Goedgevonden Complex: Amendment to Environmental Authorisation

eMalahleni Local Municipality, Nkangala District Municipality, Mpumalanga Province.

Farm: Portions Kleinzuikerboschplaats 5-IS, Grootpan 7-IS, Goedgevonden 10-IS, Zaaiwater 11-IS

Fourie, H. Dr

Palaeontological Impact Assessment: Phase Desktop Study

Facilitated by: Jacana Environmental cc

Landdros Mare Street,

Polokwane. 0699

Tel: 015 291 4015

2022/10/18

Ref: MP 30/5/1/1/2/169 MR

SAHRA Case ID 19308

Plant fossil – Ecca Group

B. Executive summary

Outline of the development project: Jacana Environmental cc has facilitated the appointment of Dr H. Fourie, a palaeontologist, to undertake a Palaeontological Impact Assessment (PIA), Desktop Study of the suitability of the proposed Goedgevonden Complex: Amendment to Environmental Authorisation in the eMalahleni Local Municipality, Nkangala District Municipality, Mpumalanga Province on Farm: Portions Kleinzuikerboschplaats 5-IS, Grootpan 7-IS, Goedgevonden 10-IS, Zaaiwater 11-IS.

The applicant, Glencore Operations South Africa (Pty) Ltd (GOSA) intends on undertaking an amendment of their existing approved mining plan by amending the approved EMPr.

The Project includes one locality Option (see Figure 2):
Option 1: A blocked polygon area with the town of Ogies and the N12 National Road to the north; and the R 555 Road in the northeast of the project. The approximate size of the site is 4 683.9272 hectares.

Legal requirements:-

The **National Heritage Resources Act (Act No. 25 of 1999) (NHRA)** requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. The Republic of South Africa (RSA) has a remarkably rich fossil record that stretches back in time for some 3.5 billion years and must be protected for its scientific value. Fossil heritage of national and international significance is found within all provinces of the RSA. South Africa's unique and non-renewable palaeontological heritage is protected in terms of the National Heritage Resources Act. According to this act, palaeontological resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

The main aim of the assessment process is to document resources in the development area and identify both the negative and positive impacts that the development brings to the receiving environment. The PIA therefore identifies palaeontological resources in the area to be developed and makes recommendations for protection or mitigation of these resources.

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

For this study, resources such as geological maps, scientific literature, institutional fossil collections, satellite images, aerial maps and topographical maps were used. It provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations (if any) for further specialist palaeontological input where this is considered necessary.

A Palaeontological Impact Assessment is generally warranted where rock units of **LOW** to **VERY HIGH** palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed area is unknown. The specialist will inform whether further monitoring and mitigation are necessary.

Types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (Act No.25 of 1999):
(i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.
This report adheres to the guidelines of Section 38 (1) of the National Heritage Resources Act (Act No. 25 of 1999).

Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; (b) the construction of a bridge or similar structure exceeding 50 m in length; (c) any development or other activity which will change the character of a site (see Section 38); (d) the re-zoning of a site exceeding 10 000 m² (1 ha) in extent; (e) or any other category of development provided for in regulations by SAHRA or a PHRA authority.

This report (Appendix 6, **1c)** aims to provide comment and recommendations on the potential impacts that the proposed development could have on the fossil heritage of the area and to state if any mitigation or conservation measures are necessary.

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

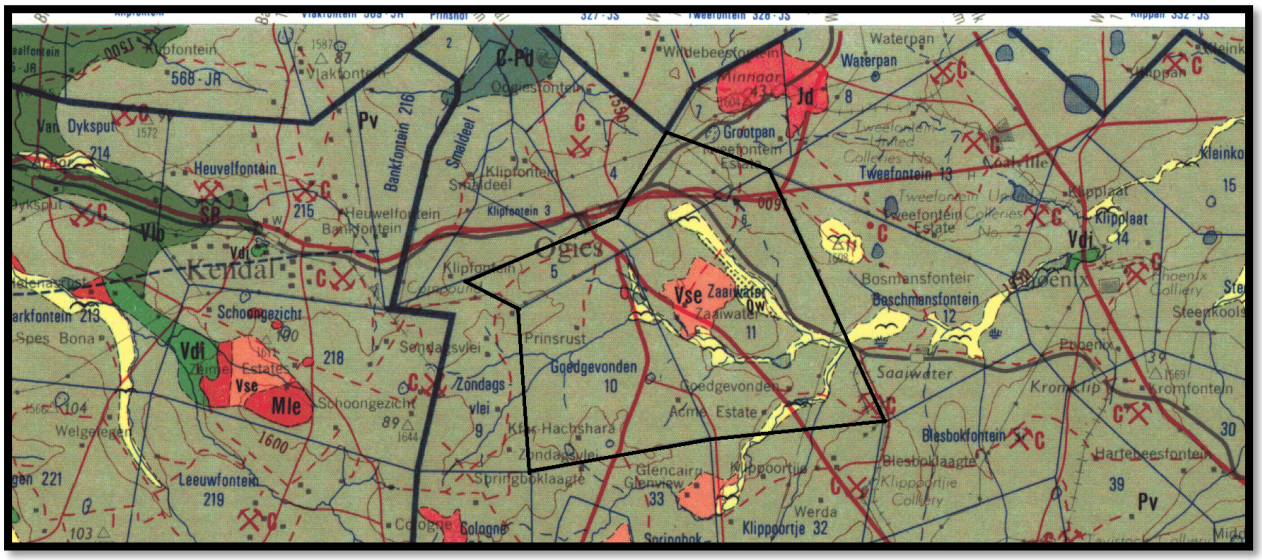

Figure: The geology of the development area.
Legend to Figure and short explanation.
Jd – Dolerite (pink). Jurassic.
Pv – Sandstone, shale and grit with coal and oil-shale beds (grey). Vryheid Formation, Ecca Group, Karoo Supergroup. Permian.
Vse – Porphyritic rhyolite with interbedded mudstone and sandstone (amber). Selonsrivier Formation, Rooiberg Group, Transvaal Supergroup. Vaalian.
…… – (black) Lineament (Possible dyke).
--f— Fault.
⊥5° - Strike and dip.
□ – Approximate position of mining (blocked in black).

The Vryheid Formation is named after the type area of Vryheid-Volksrust. In the north-eastern part of the basin the Vryheid Formation thins and eventually wedges out towards the south, southwest and west with increasing distance from its source area to the east and northeast (Johnson 2009). The Vryheid Formation consists essentially of sandstone, shale, and subordinate coal beds, and has a maximum total thickness of 500 m. It forms part of the Middle Ecca (Kent 1980). This formation has the largest coal reserves in South Africa. The pro-delta sediments are characterised by trace and plants fossils (Snyman 1996).

Palaeontology – Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity can generally be **LOW** to **VERY HIGH**, and here locally in the development area **VERY HIGH** for the Vryheid Formation (SG 2.2 SAHRA APMHOB, 2012).

The Ecca Group, Vryheid Formation (Pv) may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

Summary of findings (**1d**): The Desktop Study was undertaken in October 2022 in the summer in dry and hot conditions. As this is a desktop study the season has no influence, and the following is reported:

Observation: See Section F. It is recommended that SAHRA accept the Desktop Study (this report) because of reasons stated in Section F.

The Project includes one locality Option present on the Vryheid Formation:
Option 1: A blocked polygon area with the town of Ogies and the N12 National Road to the north; and the R 555 Road in the northeast of the project. The approximate size of the site is 4 683.9272 hectares.

Recommendation:
The potential impact of the development on fossil heritage is **VERY HIGH** and therefore a field survey was necessary for this development (according to SAHRA protocol). A Phase 1 Palaeontological Impact Assessment: Field Study will be required if fossils are found during the development.

Concerns/threats **(1k,l,m)** to be added to EMPr:

1. Threats are earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in, disturbance, damage or destruction of the fossils by development, vehicle traffic, prospecting, mining, and human disturbance.
2. Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden not to intrude fossiliferous layers.

The recommendations are **(1g)**:

1. Mitigation will be needed if fossils are found during the development.
2. No consultation with parties was necessary. The mine environmental personnel must familiarise themselves with the formations present and its fossils and follow protocol.
3. The development may go ahead with caution due to the presence of the Vryheid Formation shale.
4. The mine environmental personnel together with the mine geologist must survey for fossils before and or after clearing, blasting, drilling or excavating.
5. The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities. For a chance fossil find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation.

   Stakeholders: Developer – Glencore Operations South Afruica (Pty) Ltd. (GOSA). Farm Goedgevonden 10-IS, eMalahleni District, P/Bag X17, Leraatsfontein, 1038.

