Palaeontological Impact Assessment for the proposed re-mining and expansion of Kinross dump, Mpumalanga Province

Desktop Study

For

Cabanga Environmental

17 January 2017

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Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 30 years research; 20 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Cabanga Environmental. The views expressed in this report are entirely those of the author and Jane Reynard and no other interest was displayed during the decision making process for the project.

Specialist: …….. Prof Marion Bamford……..

Signature: …….

Executive Summary

The desktop or Phase 1 Palaeontological Impact Assessment for the proposed re-mining of tailings dumps and expansion of the Evander Gold Mine's Kinross Complex to include a new metallurgical processing plant. The site for the project lies partly on the shales and sandstones of the Volksrust Formation (Early Permian, Ecca Group) and on the Jurassic dolerite intrusions. No fossils have been reported from this region. Most of the area is on already disturbed tailing sites so there would be no new disturbance or retrieval of fossils. The proposed processing plant, to be located just north of the Kinross Tailings Facility, will also be located on disturbed ground. It is the opinion of the palaeontologist that the project may go ahead. If, in the very unlikely chance that fossils are found during excavations and construction, then a palaeontologist must be called to rescue the fossils.

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1. Background

EVANDER – ELIKHULU PROJECT DESCRIPTION (information provided by Cabanga):
Evander Gold Mines Limited (henceforth EGM) has been operational since 1958, and has an approved mining right and Environmental Management Programme report (EMPr) in terms of the Minerals and Petroleum Resources Development Act, Act 28 of 2002 (MPRDA).
The approved mining right area covers a number of portions on various farms totaling some 31,783.0738 Hectares (see Figure 1).

The approved EMPr currently authorises the mining and processing of gold and associated activities at the mine's three (3) operational complexes (Kinross, Winkelhaak and Leslie/Bracken – see Plan 2).

In addition, the approved EMPr covers the re-processing of the Kinross Tailings Storage Facility (TSF) as part of the Evander Tailings Recycling Project. EGM intends to extend this project to re-process the Winkelhaak and Leslie/Bracken TSFs, ultimately consolidating them into one large TSF at the end of life of mine. Furthermore, a second metallurgical plant is proposed at the Kinross Complex to handle additional tailings loads.
No changes are proposed to the underground mine areas or access points.
The following is relevant to the operational changes associated with this project (see specialist report for further details):

- Elikhulu Plant
- New Tailings Storage Facility (expansion to the existing Kinross TSF)
- Slurry reticulation
- Water supply
- Power Supply
- Waste management

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014)

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	**Relevant section in report**
Details of the specialist who prepared the report	Prof Marion Bamford
The expertise of that person to compile a specialist report including a curriculum vitae	Palaeontologist (PhD Wits 1990) CV attached
A declaration that the person is independent in a form as may be specified by the competent authority	Page 2
An indication of the scope of, and the purpose for which, the report was prepared	Section 2 (page 3)
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	n/a Seasons make no difference to buried coals
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2 (p. 3)
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	See table 3 (p. 8)

An identification of any areas to be avoided, including buffers	n/a
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;	n/a
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 6 (p. 9)
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	n/a Findings would be a once-off occurrence
Any mitigation measures for inclusion in the EMPr	n/a (not requested)
Any conditions for inclusion in the environmental authorisation	n/a
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	n/a (can be provided if required by SAHRA)
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	n/a
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	n/a
A description of any consultation process that was undertaken during the course of carrying out the study	n/a See section 3
A summary and copies if any comments that were received during any consultation process	n/a See section 3
Any other information requested by the competent authority.	n/a See section 3

2. Methods and Terms of Reference

1. In order to determine the likelihood of fossils occurring in the affected area geological maps, literature, palaeontological databases and published and unpublished records have been consulted.

2. If fossils are likely to occur then a site visit must be made by a qualified palaeontologist to locate and assess the fossils and their importance.

3. Unique or rare fossils should either be collected (with the relevant South African Heritage Resources Agency (SAHRA) permit) and removed to a suitable storage and curation facility, for example a Museum or University palaeontology department or protected on site.

4. Common fossils can be sacrificed if they are of minimal or no scientific importance but a representative collection could be made if deemed necessary.

