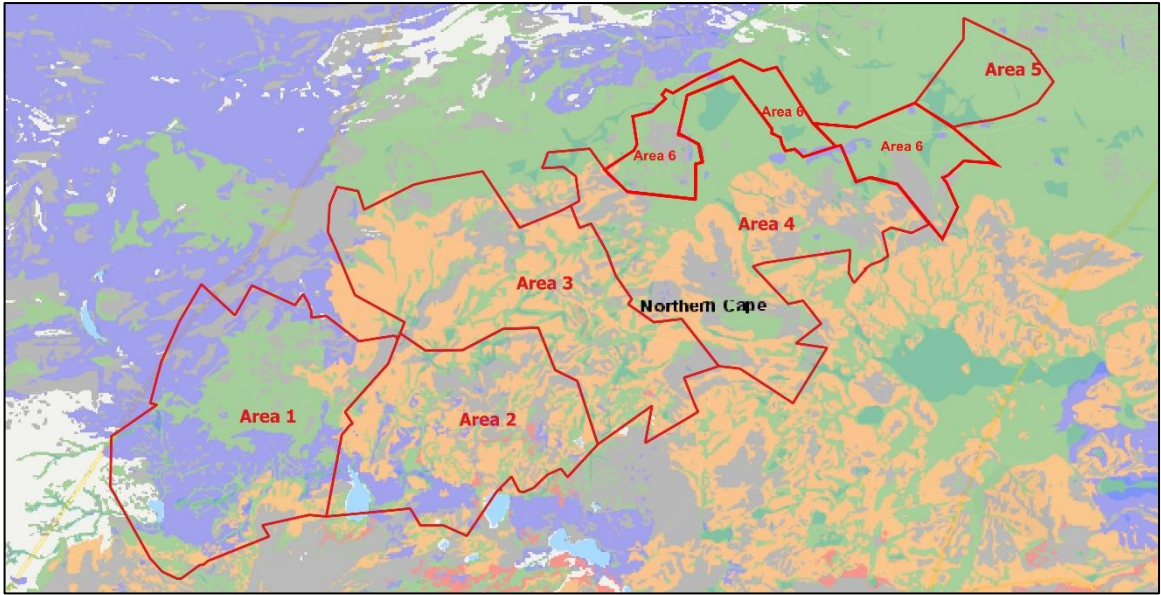
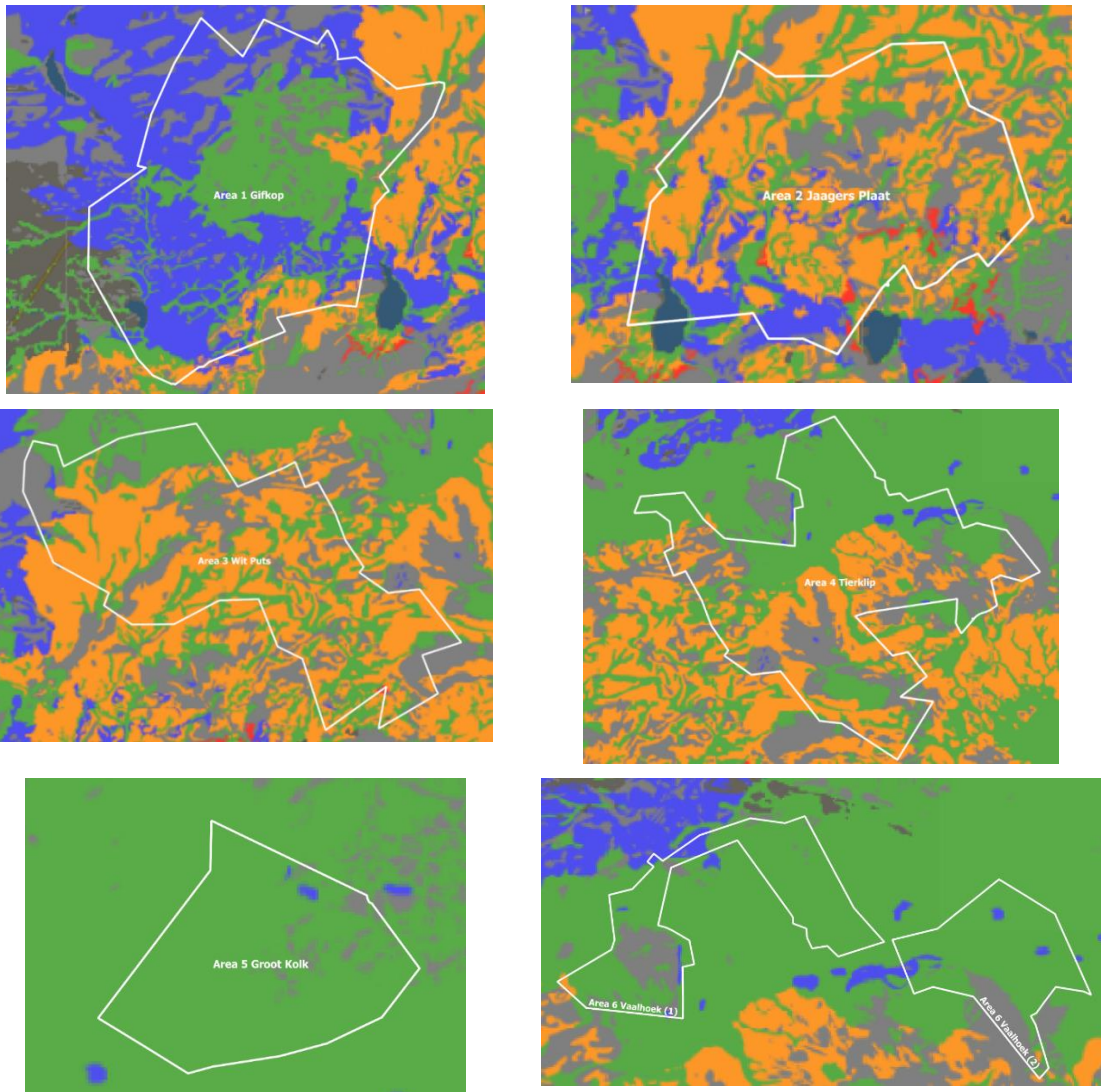