Environmental – Jacana Environmental cc. Landdros Mare Street, Polokwane, 0699. P.O. Box 31675, Superbia, 0759. Tel: 015 291 4015.
Landowner – See table below.

Property	Ptn	Registered Landowner	Title Deed nr	Size (ha)
Goedgevonden 10 IS	RE	Glencore Operations (Pty) Ltd	T14199/2014	334.0457
Goedgevonden 10 IS	RE 1	Glencore Operations South Africa (Pty) Ltd	T9057/2013	275.9915
Goedgevonden 10 IS	RE of Ptn 2 (Ptn of Ptn 1)	Glencore Operations (Pty) Ltd	T3707/2014	339.777
Goedgevonden 10 IS	RE of Ptn 3	Glencore Operations South Africa (Pty) Ltd	T4219/2009	35.7486
Goedgevonden 10 IS	Ptn 4	Glencore Operations (Pty) Ltd	T3707/2014	716.6175
Goedgevonden 10 IS	RE of Ptn 5	Glencore Operations South Africa (Pty) Ltd	T4219/2009	19.2653
Goedgevonden 10 IS	Ptn 6 (Ptn of Ptn 5)	Glencore Operations (Pty) Ltd	T7750/2014	170.8733
Goedgevonden 10 IS	Ptn 7	Glencore Operations South Africa (Pty) Ltd	T11895/2010	2.3197
Goedgevonden 10 IS	RE of Ptn 8 (Ptn of Ptn 3)	Glencore Operations South Africa (Pty) Ltd	T4219/2009	54.7821
Goedgevonden 10 IS	RE of Ptn 11 (Ptn of Ptn 3)	Glencore Operations South Africa (Pty) Ltd	T4219/2009	46.5563
Goedgevonden 10 IS	Ptn 12	Glencore Operations (Pty) Ltd	T3707/2014	42.8255
Goedgevonden 10 IS	RE of Ptn 13 (Ptn of Ptn 3)	Glencore Operations South Africa (Pty) Ltd	T4219/2009	24.1091
Goedgevonden 10 IS	Ptn 14 (Ptn of Ptn 8)	Glencore Operations South Africa (Pty) Ltd	T4219/2009	57.1017
Goedgevonden 10 IS	Ptn 15	Glencore Operations South Africa (Pty) Ltd	T4219/2009	57.1017
Goedgevonden 10 IS	RE of Ptn 16 (Ptn of Ptn 3)	Glencore Operations South Africa (Pty) Ltd	T4219/2009	64.0445
Goedgevonden 10 IS	Ptn 17	TVL Board for development of peri-urban areas	T366366/1971	4.2827
Goedgevonden 10 IS	Ptn 18	Ogies Muslim Jamaat	T95815/1995	0.4331
Goedgevonden 10 IS	Ptn 24	Glencore Operations (Pty) Ltd	T3707/2014	210
Goedgevonden 10 IS	Ptn 25	Mayet Ismail	T113452/2002	0.6783
Zaaiwater 11 IS	RE of Ptn 4	Glencore Operations South Africa (Pty) Ltd	T9057/2013	1102.0323
Zaaiwater 11 IS	Ptn of RE	Glencore Operations South Africa (Pty) Ltd	T9057/2013	169.10
Kleinzuikerboschplaats 5 IS	RE	Glencore Operations (Pty) Ltd	T7750/2014	528.5919
Grootpan 7IS	RE of Ptn 1	Ogies Township Co (Pty) Ltd	T36789/2004	3.806
Grootpan 7IS	Ptn 14	Marthinus Janse Potgieter	T941/2009	2.5696
Grootpan 7IS	Ptn 16	Delphitorque cc	T7183/2019	1.3242
Grootpan 7IS	Ptn 17	Emalahleni Local Municipality	T13805/2012	115.937
Grootpan 7IS	Ptn 18	Mohamed Mayet	T2839/2010	2.0771
Grootpan 7IS	Ptn 19	Holiness Union Mission	T22964/1956	0.8565
Grootpan 7IS	Ptn 23	Provincial Government of Mpumalanga	T10622/1951	0.4283
Grootpan 7IS	Ptn 28	Ogies Township Co (Pty) Ltd	T18178/1963	8.6301
Grootpan 7IS	Ptn 35	Provincial Government of Mpumalanga	T7354/2013	8.6441
Grootpan 7IS	Ptn 38	Transnet Ltd	T3624/1982	13.8056
Grootpan 7IS	Ptn 39	Gilbert P.V. de Cort	T26866/1989	5.0881
Grootpan 7IS	Ptn 40	Transnet Ltd	T85134/1995	0.4105
Grootpan 7IS	Ptn 41	Transnet Ltd	T85134/1995	0.0397
Grootpan 7IS	Ptn 42	Transnet Ltd	T85134/1995	2.9958
Grootpan 7IS	Ptn 46	Ou Apostoliese Kerk van Afrika	T93177/1996	0.3889

Property	Ptn	Registered Landowner	Title Deed nr	Size (ha)
Grootpan 7IS	Ptn 48	Transnet Ltd	T10343/1983	1.9881
Grootpan 7IS	Ptn 51	Masakhane Mining Supply & Construction cc	T5726/2013	154.316
Oogiesfontein 4 IS	RE of Ptn 4	South32 Coal Holdings (Pty) Ltd	T14931/2018	104.3438
			TOTAL	**4 683.9272**

C. Table of Contents

D. Background information on the project

Report

This report is part of the environmental impact assessment process under the National Environmental Management Act, as amended (Act No. 107 of 1998) (NEMA) and includes Appendix 6 (GN R326 of 7 April 2017) of the Environmental Impact Assessment Regulations (see Appendix 2). It also is in compliance with The Minimum Standards for Palaeontological Components of Heritage Impact Assessment Reports, SAHRA, APMHOB, Guidelines 2012, Pg 1-15 **(2)**.

Outline of development

This report discusses and aims to provide the developer with information regarding the location of palaeontological material that will be impacted by the development. In the pre-construction phase it may be necessary for the developer to apply for the relevant permit from the South African Heritage Resources Agency depending on the presence of fossils (SAHRA / PHRA).

The applicant, Glencore Operations South Africa (Pty) Ltd (GOSA) intends on undertaking an amendment of their existing approved mining plan by amending the approved EMPr.

GGV is essentially an opencast mine, mining seam 2, seam 4 and seam 5 coal on portions of the farms Goedgevonden 10 IS, Zaaiwater 11 IS and Kleinzuikerboschplaats 5 IS. Underground mining was approved on portions of the farm Grootpan 7 IS which is still to be developed. Recent optimisation of the mineral resource within the Mining Right area (MRA) resulted in a change to the mining schedule with the introduction of additional mining areas previously excluded from the mine plan.

The 2016 approved EMPr includes the re-alignment of provincial Road P53-1 which links Road R555 and Road 545 on the south-eastern side of Ogies. Environmental Authorisation for the re-alignment of Road P53-1 was granted by the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA) on 8 September 2015 (Ref No 17/2/3N-273). The re-alignment of Road P53-1 has recently been optimised to improve traffic safety in respect of the curvature back into the existing road, as well as to effect minimum impact on coal reserves.

To facilitate the proposed mining and infrastructure changes at GGV, it is necessary to amend the approved Environmental Authorisation (EA) and EMPr in terms of the 2014 Environment Impact Assessment (EIA) Regulations promulgated in Government Notice No. R. 982-986 of 4 December 2014 in terms of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998), as amended, to:

- Introduce limited additional mining areas (underground) that have now become economically viable
- Change the mining methodology in certain areas, from opencast to underground
- Include some limited additional infrastructure requirements for the underground mining
- Slightly revise the re-alignment of P53-1

In addition to the proposed mining and infrastructural changes at GGV, GOSA is currently in negotiation with third parties in respect of the reduction and/or extension of the GGV MRA in terms of section 102 of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002), as follow:

- An application was submitted on 24 March 2020 to abandon the remaining extent of portion 4 of Oogiesfontein 4 IS from our GGV MR in favour of South32 SA Coal Holdings (Pty) Ltd (now Seriti Resources). South32 simultaneously lodged an application in terms of section 102 on 25 March 2020 to incorporate the said land into its adjacent right 125 MR. Both these applications remain pending.
- GOSA is in the process of negotiating a sale agreement with Mshengu Mining to buy 11790 PR from them. Once the agreement is concluded, a section 11 application to cede the PR to GOSA, together with a simultaneous application in terms of section 102 to incorporate the area into GOSA's GGV MRA will be submitted.
- A Portion of Kleinzuikerboschplaats 5 IS forms part of GOSA's GGV MR. It is contemplated that this area will be abandoned in favour of Thungela Resources and/or Seriti Resources. Negotiations are currently taking place and the necessary section 102 applications will be submitted in due course.