The published geological and palaeontological literature, unpublished records of fossil sites, catalogues and reports housed in the Evolutionary Studies Institute, University of the Witwatersrand, and SAHRA databases were consulted to determine if there are any records of fossils from the sites and the likelihood of any fossils occurring there.

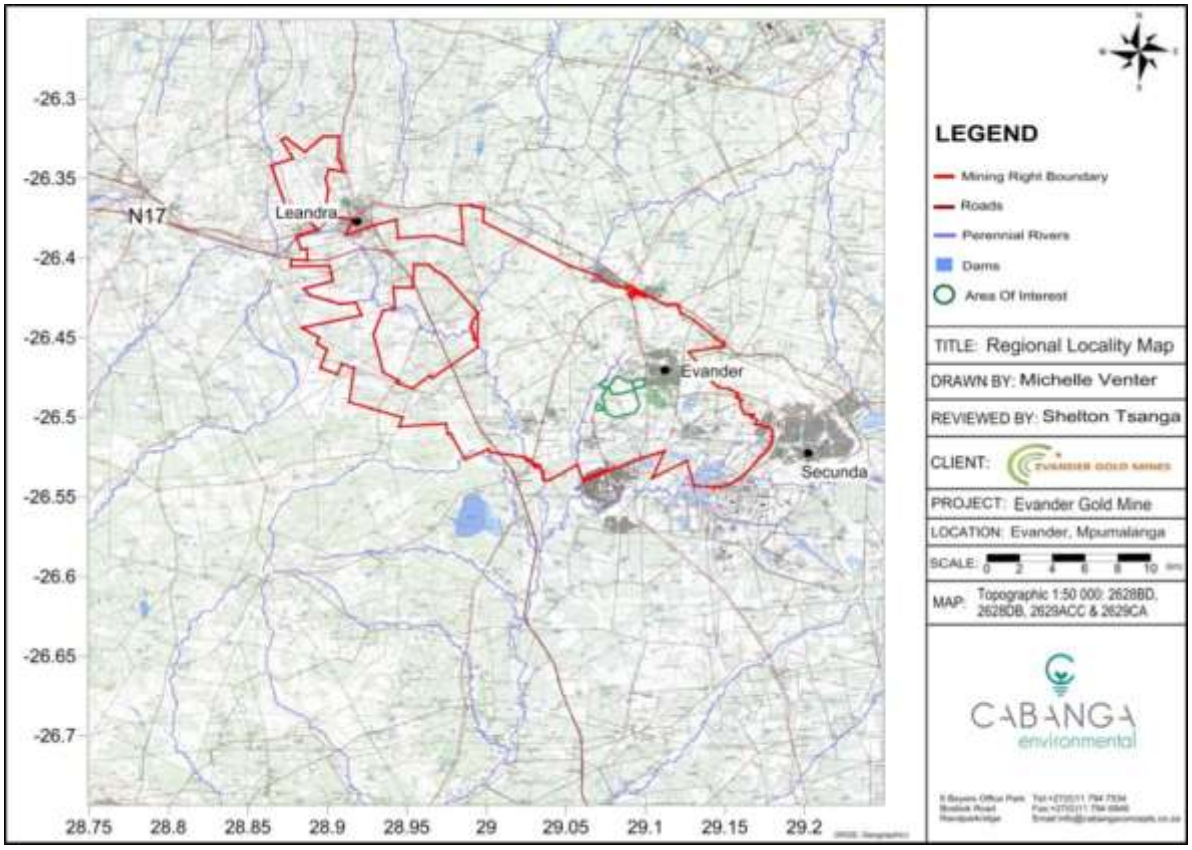

Figure 1: Location and full extent of the Evander Gold Mine's mining right area, Mpumalanga Province. Figure supplied by Cabanga Environmental.

Figure 2: EGM's three operational complexes. Plans are to extend the Evander Tailings Recycling Project to include the re-processing of the Leslie and Winkelhaak TSFs; and construct a second metallurgical plant at the Kinross Complex to handle additional tailings loads.

3. Consultation Process

No consultations were carried out during the desktop study. Apart from reviewing interested and/or affected party (IAP) comments received by the EIA consultant during the EIA process, no other consultation took place as part of the paleontological study.