Figure 27: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences). Approximate location of the six proposed prospecting application areas is indicated in red



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

According to the SAHRIS palaeosensitivity map (Figure 27: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences). Approximate location of the six proposed prospecting application areas is indicated in red **Figure 27**) there is a Moderate to High chance of finding fossils throughout the overall area, although the specific sensitivity for each prospecting rights area varies from Low to Moderate or High sensitivity.

6 GEOGRAPHICAL LOCATION OF THE SITES

Gifkop Prospecting Right Application Area

The area is about 75 to 120 kilometers South East of Aggeneys and 130 kilometers East South East of Springbok, Namaqualand District, Northern Cape Province and is approximately 177 468 Ha (one hundred and seventy-seven thousand four hundred and sixty-eight hectares) in extent

Jaagers Plat Prospecting Right Application Area

The area is situated nearly 100 to 130 kilometers South East of Aggeneys and 175 kilometers East South East of Springbok, Namaqualand District, Northern Cape Province and is about 129 407 Ha (one hundred and twenty thousand four hundred and seven hectares) in extent.

Wit Puts Prospecting Right Application Area

This Application is located nearly 114 kilometers South East of Aggeneys and 200 kilometers East of Springbok, Namaqualand District, Northern Cape Province and is approximately 174 126 Ha (one hundred and seventy-four thousand one hundred and twenty six hectares) in extent.

Tierklip Prospecting Right Application Area

The Tierklip Application is located approximately 100 to 170 kilometers South East of Aggeneys and 173 kilometers South West of Upington, Namaqualand District, Northern Cape Province. The extent of the area is approximately 180 001 Ha (one hundred and eighty thousand and one hectares).

Groot Kolk Prospecting Right Application Area

The Groot Kolk Application area can be found almost 187 kilometers South West of Upington and 193 km kilometers South East of Aggeneys, Namaqualand District, Northern Cape Province. This application area is approximately 30 150,5 Ha (Thirty Thousand One Hundred and Fifty Hectares) in extent.

Vaalhoek Prospecting Right Application

The Vaalhoek area is located between the Groot Kolk and Tierklip Prospecting areas. The area is located approximately 187 kilometres South West of the town of Upington and 193 km kilometres South East of the town of Aggeneys, Namaqualand District, Northern Cape Province. The extent of the area is approximately 66 042 Ha (Sixty Six Thousand and Forty Two Hectares).

7 ADDITIONAL INFORMATION CONSULTED.

In compiling this report the following sources were consulted:

- The Palaeosensitivity Map from the SAHRIS website.
- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984)
- Geological Map 1: 250000 Geological Series 2918 Pofadder (Council for Geoscience),
- Geological Map 1: 250000 Geological Series 2920 Kenhardt (Council for Geoscience),
- Geological Map 1:250000 Geological Series 3018 Loeriesfontein (Council for Geoscience)
- Geological Map 1: 250000 3020 Sakrivier (Council for Geoscience).
- A Google Earth map with polygons of the proposed development was obtained from *EIMS*
- Prospecting work programme submitted for a prospecting right application without bulk sampling for the Gifkop prospecting right application.
- Prospecting work programme submitted for a prospecting right application without bulk sampling for the Jaagers Plaat Prospecting Right Application
- Prospecting work programme submitted for a prospecting right application without bulk sampling for the Wit Puts Prospecting Right Application
- Prospecting work programme submitted for a prospecting right application without bulk sampling for the Tierklip Prospecting Right Application
- Prospecting work programme submitted for a prospecting right application without bulk sampling for the Groot Kolk Prospecting Right Application
- A few Impact Study reports have been found on the internet and include Almond 2018; Pether 2013. These reports have been listed in the references.