Although no new (physical) listed activities are triggered by the proposed changes and/or additions to the mining and infrastructure plan, the *amendment or variation to a right or permit in terms of section 102 of the MPRDA* (Listing Notice 1, Activity 21D inserted by regulation 27(j) of GN 517 dated 11 June 2021) triggers a Basic Assessment process contemplated in regulation 19 to regulation 20 of the 2014 EIA Regulations.

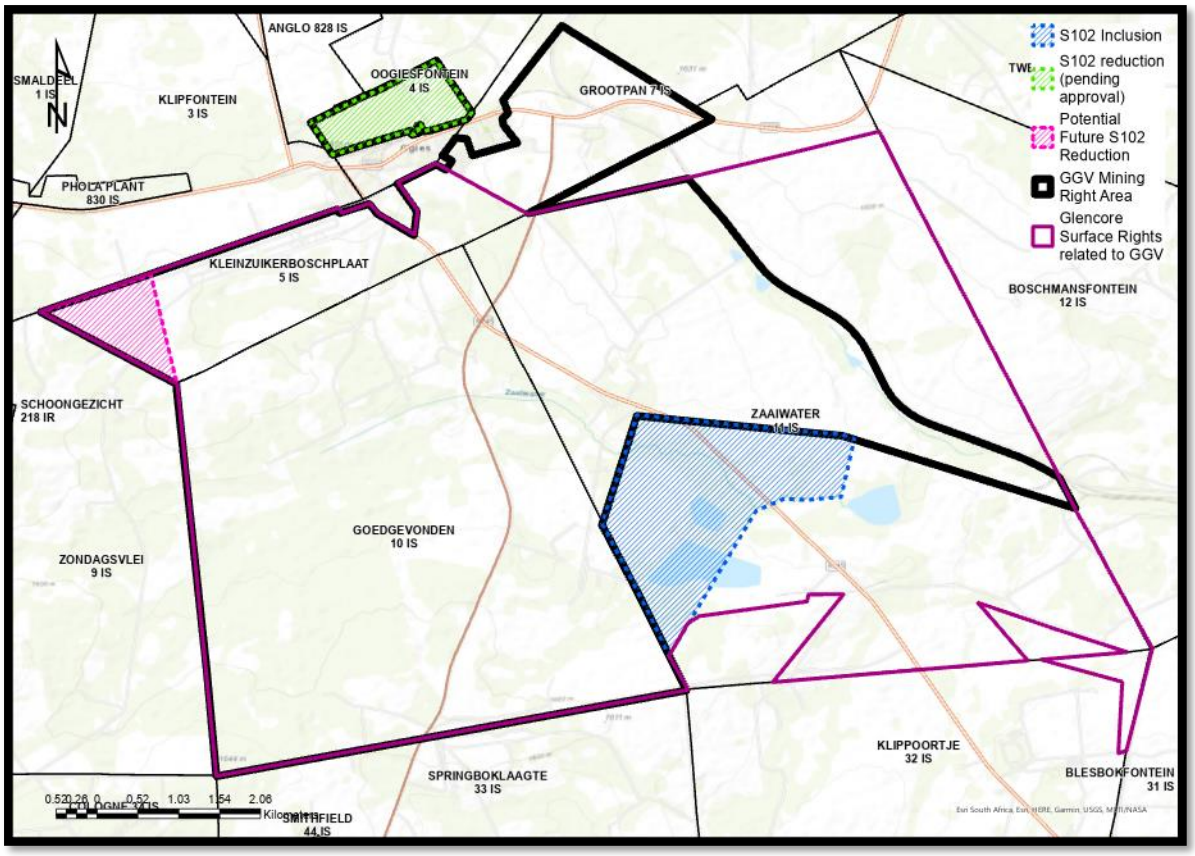

Figure 1a: Lay-out plan of development (Jacana).

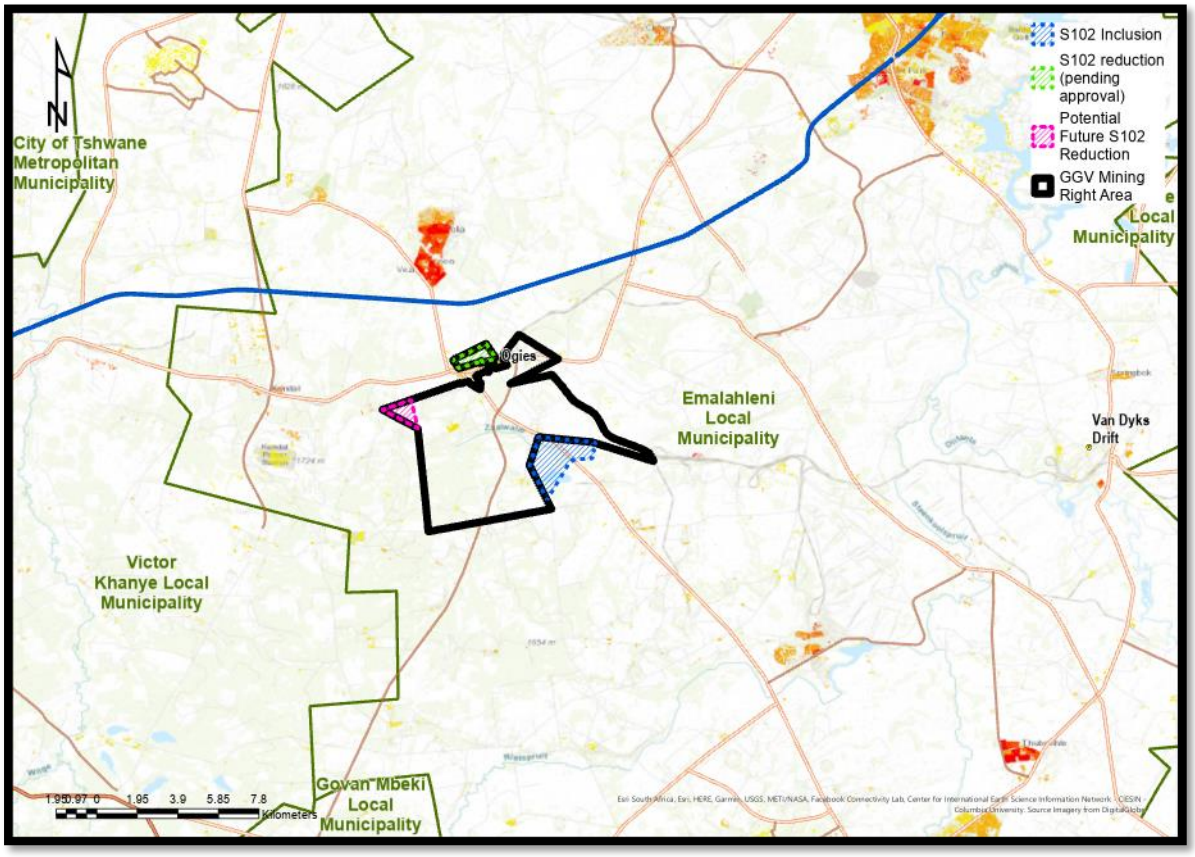

Figure 1b: Topographic figure of mine locality (Jacana).

Related Infrastructure:

The underground workings will be accessed through an incline shaft from the opencast highwall and the required infrastructure to support the underground workings will be constructed within the already approved opencast footprint. This will prevent any further surface disturbance and vegetation clearance within the remaining natural environment. The positions of the incline shafts are shown in figure below and infrastructure includes:

- Offices, change houses, water treatment plant, pollution control dam (PCD), workshops, substations, parking lots, wash bays, diesel tanks, weighbridge, stores yard and sewage plant
- Conveyor systems for the No 2 and 4 seams with stockpile area
- Stone dust silos
- Underground fans
- Concrete water reservoir
- Stormwater trench and holding dam

The Project includes one locality Option (see Figure 2):
Option 1: A blocked polygon area with the town of Ogies and the N12 National Road to the north; and the R 555 Road in the northeast of the project. The approximate size of the site is 4 683.9272 hectares.