4. Geology and Palaeontology

Project location and geological setting

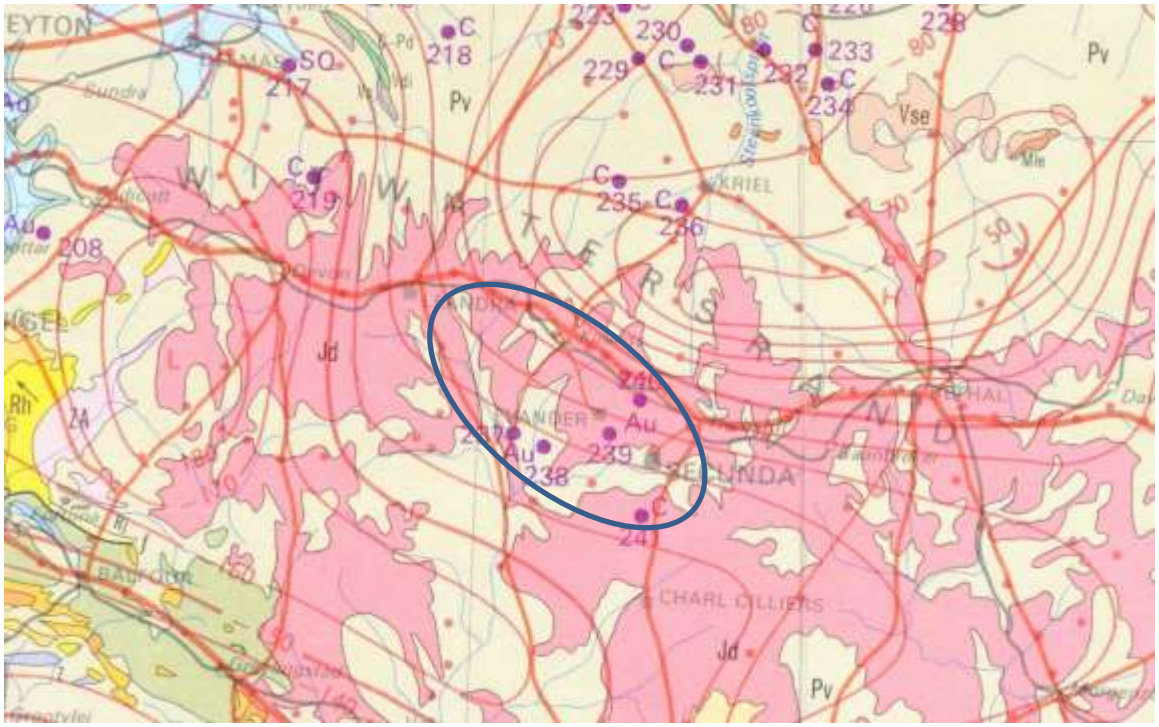

Figure 3. Geological map of the area around Evander, Leandra and Secunda with the EGM area outlined. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 2: Explanation of symbols for the geological map (Figure 3) and approximate ages in millions of years (Ma). (Buchanan, 2006; Eriksson et al., 2006; Johnson et al., 2006; McCarthy, 2006; van der Westhuisen et al., 2006).

Symbol	Group/Formation	Lithology	Approximate Age
Jd	Jurassic	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pv	Vryheid Fm, Early Ecca Group	Sandstone, shale, coal	Early Permian
Vse	Selons River, Rooiberg Group	Red porphyritic rhyolite	2050 Ma

Symbol	Group/Formation	Lithology	Approximate Age
Vm	Malmani subgroup, Chuniespoort Group	Dolomite, chert	2600-2500 Ma
Rk	Klipriviersberg Group, Ventersdorp SG	Andesite, tuff	Ca 2800 Ma
Rh	Hospital Hill Fm, Johannesburg subG, Central Rand Group, Ventersdorp SG	Quartzite, shale, conglomerate, volcanic rocks	3000-2800 Ma

Geology

The underlying geology in this region is the Evander goldfield which is the easternmost extent of the Witwatersrand Basin sediments, comprising quartzites, shale, conglomerates (gold-bearing) and volcanic rocks. These belong to the Johannesburg Subgroup (Central Rand Group, Ventersdorp Supergroup) and are dated between 2800-3000 million years old. The environmental setting was a fluvial braidplain one (McCarthy, 2006).