8 METHODS

A desktop study was assembled to evaluate the possible risk to palaeontological heritage (this includes fossils as well as trace fossils) in the proposed development area. In compiling the desktop report aerial photos, Google Earth 2018, topographical and geological maps and other reports from the same area as well as the author's experience were used to assess the proposed development footprint.

8.1 Assumptions and Limitations

The accuracy of DIA is reduced by several factors which may include the following: the databases of institutions are not always up to date and relevant locality and geological information were not accurately documented in the past. Various remote areas of South Africa have not been assessed by palaeontologists and data is based on aerial photographs alone. Geological maps concentrate on the geology of an area and the sheet explanations were never intended to focus on palaeontological heritage.

Similar Assemblage Zones, but in different areas is used to provide information on the presence of fossil heritage in an unmapped area. Desktop studies of similar geological formations and Assemblage Zones generally **assume** that exposed fossil heritage is present within the development area. The accuracy of the Palaeontological Impact Assessment is thus improved considerably by conducting a field-assessment.

9 THE IMPACT ASSESSMENT METHODOLOGY

An assessment of the impact significance of the proposed NC Prospecting Right applications on local fossil heritage is presented here:

9.1 Methodology for Impact Assessment

The impact assessment methodology is guided by the requirements of the NEMA EIA Regulations (2010). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). Please note that the impact assessment must apply to the identified Sub Station alternatives as well as the identified Transmission line routes.

9.1.1 Determination of Environmental Risk

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER).

The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E+D+M+R)}{4} \times N$$

4

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 19.

Table 19: Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site)
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.

Aspect	Score	Definition
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table 20.

Table 20: Probability Scoring

Probability	Score	Definition
	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \times P$$

Table 21: Determination of Environmental Risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
Probability						

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 22.

Table 22: Significance Classes

Environmental Risk Score	
Value	Description
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9; <17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation

measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

9.1.2 Impact Prioritisation:

In accordance with the requirements of Regulation 31 (2)(l) of the EIA Regulations (GNR 543), and further to the assessment criteria presented in the Section above it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

In addition, it is important that the public opinion and sentiment regarding a prospective development and consequent potential impacts is considered in the decision-making process.

In an effort to ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 23: Criteria for Determining Prioritisation

Public response (PR)	Low (1)	Issue not raised in public response.
	Medium (2)	Issue has received a meaningful and justifiable public response.
	High (3)	Issue has received an intense meaningful and justifiable public response.
Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 23. The impact priority is therefore determined as follows:

$$\text{Priority} = \text{PR} + \text{CI} + \text{LR}$$

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (Refer to **Table 24**).

Table 24: Determination of Prioritisation Factor

Priority	Ranking	Prioritisation Factor
3	Low	1
4	Medium	1.17
5	Medium	1.33
6	Medium	1.5
7	Medium	1.67
8	Medium	1.83
9	High	2

In order to determine the final impact significance, the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is to be able to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential, significant public response, and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table 25: Final Environmental Significance Rating

Environmental Significance Rating	
Value	Description
< 10	Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
≥10 <20	Medium (i.e. where the impact could influence the decision to develop in the area),
≥ 20	High (i.e. where the impact must have an influence on the decision process to develop in the area).

The following impact table is applicable to the following Application areas:

- Gifkop Prospecting Right Application
- Jaagers Plaat Prospecting Right Application
- Wit Puts Prospecting Right Application
- Tierklip Prospecting Right Application

Table 26: Impact Risk Classes

Impact Name	Impact on palaeontological resources
Alternative	0
Phase	Planning
Environmental Risk	

Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	4	2
Extent of Impact	1	1	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	4	1
Environmental Risk (Pre-mitigation)					-15,00
Mitigation Measures					
<i>If fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations the Chance Find Protocol must be implemented by the ECO in charge of these developments. These discoveries ought to be secured (preferably in situ) and the ECO ought to alert SAHRA so that appropriate mitigation (e.g. documented and collection) can be undertaken by a professional palaeontologist.</i>					
Environmental Risk (Post-mitigation)					-3,25
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
<i>Low: Issue not raised in public responses</i>					
Cumulative Impacts					1
<i>Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.</i>					
Degree of potential irreplaceable loss of resources					3
<i>The impact may result in the irreplaceable loss of resources of high value (services and/or functions).</i>					
Prioritisation Factor					1,33
Final Significance					-4,33

The impact of the proposed prospecting activities on potential palaeontological resources is rated as MEDIUM negative significance before mitigation and with the implementation of the mitigation measures the impact significance is reduced to LOW negative.