Rezoning/ and or subdivision of land: No.
Name of Developer and Consultant: Glencore Operations South Africa (Pty) Ltd (GOSA) and Jacana Environmental cc.
Terms of reference: Dr H. Fourie is a palaeontologist commissioned to do a palaeontological impact assessment: desktop to ascertain if any palaeontological sensitive material is present in the development area. This study will advise on the impact on fossil heritage mitigation or conservation necessary, if any.
Short *Curriculum vitae* ***(1ai,aii)***: Dr Fourie obtained a Ph.D from the Bernard Price Institute for Palaeontological Research (now ESI), University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. At present she is curator of a large fossil invertebrate collection, Therapsids, dinosaurs, amphibia, fish, reptiles, and plants at Ditsong: National Museum of Natural History. For the past 16 years she carried out field work in the North West, Western Cape, Northern Cape, Eastern Cape, Limpopo, Mpumalanga, Gauteng and Free State Provinces. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 28 years.
Legislative requirements: South African Heritage Resources Agency (SAHRA) for issue of permits if necessary. National Heritage Resources Act (Act No. 25 of 1999). An electronic copy of this report must be supplied to SAHRA.

E. Description of property or affected environment
Location and depth:
The suitability of the proposed Goedgevonden Complex: Amendment to Environmental Authorisation will be situated in the eMalahleni Local Municipality, Nkangala District Municipality, Mpumalanga Province on Farm: Portions Kleinzuikerboschplaats 5-IS, Grootpan 7-IS, Goedgevonden 10-IS, Zaaiwater 11-IS.

Depth is determined by the related infrastructure to be developed and the thickness of the formation in the development area as well as depth of the foundations, footings and channels to be developed. Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to determine

due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot. Geological maps do not provide depth or superficial cover, it only provides mappable surface outcrops. The depth can be verified with test pit results or drill cores. The depth of the Vryheid Formation is 120 m deep.

The site is underlain by the Karoo Supergroup Formations.

F. Description of the Geological Setting

Description of the rock units:

Large areas of the southern African continent are covered by the Karoo Supergroup (Figure 2). It covers older geological formations with an almost horizontal blanket. Several basins are present with the main basin in the central part of south Africa and several smaller basins towards Lebombo, Springbok Flats and Soutpansberg. An estimated age is 150 – 180 Ma. And a maximum thickness of 7000 m is reached in the south. Three formations overlie the Beaufort Group, they are the Molteno, Elliot and Clarens Formations. The Elliot Formation is also known as the Red Beds and the old Cave Sandstone is known as the Clarens Formation. At the top is the Drakensberg Basalt Formation with its pillow lavas, pyroclasts, etc. (Kent 1980, Snyman 1996). The Beaufort Group is underlain by the Ecca Group which lies on the Dwyka Group.

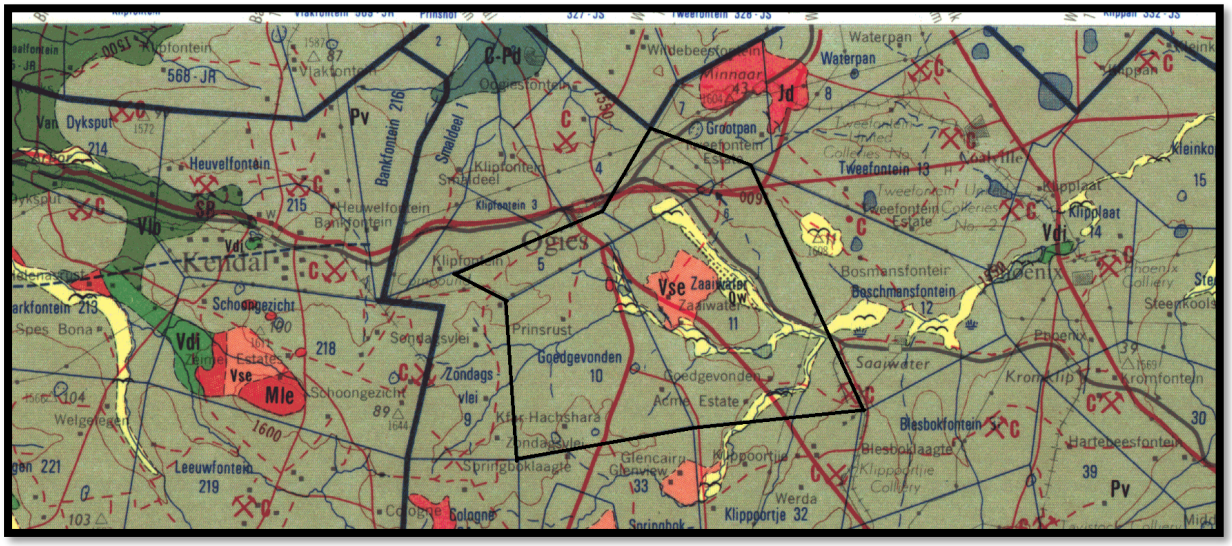

Figure 2: Geology of the development area **(1h)**.

Legend to Figure and short explanation.

Jd – Dolerite (pink). Jurassic.

Pv – Sandstone, shale and grit with coal and oil-shale beds (light brown). Vryheid Formation, Ecca Group, Karoo Supergroup. Permian.

Vse – Porphyritic rhyolite with interbedded mudstone and sandstone (amber). Selonsrivier Formation, Rooiberg Group, Transvaal Supergroup. Vaalian.

…… – (black) Lineament (Possible dyke).

--f— Fault.

⊥5° - Strike and dip.

□ – Approximate position of mine extension (blocked in black).

Mining Activities on Figure:

C – Coal.

Mining past and present have an influence on the project.

Dolerite dykes (Jd) occur throughout the Karoo Supergroup. Structural geological features such as dykes and faults can have a measurable influence on ground water flow and mass transport. Permian sediments are extensively intruded and thermally metamorphosed (baked) by sub-horizontal sills and steeply inclined dykes of the Karoo Dolerite Suite. These early Jurassic (183 Ma) basic intrusions baked the adjacent mudrocks and sandstones to form splintery hornfels and quartzites respectively. Thermal metamorphism by dolerite intrusions tends to reduce the palaeontological heritage potential of the adjacent sediments.

The Ecca Group is early to mid-Permian (545-250 Ma) in age. Sediments of the Ecca group are lacustrine and marine to fluvio-deltaic (Snyman 1996). The Ecca group is known for its coal (mainly the Vryheid Formation) (five coal seams) and uranium. Coalfields formed due to the accumulation of plant material in shallow and large swampy deltas (see Appendix 1). The Ecca Group conformably overlies the Dwyka Group and is conformably overlain by the Beaufort Group, Karoo Supergroup. It consists essentially of mudrock (shale), but sandstone-rich units occur towards the margins of the present main Karoo basin in the south, west and north-east, with coal seams also being present in the north-east (Kent 1980, Johnson 2009).

The Vryheid Formation is named after the type area of Vryheid-Volksrust. In the north-eastern part of the basin the Vryheid Formation thins and eventually wedges out towards the south, southwest and west with increasing distance from its source area to the east and northeast (Johnson 2009). The Vryheid Formation consists essentially of sandstone, shale, and subordinate coal beds, and has a maximum total thickness of 500 m. It forms part of the Middle Ecca (Kent 1980). This formation has the largest coal reserves in South Africa. The pro-delta sediments are characterised by trace and plants fossils (Snyman 1996).

Coal has always been the main energy source in industrial South Africa. It is in Mpumalanga, south of the N4, that most of the coal-fired power stations are found. Eskom is by far the biggest electricity generator in Africa. Thick layers of coal just below the surface are suited to open-cast mining and where the overlying sediments are too thick, shallow underground mining. In 2003, coal was South Africa's third most valuable mineral commodity and is also used by Sasol for fuel- and chemicals-from-coal (Norman and Whitfield 2006). Grodner and Cairncross (2003) proposed a 3-D model of the Witbank Coalfield to allow easy evaluation of the sedimentary rocks, both through space and time. Through this, one can interpret the environmental conditions present at the time of deposition of the sediments. This can improve mine planning and mining techniques. The Vryheid Formation is underlain by the Dwyka Group and is gradually overlain by mudstones (and shale) and sandstones of the Volksrust Formation. The typical colours for the Vryheid Formation are grey and yellow for the sediments and black for the coal seam. The thickness of the grey shale can vary and this is interlayered with the also variable yellow sandstone and coal seams.

Ecca rocks are stable and lend themselves well to developments. It is only unstable in or directly above mining activities (Snyman 1996). Dolerite dykes occur throughout the Karoo Supergroup. Structural geological features such as dykes and faults can have a measurable influence on ground water flow and mass transport. The Vryheid Formation sediments may attain a thickness of 120 – 140 m. A typical profile includes soil and clay, sandstone and siltstone, shale, 2 upper seam, shale, 2 seam, sandstone, no 1 seam, shale and dolomite at the bottom. The typical colours for the Vryheid Formation are grey and yellow for the sediments and black for the coal seam. The thickness of the grey shale can vary and this is interlayered with the also variable yellow sandstone and coal seams.