There are minor outcrops of other old igneous rocks to the north and east (Rooiberg Group and Malmani subgroup; Buchanan, 2006; Eriksson et al., 2006).

The Ventersdorp rocks are disconformably overlain by the Volksrust Formation (Ecca Goup and Early Permian in age) which comprises sandstones, shales and coal (Johnson et al., 2006). The uppermost coal seams are 25-50 m below the surface in the Leandra area (Snyman, 1998).

The most extensive surface rock type in the area is the dolerite intrusive rocks that are Jurassic in age, circa 180-170 Ma.

Palaeontology

The rocks of the Johannesburg Subgroup which underlie the area and contain the gold deposits are too old and not suitable to contain any fossils. There could potentially be fossil vertebrates and plants in the sandstones and shales of the Volksrust Formation but in many cases these would have been destroyed by the dolerite dykes. Fossil plants are associated with the shale lenses between the coal seams but in this area the uppermost coal seam is 25 or more metres below the ground surface. No vertebrate or plant fossils have been reported from this area (published and unpublished reports and databases).

The SAHRIS palaeosensitivity map for the site indicates both red (highly sensitive) and grey regions (insignificant to zero) for this area. There are, however, no published records of fossil plants or invertebrates from this area.

Figure 4: SAHRIS palaeosensitivity map of the Evander region (Grey = non sensitive, no PIA required; green moderately sensitive, desktop PIA required; red very sensitive, PIA required).

The areas designated for re-processing are already highly disturbed and the tailings have covered the land surface, i.e. Kinross, Winkelhaak and Leslie/Bracken complexes so no fossils would be further disturbed. The new TSF expansion (plan 3) includes an area that was used as an airstrip and for agricultural purposes so it too has been disturbed. The excavations for foundations and construction of the second processing plant (just north of the Kinross complex) has a small footprint and is in an already disturbed area, so it is highly unlikely that any fossils would be found there.

5. Impact assessment

Using the table below, the impact of this proposed development has been assessed:

TABLE 3: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term

	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

Assessment:

The surface activities would not impact on the fossil heritage as there are no known occurrences of fossils in this area. The IMPACT is nil.

Once excavations for the metallurgical processing plants, infrastructure, water pipes etc., begin there would be minor deterioration of the site and no impact on people. Therefore the SEVERITY/NATURE of the environmental impact would be L.

DURATION of the impact would be permanent: H.

Since only the possible fossils within the development area would be affected the SPATIAL SCALE will be localised within the site boundary: L.

Any disturbance would be on the surface and possibly a few metres below the surface. Any fossils that were present are most likely to have been destroyed by previous mining and human activities. Therefore, the PROBABILITY of affecting any fossils is unlikely or seldom: L.

6. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the sandstones, shales and coals of the Volksrust Formation that are intruded by the Jurassic dolerite dykes are typical of other deposits in the Karoo Basin, so there is a small chance that fossil plants, animals or invertebrates would occur there. However due the fact that no fossils have been reported previously and the area is already highly disturbed, the chance of finding recognizable and well preserved fossils is extremely small.

7. Recommendation

While it is possible that fossils could occur in the proposed metallurgical processing plant site and TSF expansion area, they would not be detected until excavations begin. A site visit is therefore not feasible until such stage.

If fossil material is discovered during the development of the site, then it is strongly recommended that a professional palaeontologist be called to assess the importance and to rescue them if necessary (with the relevant SAHRA permit).

If the fossil material is deemed to be of scientific interest then further visits by a professional palaeontologist would be required to collect more material and deposit a representative sample in a recognized institute for further study. No further impact assessment is required at this stage.

8. References

Buchanan, B.C., 2006. The Rooiberg Group. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 283 – 289.

Erikssen, P.G., Altermann, W., Hartzer, F.J., 2006. The Transvaal Supergroup and its pre-cursors. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 237-260.

McCarthy, T.S., 2006. The Witwatersrand Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 155-186.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

Snyman, C.P., 1998. Coal. In: Wilson, M.G.C., and Anhaeusser, C.P., (Eds) The Mineral Resources of South Africa: Handbook, Council for Geosciences 16, 136-205.

Van der Westhuizen, W.A., de Bruiyn, H., Meintjes, P.G., 2006. The Ventersdorp Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 187-208.

MKB 11-01-2017