The following impact table is applicable to the Groot Kolk and Vaalhoek Application areas:

Table 27: Impact Risk Classes

Impact Name	Impact on palaeontological resources				
Alternative	0				
Phase	Planning				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	3	2
Extent of Impact	1	1	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	2	1
Environmental Risk (Pre-mitigation)					-7,00
Mitigation Measures					
<i>If fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations the Chance Find Protocol must be implemented by the ECO in charge of these developments. These discoveries ought to be secured (preferably in situ) and the ECO</i>					

<i>ought to alert SAHRA so that appropriate mitigation (e.g. documented and collection) can be undertaken by a professional palaeontologist</i>	
Environmental Risk (Post-mitigation)	-3,25
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Public Response	1
<i>Low: Issue not raised in public responses</i>	
Cumulative Impacts	1
<i>Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.</i>	
Degree of potential irreplaceable loss of resources	1
<i>The impact is unlikely to result in irreplaceable loss of resources.</i>	
Prioritisation Factor	1,00
Final Significance	-3,25

The impact of the proposed prospecting activities on potential palaeontological resources is rated as LOW negative significance before mitigation and with the implementation of the mitigation measures the impact significance is reduced to LOW negative.

9.2 Summary of Impact Tables

The location of the six proposed Prospecting Right Application Areas in the Northern Cape is completely underlain by basement bedrock of the Bushmanland Group of the Namaqua Metamorphic Province, igneous Karoo dolerite which has a zero Palaeontological Significance, while the Prins Albert and White Hill Formations (Ecca Group) of the Karoo Supergroup has a high Palaeontological Sensitivity. Quaternary to Recent aeolian sediments of the Gordonia Formation (Kalahari Group), and alluvial calcretes and gravels are also present. The latter has a Low palaeontological sensitivity but locally high.

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

10 IMPACT ASSESSMENT METHODOLOGY

10.1.1 Summary of Impact Tables

The impacts were assessed for each of the five application processes

The proposed Prospecting Right Applications in the Northern Cape is completely underlain by basement bedrock of the Bushmanland Group of the Namaqua Metamorphic Province, igneous Karoo dolerite, as well as the Prins Albert and White Hill Formations (Ecca Group) of the Karoo

Supergroup. Quaternary to Recent aeolian sediments of the Gordonia Formation (Kalahari Group), and alluvial calcretes and gravels are also present.

The **Gifkop** Prospecting right Application area is mainly underlain by the Kalahari Formation with isolated areas of the Dwyka Group, Karoo Dolerite and Prins Albert Formation. The Jaagers Plaat Prospecting Right Applications area is mainly underlain by the Kalahari and Prins Albert Formations with isolated outcrops of Karoo Dolerite, Whitehill Formation. The **Wit Puts** Prospecting Right Applications is mainly underlain by the Prins Albert Formation in the central areas, with scattered areas of Karoo Dolerite, a small outcrop Dwyka in the north. The **Tierklip** Prospecting Right Applications falls mainly in the Dwyka Group and the Prins Albert Formation with isolated areas of Karoo Dolerite and Vaalhoek Granite. The **Groot Kolk** Prospecting Right Applications area is mainly underlain by the Dwyka Group with small isolated outcrops of De Kruis Group and Bayswater Metamorphic rocks. The **Vaalhoek** Prospecting Right Application is mainly underlain by the Dwyka Group with small isolated outcrops of Karoo Dolerite, Vaalhoek Granite, Grappies rocks as well as a very small area of Prins Albert Formation in the eastern corner.

According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Kalahari Group is Low, the igneous rocks of the Bushmanland and Karoo Dolerite is Insignificant or zero while the Ecca sediments of the Karoo Supergroup have a High Paleontological Sensitivity.

11 FINDINGS AND RECOMMENDATIONS

The six proposed Prospecting Right Application areas in the Northern Cape are completely underlain by basement bedrock of the Bushmanland Group of the Namaqua Metamorphic Province, igneous Karoo dolerite, as well as the Prins Albert and White Hill Formations (Ecca Group) of the Karoo Supergroup. Quaternary to Recent aeolian sediments of the Gordonia Formation (Kalahari Group), and alluvial calcretes and gravels are also present.

The **Gifkop** Prospecting right Application area is mainly underlain by the Kalahari Formation with isolated areas of the Dwyka Group, Karoo Dolerite, and Prins Albert Formation. The **Jaagers Plaat** Prospecting Right Application area is mainly underlain by the Kalahari and Prins Albert Formations with isolated outcrops of Karoo Dolerite and Whitehill Formation. The **Wit Puts** Prospecting Right Application area is mainly underlain by the Prins Albert Formation in the central areas, with scattered areas of Karoo Dolerite, and a small Dwyka outcrop in the north. The **Tierklip** Prospecting Right Application area falls mainly in the Dwyka Group and the Prins Albert Formation with isolated areas of Karoo Dolerite and Vaalhoek Granite. The **Groot Kolk** Prospecting Right Application area is mainly underlain by the Dwyka Group with small isolated outcrops of De Kruis Group and Bayswater Metamorphic rocks. The **Vaalhoek** Prospecting Right Application is mainly underlain by

the Dwyka Group with small isolated outcrops of Karoo Dolerite, Vaalhoek Granite, Grappies rocks as well as a very small area of Prins Albert Formation in the eastern corner.