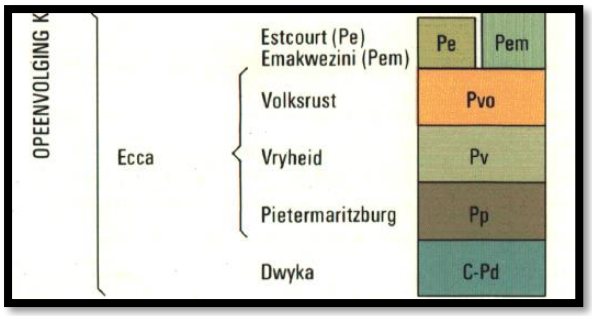

Figure 3: Lithostratigraphic column of the development area (Vryheid 2730).

The Transvaal Supergroup fills an east-west elongated basin in the south-central part of the old Transvaal (now North – West, Gauteng and Mpumalanga) as far south as Potchefstroom. It is Vaalian in age, approximately 2600 Ma to 2100 Ma. A maximum thickness of the Transvaal Supergroup reaches 2000 m in the north-eastern section. The east-west elongated basin is filled with clastic, volcanic and chemical sedimentary rocks. Three groups based on lithological differences have been established: they are the Rooiberg, Pretoria and Chuniespoort Groups as well as other smaller groups such as the Groblersdal Group, Buffelsfontein Group, Wolkberg Group and the Black Reef Formation (Kent 1980, Snyman 1996). It is the Bushveld Complex that is responsible for the tilting of the Transvaal sediments and the heat of its intrusion having created andalusite crystals (Norman and Whitfield 2006). This Supergroup is underlain by the Ventersdorp, Witwatersrand and Pongola Supergroups, and the Dominion Group. Three prominent ridges are present from the oldest to the youngest, the Time Ball Hill, Daspoort and Magaliesberg Formations (Norman and Whitfield 2006).

The Rooiberg Group is a 2500-6000m thick succession of feldspathic quartzites, arkoses and shales, with interbedded volcanics and felsites. It consists of two formations, the lower Damwal (Vdr) and the upper Selons River (Vs), restricted in its distribution to the central part of the basin (Kent 1980, Snyman 1996). The Selons River Formation has either a sandstone or a quartzite at its base and mainly consists of red rhyolite. It (Selons River) was further subdivided into the lower Doornkloof Felsite Member and an upper Klipnek Felsite Member (Kent 1980, Visser 1989) and west of Warmbath (Bela Bela) it is again subdivided into two units, the Kwaggasnek Formation and the Schrikkloof Formation. A layer of amygdaloidal rhyolite is present close to the top of the Kwaggasnek Formation. It rests on the Smelterskop sediments at Rooiberg and is intruded by Nebo granite. The Schrikkloof Formation in the Nylstroom area is conformably overlain by sediments from the Waterberg Group in an ash-flow sheet. Together with the Kwaggasnek Formation it reaches thicknesses of 6000 m as is equivalent to the Selonsrivier Formation. This group has an estimated age of 2,150 Ma (Visser 1989).

Observation: A site visit is not necessary as underground areas have now become viable to be mined economically. This has already been approved in 2010. Limited additional infrastructure will be placed within the already mined area. Road P53-1 has been re-aligned as approval was granted in 2015. A site visit will not add value to the heritage knowledge of the area. As seen on Figure 4 the areas are disturbed and mined out.

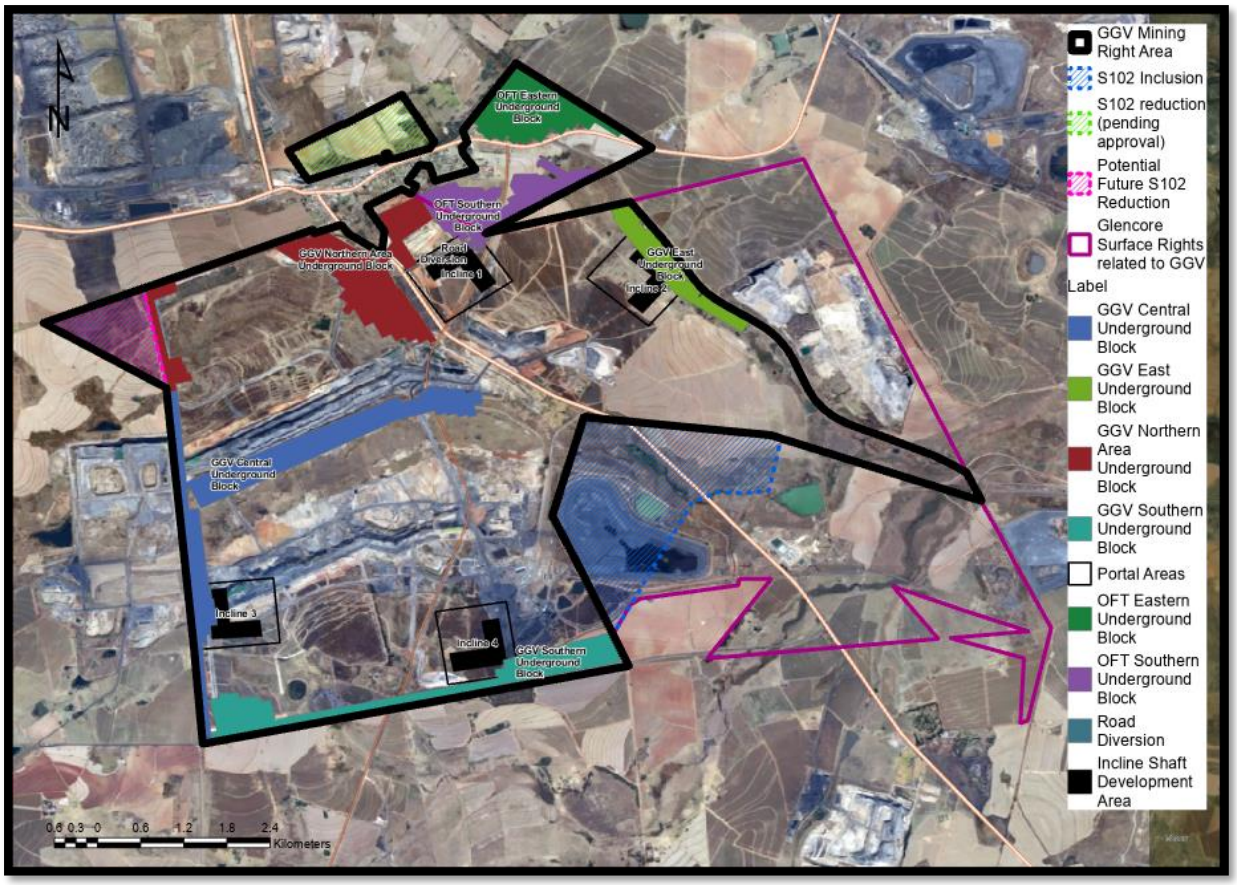

Figure 4: Figure showing Mining Right Area and

The re-alignment of Road P53-1 as approved within the 2015 Environmental Authorisation and the 2016 EMPr is shown as the green line in figure 5. The route encroaches on the farm Grootpan 7 IS, which is privately owned.

The proposed re-alignment of P53-1 is indicated as the red line in figure 5.

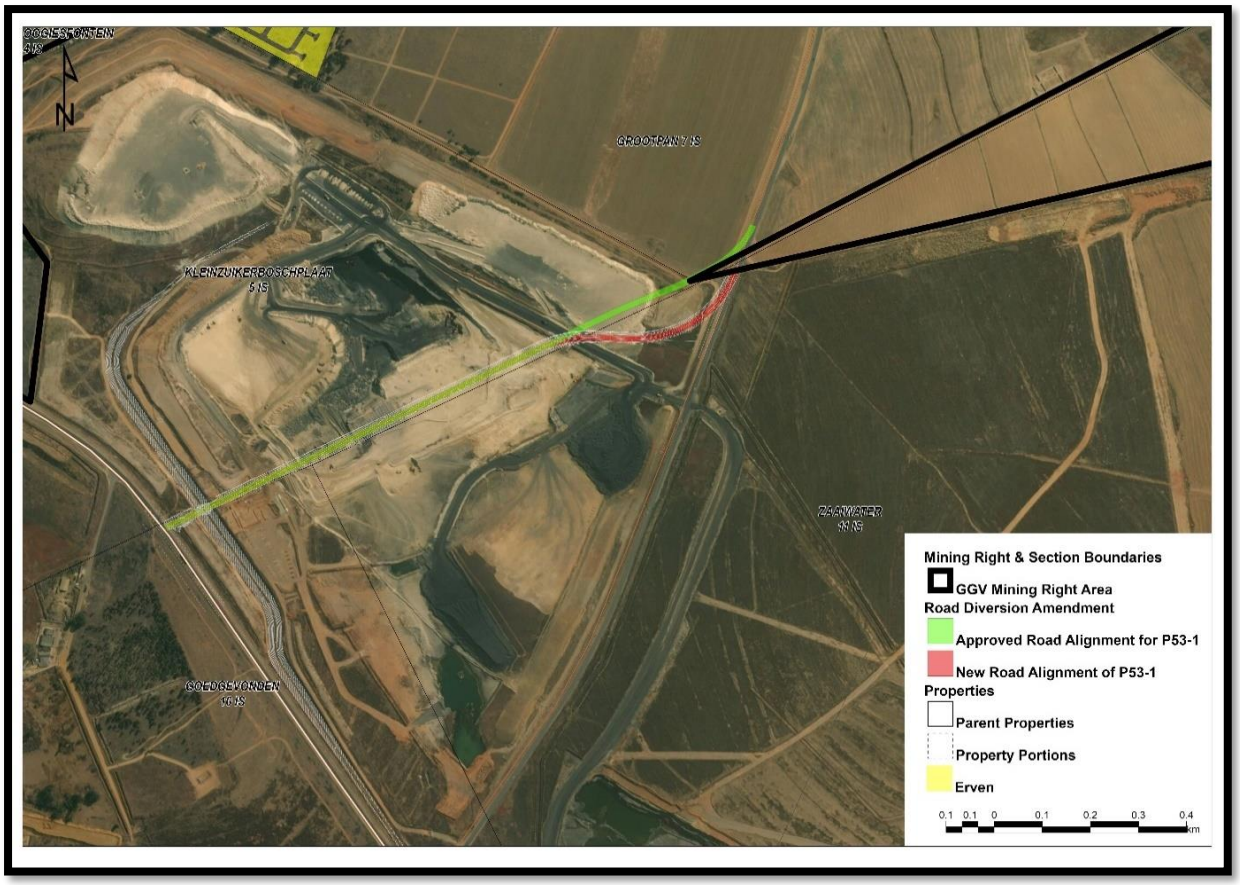

Figure 5: Google Earth image showing road realignment (Jacana).

The proposed re-alignment follows the approved re-alignment for the first 860 m from the Road R545 intersection. It then deviates east for approximately 390 m, to intersect with the current alignment of Road P53-1 approximately 105 m further south than the approved re-alignment.

The total length of the proposed (revised) re-alignment is 1.25 km vs original alignment length of 1.28 km. This is a deviation of less than 5% on the total road alignment.

The revised re-alignment of Road P53-1 has been optimised to improve traffic safety in respect of the curvature back into the existing road, as well as to effect minimum impact on coal reserves. In addition, the approved re-alignment (EMPr, 2016) extends outside of GOSA's property boundary, whilst the proposed re-alignment remains on GOSA property.

This is to optimise the mining schedule, as well as the road alignment as indicated in previous paragraphs.

The GGV operation is an important economic driver within the local area, and contributes to the economic growth, employment and indirect and induced economic benefits of not just the local area, but within the Mpumalanga Province.

Mining activities and associated employment benefits and SLP contribution will continue regardless of whether this amendment is approved of not. However, if the decision is taken not to approve the proposed amendments, some of the benefits may reduce slightly, i.e. tax contribution, capital formation. The LOM may also reduce slightly, thereby reducing the supply to Eskom for power generation.

There will be limited new impacts due to the amendment application, rather a continuation of existing impacts on the socio-economic and physical environment. Existing impacts on the environmental and local communities will continue regardless of this amendment.

It is recommended that SAHRA accept the Desktop Study (this report) because of reasons stated above. SAHRA protocol must be followed.

G. Background to Palaeontology of the area

Summary: When rock units of moderate to very high palaeontological sensitivity are present within the development footprint, a desk top and or field scoping (survey) study by a professional palaeontologist is usually warranted. The main purpose of a field scoping (survey) study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase may be required (SG 2.2 SAHRA AMPHOB, 2012). However, a site visit will not add value to the heritage knowledge of the area.

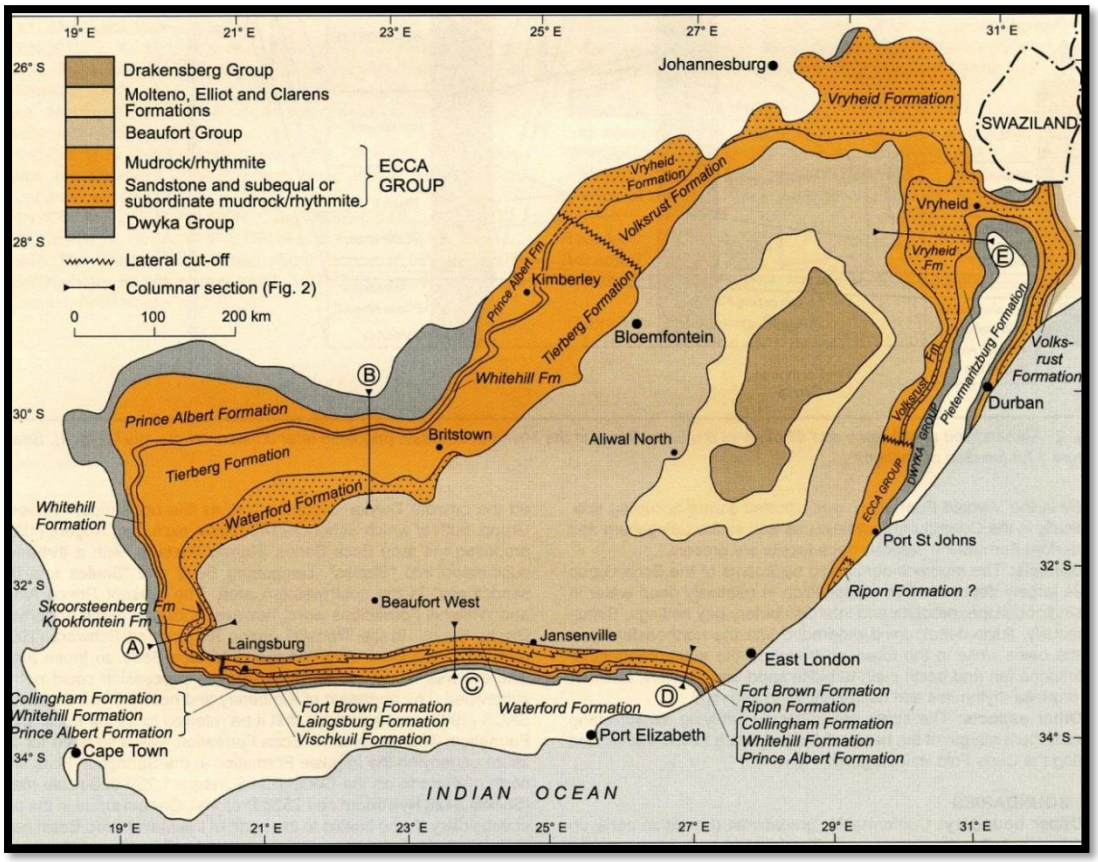

Figure 6: Extent of the Karoo Supergroup (Johnson 2009).

The Ecca Group, Vryheid Formation (Figure 6) may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

The Glossopteris flora is thought to have been the major contributor to the coal beds of the Ecca. These are found in Karoo-age rocks across Africa, South America, Antarctica, Australia and India. This was one of the early clues to the theory of a former unified Gondwana landmass (Norman and Whitfield 2006).

Rocks of Permian age in South Africa are particularly rich in fossil plants (Rayner and Coventry 1985). The fossils are present in the grey shale interlayered with the coal seams. The fossils are not very rare and occur also in other parts of the Karoo stratigraphy. It is often difficult to spot the greyish fossils as they are the same colour as the grey shale in which they are present as these coalified compressions have been weathered to leave surface replicas on the enclosing shale matrix. The pollen of the Greenside Colliery near Witbank also on the Vryheid Formation was the focus of a Ph.D study. A locality close to Ermelo, also Vryheid Formation, has yielded *Scutum, Glossopteris* leaves, *Neoggerathiopsis* leaves, the lycopod *Cyclodendron leslii,* and various seeds and scale leaves (Prevec 2011).

Both the Dolerite and Rooiberg Group are devoid of fossils.