According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Kalahari Group is Low, the igneous rocks of the Bushmanland and Karoo Dolerite is Insignificant or zero while the Ecca sediments of the Karoo Supergroup have a High Paleontological Sensitivity. According to the Impact Tables, the Application areas of **Gifkop; Jaagers Plat; Wit Puts** and **Tierklip** all have a Medium Impact rating while the **Groot Kolk** and **Vaalhoek** Application areas have a Low Impact rating.

If fossil remains are discovered during any phase of prospecting, either on the surface or exposed by further excavations the **Chance Find Protocol** (which is required to be included in the Environmental Management Plan) must be implemented by the ECO in charge of these developments. These discoveries must be secured (*in situ*) and the ECO will have to alert SAHRA so that appropriate mitigation (documented and collection) can be undertaken. The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHR.

As only drilling is proposed for this project, it is considered that the Northern Cape Prospecting Right Application Areas are deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area if appropriate monitoring is implemented.

12 CHANCE FINDS PROTOCOL

A following procedure will only be followed in the event that fossils are uncovered during excavation.

12.1 Legislation

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

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on

behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

12.2 Background

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

12.3 Introduction

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

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

12.4 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately **stop working** and all work must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ECO or site manager. The ECO must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.

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

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

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

13 REFERENCES

ALMOND, J.E. and PETHER, J. 2009. SAHRA Palaeotechnical Report: Palaeontological Heritage of the Northern Cape Province. South African Heritage Resources Agency, Pp 1-143.

ALMOND, J., PETHER, J, and GROENEWALD, G. 2013. South African National Fossil Sensitivity Map. SAHRA and Council for Geosciences. Schweitzer *et al.* (1995) pp p288.

ALMOND, J. E. 2018. Recommended exemption from further palaeontological studies: Proposed 300 MW photovoltaic electricity generation facility & associated 132 KV power line on Portions 6 and 3 of farm 187 Olyvenkolk, Kenhardt District, Northern Cape.

BAILIE, R., ARMSTRONG, R. & REID, D. 2007. The Bushmanland Group supracrustal succession, Aggeneys, Bushmanland, South Africa: Provenance, age of deposition and metamorphism. South African Journal of Geology 110: 59-86.

BAMFORD, M.K. 2000. Cenozoic Macro-Plants. In: Partridge, T.C. & Maud, R.R. (Eds.) The Cenozoic of Southern Africa, pp.351-356. Oxford University Press, Oxford.

CORNELL, D.H., THOMAS, R.J., MOEN, H.F.G., REID, D.L., MOORE, J.M. & GIBSON, R.L. 2006. The Namaqua-Natal Province. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The Geology of South Africa, pp. 461-499. Geological Society of South Africa, Marshalltown.

DU TOIT, A. 1954. The geology of South Africa. xii + 611pp, 41 pls. Oliver & Boyd, Edinburg.

KENT, L. E., 1980. Part 1: Lithostratigraphy of the Republic of South Africa, South West Africa/Namibia and the Republics of Bophuthatswana, Transkei, and Venda. SACS, Council for Geosciences, Pp 535-574.

MACRAE, C. 1999. Life etched in stone. Fossils of South Africa. 305 pp. The Geological Society of South Africa, Johannesburg.

SG 2.2 SAHRA APMHOB Guidelines, 2017. Minimum standards for palaeontological components of Heritage Impact Assessment Reports, Pp 1-15.

VISSER, D.J.L. (ed) 1984. Geological Map of South Africa 1:100 000. South African Committee for Stratigraphy, Council for Geoscience, Pretoria.

VISSER, D.J.L. (ed) 1989. *Toeligting: Geologiese kaart (1:100 000). Die Geologie van die Republieke van Suid Afrika, Transkei, Bophuthatswana, Venda, Ciskei en die Koningkryke van Lesotho en Swaziland.* South African Committee for Stratigraphy. Council for Geoscience, Pretoria, Pp 494.

Appendix A – Elize Butler CV

CURRICULUM VITAE

ELIZE BUTLER

PROFESSION: Palaeontologist

YEARS' EXPERIENCE: 26 years in Palaeontology

EDUCATION: B.Sc Botany and Zoology, 1988
University of the Orange Free State

B.Sc (Hons) Zoology, 1991
University of the Orange Free State

Management Course, 1991
University of the Orange Free State

M. Sc. *Cum laude* (Zoology), 2009
University of the Free State

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

Registered as a PhD fellow at the Zoology Department of the UFS

2013 to current

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

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

Part-time Laboratory assistant Department of Zoology & Entomology
University of the Free State Zoology
1989-1992

Part-time laboratory assistant Department of Virology
University of the Free State Zoology
1992

Research Assistant

National Museum, Bloemfontein 1993 –
1997

Principal Research Assistant
and Collection Manager

National Museum, Bloemfontein
1998–currently

TECHNICAL REPORTS

Butler, E. 2014. Palaeontological Impact Assessment for the proposed upgrade of existing water supply infrastructure at Noupoort, Northern Cape Province. 2014. Bloemfontein.

Butler, E. 2015. Palaeontological impact assessment of the proposed consolidation, re-division and development of 250 serviced erven in Nieu-Bethesda, Camdeboo local municipality, Eastern Cape. Bloemfontein.

Butler, E. 2015. Palaeontological impact assessment of the proposed mixed land developments at Rooikraal 454, Vrede, Free State. Bloemfontein.

Butler, E. 2015. Palaeontological exemption report of the proposed truck stops development at Palmiet 585, Vrede, Free State. Bloemfontein.

Butler, E. 2015. Palaeontological impact assessment of the proposed Orange Grove 3500 residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Gonubie residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Ficksburg raw water pipeline. Bloemfontein.

Butler, E. 2015. Palaeontological Heritage Impact Assessment report on the establishment of the 65 MW Majuba Solar Photovoltaic facility and associated infrastructure on portion 1, 2 and 6 of the farm Witkoppies 81 HS, Mpumalanga Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed township establishment on the remainder of portion 6 and 7 of the farm Sunnyside 2620, Bloemfontein, Mangaung metropolitan municipality, Free State, Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 1 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 2 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Orkney solar energy farm and associated infrastructure on the remaining extent of Portions 7 and 21 of the farm Wolvehuis 114, near Orkney, North West Province. Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Spectra foods broiler houses and abattoir on the farm Maiden Manor 170 and Ashby Manor 171, Lukhanji Municipality, Queenstown, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoot concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoot, Northern Cape. Prepared for Savannah Environmental. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Woodhouse 1 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Woodhouse 2 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.

Butler, E. 2016. Proposed 132kV overhead power line and switchyard station for the authorised Solis Power 1 CSP project near Upington, Northern Cape. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Senqu Pedestrian Bridges in Ward 5 of Senqu Local Municipality, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Modderfontein Filling Station on Erf 28 Portion 30, Founders Hill, City Of Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Modikwa Filling Station on a Portion of Portion 2 of Mooihoek 255 Kt, Greater Tubatse Local Municipality, Limpopo Province. Bloemfontein.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Heidedal filling station on Erf 16603, Heidedal Extension 24, Mangaung Local Municipality, Bloemfontein, Free State Province. Bloemfontein.

Butler, E. 2016. Recommended Exemption from further Palaeontological studies: Proposed Construction of the Gunstfontein Switching Station, 132kv Overhead Power Line (Single Or Double Circuit) and ancillary infrastructure for the Gunstfontein Wind Farm Near Sutherland, Northern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Chris Hani District Municipality Cluster 9 water backlog project phases 3a and 3b: Palaeontology inspection at Tsomo WTW. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoot concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoot, Northern Cape. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed upgrading of the main road MR450 (R335) from the Motherwell to Addo within the Nelson Mandela Bay Municipality and Sunday's river valley Local Municipality, Eastern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment construction of the proposed Metals Industrial Cluster and associated infrastructure near Kuruman, Northern Cape province. Savannah South Africa. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed construction of up to a 132kv power line and associated infrastructure for the proposed Kalkaar Solar Thermal Power Plant near Kimberley, Free State, and Northern Cape Provinces. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed development of two burrow pits (DR02625 and DR02614) in the Enoch Mgijima Municipality, Chris Hani District, Eastern Cape.

Butler, E. 2016. Ezibeleni waste Buy-Back Centre (near Queenstown), Enoch Mgijima Local Municipality, Eastern Cape. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed construction of two 5 Mw Solar Photovoltaic Power Plants on Farm Wildebeestkuil 59 and Farm Leeuwbosch 44, Leeudoringstad, North West Province. Bloemfontein.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed development of four Leeuwberg Wind farms and basic assessments for the associated grid connection near Loeriesfontein, Northern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological impact assessment for the proposed Aggeneys south prospecting right project, Northern Cape Province. Bloemfontein.

Butler, E. 2016. Palaeontological impact assessment of the proposed Motuoane Ladysmith Exploration right application, KwaZulu Natal. Bloemfontein.

Butler, E. 2016. Palaeontological impact assessment for the proposed construction of two 5 MW solar photovoltaic power plants on farm Wildebeestkuil 59 and farm Leeuwbosch 44, Leeudoringstad, North West Province. Bloemfontein.