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

Table 1: Taken from Palaeotechnical Report (Groenewald 2012) (**1cA)**.

Vryheid (Pv)		Light grey coarse- to fine-grained sandstone and siltstone. Dark coloured siltstone due to presence of carbon enrichment and coal beds	Abundant plant fossils of *Glossopteris* and other plants. Trace fossils. The reptile *Mesosaurus* has been found in the southern part of the Karoo Basin
	ROOIBERG	Selons River(Vs; Vse) (now renamed subdivided into Kwaggasnek Schrikkloof Fms)	Volcanics plus minor, thin but extensive horizons of metamorphosed sediments (quartzites, sandstones, mudrocks, cherts), mainly of fluvial origin. Volcanics are related to intrusives of the underlying Bushveld Magmatic Province 2.06 Ga Vaalian	Fossils within minor sedimentary units unlikely because of fluvial depositional setting and subsequent metamorphism.	Possible evidence for a catastrophic event at the base of Rooiberg Group (basin floor collapse, slumping, volcanism) Selons River and Kwaggasnek units previously included within upper Pretoria Group by some geologists
		Damwal (Vdr)			

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

Rock Unit	Significance/vulnerability	Recommended Action
Vryheid Formation	Very High	Field assessment and protocol for finds is required
Selonsrivier Formation	Very Low	No action required

Databases and collections: Ditsong: National Museum of Natural History. Evolutionary Studies Institute, University of the Witwatersrand (ESI).
Impact: **VERY HIGH** for the Vryheid Formation, Karoo Supergroup. There are significant fossil resources that may be impacted by the development (mudstone, shale) and if destroyed are no longer available for scientific research or other public good (Almond, *et al.* 2009).

The Project includes one locality Option (see Figure 1) (**1f,j)** The palaeontological sensitivity is as stated above.
Option 1: A blocked polygon area with the town of Ogies and the N12 National Road to the north; and the R 555 Road in the northeast of the project. The approximate size of the site is 4 683.9272 hectares.

All the land involved in the development was assessed **(ni,nii)** and none of the property is unsuitable for development (see Recommendation B).

H. Description of the Methodology (1e)

The palaeontological impact assessment was undertaken in October 2022. A Phase 1: Field Survey will entail taking photographs of the affected portion (in 7.1 mega pixels) with a digital camera (Canon PowerShot A470). Additionally, Google Maps will be accessed on a cellular phone/tablet for navigation. A Global Positioning System (GPS) (Garmin eTrex 10) is used to record fossiliferous finds and outcrops (bedrock) when the area is not covered with topsoil, subsoil, overburden, vegetation, grassland, trees or waste. The survey did identify the Karoo Supergroup. A literature survey is included and the study relied heavily on geological maps.

SAHRA document 7/6/9/2/1 (SAHRA 2012) requires track records/logs from archaeologists not palaeontologists as palaeontologists concentrate on outcrops which may be recorded with a GPS. Isolated occurrences of rocks usually do not constitute an outcrop. Fossils can occur in dongas, as nodules, in fresh rock exposures, and in riverbeds. Finding fossils require the experience and technical knowledge of the professional palaeontologist, but that does not mean that an amateur can't find fossils. The geology of the region is used to predict what type of fossil and zone will be found in any particular region. Archaeozoologists concentrate on more recent fossils in the quaternary and tertiary deposits.

Assumptions and Limitations (**1i)**:-

The accuracy and reliability of the report **may be** limited by the following constraints:

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

A Phase 2 Palaeontological Impact Assessment: Mitigation will include:

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

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

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

National Estate: 3 (2) (f) archaeological and palaeontological sites,

(i)(1) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens,

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

(b) Grade 2: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and (c) Grade 3: Other heritage resources worthy of conservation.

SAHRA is responsible for the identification and management of Grade 1 heritage resources.
Provincial Heritage Resources Authority (PHRA) identifies and manages Grade 2 heritage resources.
Local authorities identify and manage Grade 3 heritage resources.

No person may damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a provincially protected place or object without a permit issued by a heritage resources authority or local authority responsible for the provincial protection.
Archaeology, palaeontology and meteorites: Section 35.
(2) Subject to the provisions of subsection (8) (a), all archaeological objects, palaeontological material and meteorites are the property of the State.
(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before a Phase 2 may be implemented.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (*e. g.* during bedrock excavations), this must be safeguarded, where feasible *in situ,* and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (*e. g.* Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

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

I. Description of significant fossil occurrences

All Karoo Supergroup geological formations are ranked as **LOW** to **VERY HIGH**, and here the impact is potentially **VERY HIGH** for the Vryheid Formation.

Fossils likely to be found are mostly plants (Appendix 1) such as '*Glossopteris* flora' of the Vryheid Formation. The aquatic reptile *Mesosaurus* and fossil fish may also occur with marine invertebrates, arthropods and insects. Trace fossils can also be present. During storms a great variety of leaves, fructifications and twigs accumulated and because they were sandwiched between thin films of mud, they were preserved to bear record of the wealth and the density of the vegetation around the pools. They make it possible to reconstruct the plant life in these areas and wherever they are found, they constitute most valuable palaeobotanical records (Plumstead 1963) and can be used in palaeoenvironmental reconstructions (Appendix 1).

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

The threats are:-

- Earth moving equipment/machinery (front end loaders, excavators, graders, dozers) during construction,
- The sealing-in or destruction of fossils by development, vehicle traffic, prospecting, mining, and human disturbance. See Description of the Geological Setting (F) above.

J. Recommendation

a. There is no objection (see Recommendation B) to the development, it is not necessary to request a Phase 1 Palaeontological Impact Assessment: Field Study to determine whether the development will affect fossiliferous outcrops, but the palaeontological sensitivity of the area is **VERY HIGH,** therefore a Phase 1 Palaeontological Assessment is required if a fossiliferous formation (Karoo Supergroup) and or fossils are found during the development. See Section F for explanation. Protocol is attached (Appendix 2).
b. This project may benefit the community, will create short- and long-term employment, the life expectancy of the community, the growth of the community, and social development in general.
c. Preferred choice: Locality Option 1 is preferred and possible.
d. The following should be conserved: if any palaeontological material is exposed during clearing, digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped, a 30 m no-go barrier constructed and a palaeontologist should be called in to determine proper mitigation measures.
e. Consultation with parties was not necessary **(1o,p,q).**
f. This report must be submitted to SAHRA/PHRA together with the Heritage Impact Assessment Report.

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

a. Objections: Cautious. See heritage value and recommendation.
b. Conditions of development: See Recommendation.
c. Areas that may need a permit: Yes.
d. Permits for mitigation: **Needed from SAHRA/PHRA prior to Mitigation**.

K. Conclusions

a. All the land involved in the development was assessed and none of the property is unsuitable for development (see Recommendation B).
b. All information needed for the Palaeontological Impact Assessment was provided by the Consultant. All technical information was provided by Jacana Environmental cc.
c. Areas that would involve mitigation and may need a permit from the South African Heritage Resources Agency are discussed.

d. The following should be conserved: if any palaeontological material is exposed during clearing, digging, excavating, drilling or blasting, SAHRA must be notified. All development activities must be stopped, a 30 m barrier constructed, and a palaeontologist should be called in to determine proper mitigation measures.
e. Condition in which development may proceed: It is further suggested that a Section 37(2) agreement of the Occupational, Health and Safety Act 85 of 1993 is signed with the relevant contractors to protect the environment (fossils) and adjacent areas as well as for safety and security reasons.

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Declaration (1b)

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

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

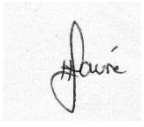
It may be possible that the Palaeontological Study may have missed palaeontological resources in the project area as outcrops are not always present or visible while others may lie below the overburden of earth and may only be present once development commences.