Butler, E. 2016: Palaeontological desktop assessment of the establishment of the proposed residential and mixed-use development on the remainder of portion 7 and portion 898 of the farm Knopjeslaagte 385 Ir, located near Centurion within the Tshwane Metropolitan Municipality of Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological impact assessment for the proposed development of a new cemetery, near Kathu, Gamagara local municipality and John Taolo Gaetsewe district municipality, Northern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment Of The Proposed Development Of The New Open Cast Mining Operations On The Remaining Portions Of 6, 7, 8 And 10 Of The Farm Kwaggafontein 8 In The Carolina Magisterial District, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Development of a Wastewater Treatment Works at Lanseria, Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological Scoping Report for the Proposed Construction of a Warehouse and Associated Infrastructure at Perseverance in Port Elizabeth, Eastern Cape Province.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Establishment of a Diesel Farm and a Haul Road for the Tshipi Borwa mine Near Hotazel, In the John Taolo Gaetsewe District Municipality in the Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Changes to Operations at the UMK Mine near Hotazel, In the John Taolo Gaetsewe District Municipality in the Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment for the Development of the Proposed Ventersburg Project-An Underground Mining Operation near Ventersburg and Henneman, Free State Province. Bloemfontein.

Butler, E. 2017. Palaeontological desktop assessment of the proposed development of a 3000 MW combined cycle gas turbine (CCGT) in Richards Bay, KwaZulu-Natal. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment for the Development of the Proposed Revalidation of the lapsed General Plans for Elliotdale, Mbhashe Local Municipality. Bloemfontein.

Butler, E. 2017. Palaeontological assessment of the proposed development of a 3000 MW Combined Cycle Gas Turbine (CCGT) in Richards Bay, KwaZulu-Natal. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed development of the new opencast mining operations on the remaining portions of 6, 7, 8 and 10 of the farm Kwaggafontein 8 10 in the Albert Luthuli Local Municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed mining of the farm Zandvoort 10 in the Albert Luthuli Local Municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed Lanseria outfall sewer pipeline in Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of open-pit mining at Pit 36W (New Pit) and 62E (Dishaba) Amandelbult Mine Complex, Thabazimbi, Limpopo Province. Bloemfontein.

Butler, E. 2017. Palaeontological impact assessment of the proposed development of the sports precinct and associated infrastructure at Merrifield Preparatory school and college, Amathole Municipality, East London. PGS Heritage. Bloemfontein.

Butler, E. 2017. Palaeontological impact assessment of the proposed construction of the Lehae training and fire station, Lenasia, Gauteng Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the new opencast mining operations of the Impunzi mine in the Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the construction of the proposed Viljoenskroon Munic 132 KV line, Vierfontein substation and related projects. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed rehabilitation of 5 ownerless asbestos mines. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the Lephhalale coal and power project, Lephhalale, Limpopo Province, Republic of South Africa. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of a 132KV powerline from the Tweespruit distribution substation (in the Mantsopa local municipality) to the Driedorp rural substation (within the Naledi local municipality), Free State province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the new coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of a Photovoltaic Solar Power station near Collett substation, Middelberg, Eastern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment for the proposed township establishment of 2000 residential sites with supporting amenities on a portion of farm 826 in Botshabelo West, Mangaung Metro, Free State Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed prospecting right project without bulk sampling, in the Koa Valley, Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed Aroams prospecting right project, without bulk sampling, near Aggeneys, Northern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed Belvior aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mjijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

Butler, E. 2017. PIA site visit and report of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of Tina Falls Hydropower and associated power lines near Cumbu, Mthlontlo Local Municipality, Eastern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed construction of the Mangaung Gariep Water Augmentation Project. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed Belvoir aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mjijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of the Melkspruit-Rouxville 132KV Power line. Bloemfontein.

Butler, E. 2017 Palaeontological Desktop Assessment of the proposed development of a railway siding on a portion of portion 41 of the farm Rustfontein 109 is, Govan Mbeki local municipality, Gert Sibande district municipality, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed consolidation of the proposed Ilima Colliery in the Albert Luthuli local municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed extension of the Kareerand Tailings Storage Facility, associated borrow pits as well as a stormwater drainage channel in the Vaal River near Stilfontein, North West Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed construction of a filling station and associated facilities on the Erf 6279, district municipality of John Taolo Gaetsewe District, Ga-Segonyana Local Municipality Northern Cape. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed of the Lephale Coal and Power Project, Lephale, Limpopo Province, Republic of South Africa. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed Overvaal Trust PV Facility, Buffelspoort, North West Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed development of the H2 Energy Power Station and associated infrastructure on Portions 21; 22 And 23 of the farm Hartebeestspruit in the Thembisile Hani Local Municipality, Nkangala District near Kwamhlanga, Mpumalanga Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed upgrade of the Sandriver Canal and Klippan Pump station in Welkom, Free State Province. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed upgrade of the 132kv and 11kv power line into a dual circuit above ground power line feeding into the Urania substation in Welkom, Free State Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed diamonds alluvial & diamonds general prospecting right application near Christiana on the remaining extent of portion 1 of the farm Kaffraria 314, registration division HO, North West Province. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Hartebeesfontein, near Panbult, Mpumalanga. Bloemfontein.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Rustplaas near Piet Retief, Mpumalanga. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment for the Proposed Landfill Site in Luckhoff, Letsemeng Local Municipality, Xhariep District, Free State. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed development of the new Mutsho coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment of the authorization and amendment processes for Manangu mine near Delmas, Victor Khanye local municipality, Mpumalanga. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed Mashishing township establishment in Mashishing (Lydenburg), Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the Proposed Mlonzi Estate Development near Lusikisiki, Ngquza Hill Local Municipality, Eastern Cape. Bloemfontein.