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

<u>POPI Act 2013 Statement</u>

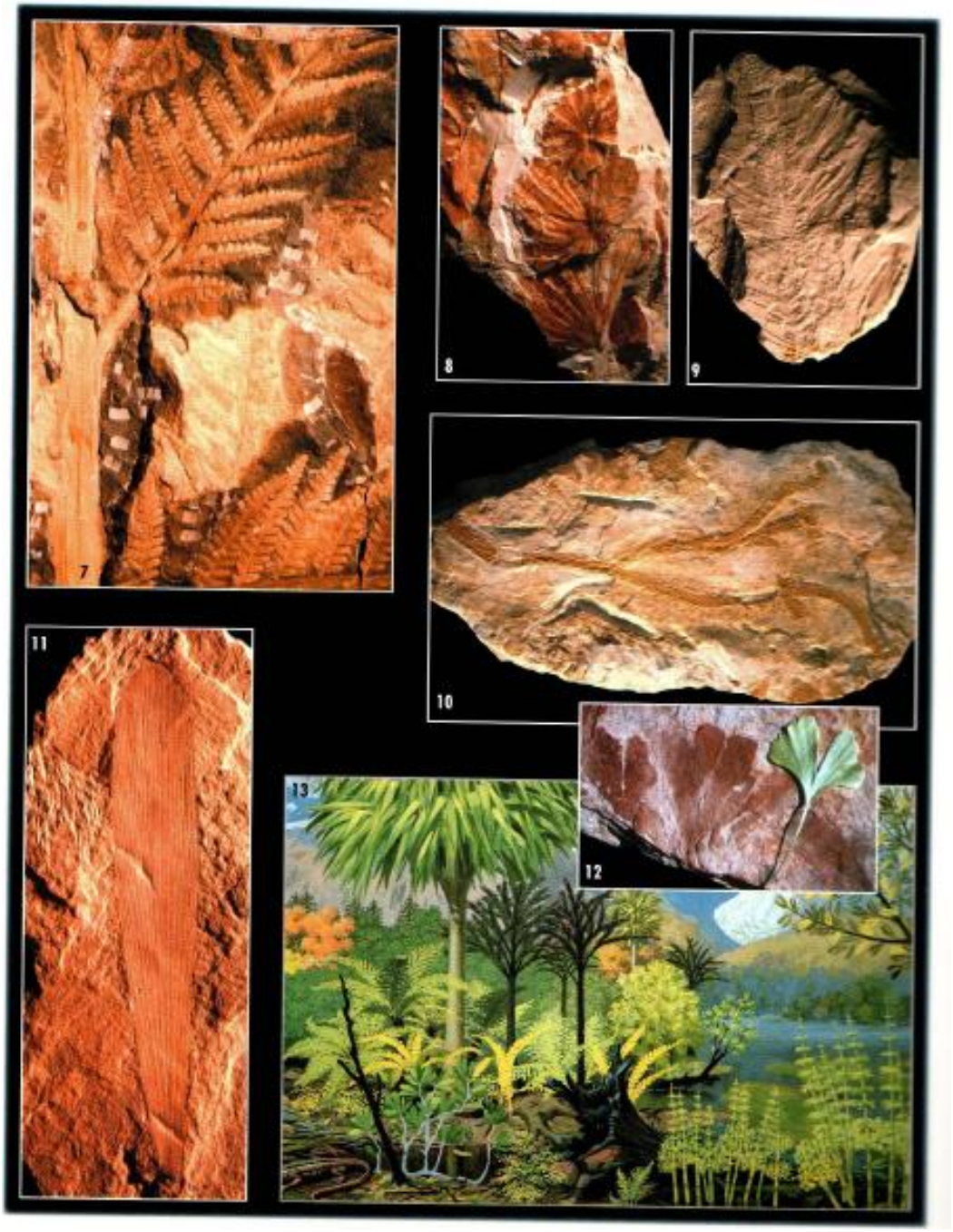
It provides that everyone has the right to privacy and includes a right to protection against the unlawful collection, retention dissemination and use of personal information contained in this document and pertains to the phone and contact details, signature and contents.

As per the Declaration Section none of the information may be shared without the permission of the author.



Heidi Fourie
2022/10/17

Appendix 1: Example of Vryheid Formation Fossils (MacRae 1999)



Appendix 2: **Protocol for Chance Finds and Management Plan (1k,l,m)**

This section covers the recommended protocol for a Phase 2 Mitigation process as well as for reports where the Palaeontological Sensitivity is **LOW**; this process guides the palaeontologist / palaeobotanist on site and should not be attempted by the layman / developer.

- The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities.
- For a chance find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation. Construction workers must be informed that this is a no-go area.
- It is recommended that the EMPr be updated to include the involvement of a palaeontologist for pre-construction training of the mine environmental personnel or during the digging and excavation phase of the development.
- The mine environmental personnel and mine geologist must visit the site after clearing, drilling, excavations and blasting and keep a photographic record.
- The developer may be required to survey the areas affected by the development and indicate on a plan where the construction / development / mining will take place. Trenches may have to be dug to ascertain how deep the sediments are above the bedrock (can be a few hundred metres). This will give an indication of the depth of the topsoil, subsoil, and overburden, if need be trenches should be dug deeper to expose the interburden.

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

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

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

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

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

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before a Phase 2 may be implemented.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (*e. g.* during bedrock excavations), this must be safeguarded, where feasible *in situ,* and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (*e. g.* Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

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

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

1. The developer needs to clearly stake or peg-out (survey) the areas affected by the mining/ construction/ development operations and dig representative trenches and if possible supply geological borehole data. When the route is better defined, it is recommended that a specialist undertake a 'walk through' of the entire road as well as construction areas, including camps and access roads, prior to the start of any construction activities, this may be done in sections.
2. When clearing vegetation, topsoil, subsoil or overburden, hard rock (outcrop) is found, the contractor needs to stop all work.
3. A Palaeobotanist / palaeontologist (contact SAHRIS for list) must then inspect the affected areas and trenches for fossiliferous outcrops / layers. The contractor / developer may be asked to move structures, and put the development on hold.
4. If the palaeontologist / palaeobotanist is satisfied that no fossils will be destroyed or have removed the fossils, development and removing of the topsoil can continue.
5. After this process the same palaeontologist / palaeobotanist will have to inspect and offer advice through the Phase 2 Mitigation Process. Bedrock excavations for footings may expose, damage or destroy previously buried fossil material and must be inspected.

6. When permission for the development is granted, the next layer can be removed, if this is part of a fossiliferous layer, then with the removal of each layer of sediment, the palaeontologist / palaeobotanist must do an investigation (a minimum of once every week).
7. At this stage the palaeontologist / palaeobotanist in consultation with the developer / mining company must ensure that a further working protocol and schedule is in place. Onsite training should take place, followed by an annual visit by the palaeontologist / palaeobotanist.

Fossil excavation if necessary, during Phase 2:

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

This document forms part of the Environmental Monitoring Programme. For practical reasons a palaeontologist/palaeobotanist may be required to be on site as predetermined. If any fossil material is discovered then a Phase 2 rescue operation may be necessary, and a permit will be required.

The South African Heritage Resources Agency has the following documents in place:
Guidelines to Palaeontological Permitting policy.
Minimum Standards: Palaeontological Component of Heritage Impact Assessment reports.
Guidelines for Field Reports.
Palaeotechnical Reports (Eastern Cape, North West, Northern Cape, Mpumalanga, Gauteng, Western Cape, Free State, Kwazulu Natal, and Limpopo)

Appendix 3:
Table 2: Listing points in Appendix 6 of the Act and position in Report (bold in text).

Section in Report	Point in Act	Requirement
B	1(c)	Scope and purpose of report
B	1(d)	Duration, date and season
B	1(g)	Areas to be avoided
D	1(ai)	Specialist who prepared report
D	1(aii)	Expertise of the specialist
F Figure 3	1(h)	Map
F, B	1(ni)(iA)	Authorisation
F, B	1(nii)	Avoidance, management, mitigation and closure plan
G Table 1	1(cA)	Quality and age of base data
G Table 2	1(cB)	Existing and cumulative impacts
G, D	1(f)	Details or activities of assessment
G	1(j)	Description of findings
H	1(e)	Description of methodology
H	1(i)	Assumptions

J	1(o)	Consultation
J	1(p)	Copies of comments during consultation
J	1(q)	Information requested by authority
Declaration	1(b)	Independent declaration
Appendix 2	1(k)	Mitigation included in EMPr
Appendix 2	1(l)	Conditions included in EMPr
Appendix 2	1(m)	Monitoring included in EMPr
D	2	Protocol or minimum standard

Appendix 4: Impact Statement

The development footprint is situated on the Vryheid Formation (Pv) of the Ecca Group, Karoo Supergroup with a Very High palaeontological sensitivity. The nature of the impact is the destruction of Fossil Heritage. Loss of fossil heritage will have a negative impact. The extent of the impact only extends in the region of the development activity footprint and may include transport routes. The expected duration of the impact is assessed as potentially permanent. The intensity/magnitude of the impact is high as it is destructive. The probability of the impact occurring will be definite and will occur regardless of preventative measures.

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 irreversible. With Mitigation the impact will be moderate and the cumulative impact is low. Impacts on palaeontological heritage during the mining/construction and pre-mining/preconstruction phase could potentially occur and is regarded as having a high possibility. The significance of the impact occurring will be as below:

S= (2+5+8)5
S = 75 High (>60).