Butler, E. 2018. Palaeontological Phase 1 Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed electricity expansion project and Sekgame Switching Station at the Sishen Mine, Northern Cape Province. Bloemfontein.

Butler, E. 2018. Palaeontological field assessment of the proposed construction of the Zonnebloem Switching Station (132/22kV) and two loop-in loop-out power lines (132kV) in the Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological Field Assessment for the proposed re-alignment and decommissioning of the Firham-Platrand 88kv Powerline, near Standerton, Lekwa Local Municipality, Mpumalanga province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

Butler, E. 2018. Palaeontological field Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

Butler, E. 2018. Palaeontological desktop assessment of the proposed Mookodi – Mahikeng 400kV line, North West Province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed Thornhill Housing Project, Ndlambe Municipality, Port Alfred, Eastern Cape Province. Bloemfontein.

Butler, E. 2018. Palaeontological desktop assessment of the proposed housing development on portion 237 of farm Hartebeestpoort 328. Bloemfontein.

Butler, E. 2018. Palaeontological desktop assessment of the proposed New Age Chicken layer facility located on holding 75 Endicott near Springs in Gauteng. Bloemfontein.

Butler, E. 2018 Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological field assessment of the proposed development of the Wildealskloof mixed-use development near Bloemfontein, Free State Province. Bloemfontein.

Butler, E. 2018. Palaeontological Field Assessment of the proposed Megamor Extension, East London. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed diamonds Alluvial & Diamonds General Prospecting Right Application near Christiana on the Remaining Extent of Portion 1 of the Farm Kaffraria 314, Registration Division HO, North West Province. Bloemfontein.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed construction of a new 11kV (1.3km) Power Line to supply electricity to a cell tower on farm 215 near Delportshoop in the Northern Cape. Bloemfontein.

Butler, E. 2018. Palaeontological Field Assessment of the proposed construction of a new 22 kV single wood pole structure power line to the proposed MTN tower, near Britstown, Northern Cape Province. Bloemfontein.

Butler, E. 2018. Palaeontological Exemption Letter for the proposed reclamation and reprocessing of the City Deep Dumps in Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2018. Palaeontological Exemption letter for the proposed reclamation and reprocessing of the City Deep Dumps and Rooikraal Tailings Facility in Johannesburg, Gauteng Province. Bloemfontein.

Butler, E. 2018. Proposed Kalabasfontein Mine Extension project, near Bethal, Govan Mbeki District Municipality, Mpumalanga. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop assessment of the Proposed New Age Chicken Layer Facility located on Holding 75 Endicott near Springs in Gauteng. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment of the proposed Mookodi – Mahikeng 400kV Line, North West Province. Bloemfontein.

Butler, E. 2018. Environmental Impact Assessment (EIA) for the Proposed 325mw Rondekop Wind Energy Facility between Matjiesfontein and Sutherland in the Northern Cape Province.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed construction of the Tooverberg Wind Energy Facility, and associated grid connection near Touws River in the Western Cape Province. Bloemfontein.

CONFERENCE CONTRIBUTIONS

NATIONAL

PRESENTATION

Butler, E., Botha-Brink, J., and F. Abdala. A new gorgonopsian from the uppermost *Dicynodon Assemblage Zone*, Karoo Basin of South Africa. 18th Biennial conference of the PSSA 2014. Wits, Johannesburg, South Africa.

INTERNATIONAL

Attended the Society of Vertebrate Palaeontology 73th Conference in Los Angeles, America. October 2012.

CONFERENCES: POSTER PRESENTATION

NATIONAL

Butler, E., and J. Botha-Brink. Cranial skeleton of *Galesaurus planiceps*, implications for biology and lifestyle. University of the Free State Seminar Day, Bloemfontein. South Africa. November 2007.

Butler, E., and J. Botha-Brink. Postcranial skeleton of *Galesaurus planiceps*, implications for biology and lifestyle. 14th Conference of the PSSA, Matjiesfontein, South Africa. September 2008:

Butler, E., and J. Botha-Brink. The biology of the South African non-mammaliaform cynodont *Galesaurus planiceps*. 15th Conference of the PSSA, Howick, South Africa. August 2008.

INTERNATIONAL VISITS

Natural History Museum, London

July 2008

Paleontological Institute, Russian Academy of Science, Moscow

November 2014