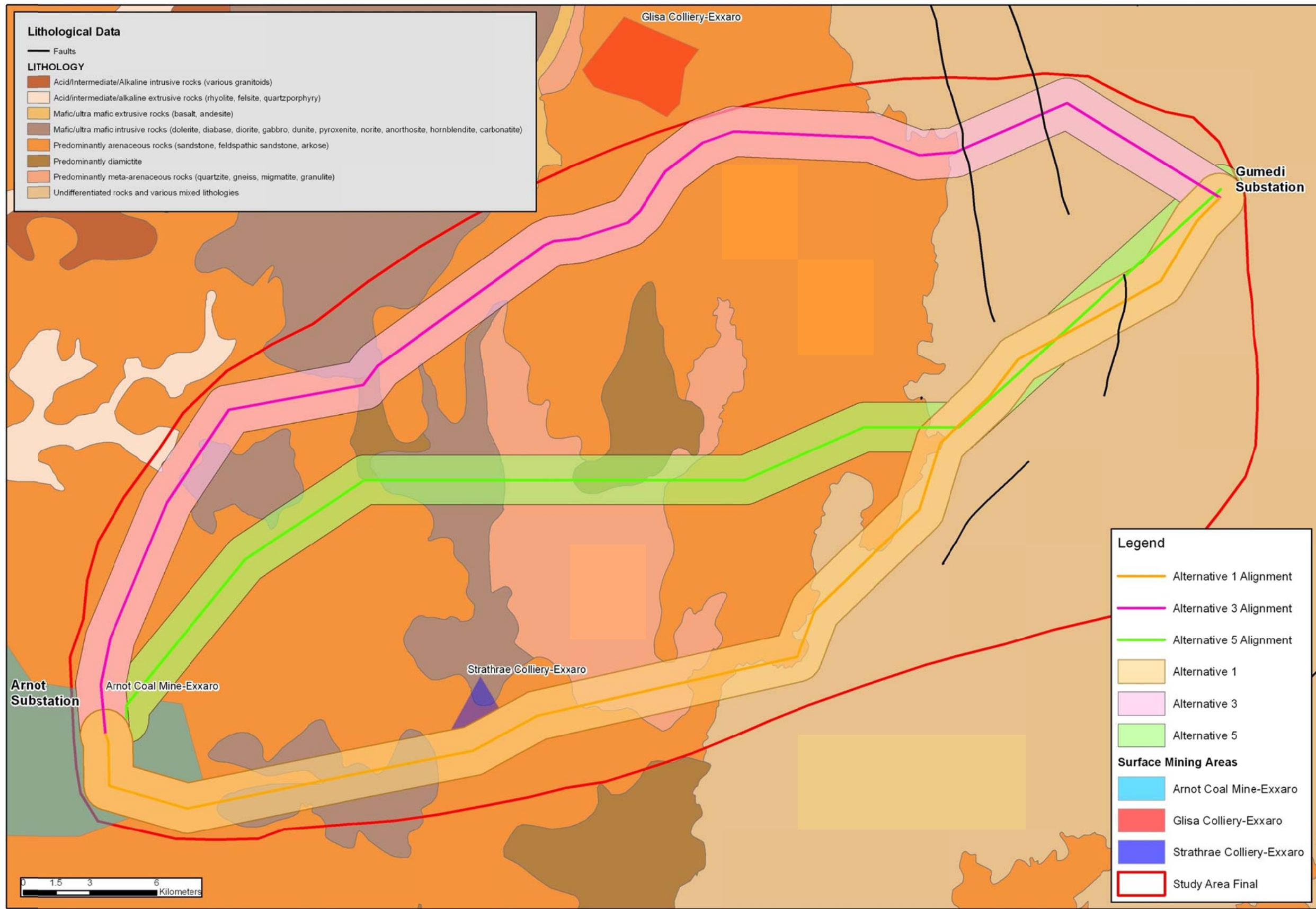


ARNOT TO GUMENI POWERLINES UNDERMINING STUDY
 GEOLOGICAL MAP SHOWING STRATIGRAPHY IN RELATION TO PROPOSED ALTERNATIVE POWERLINE ROUTES

Data Source:	
RSA 1:500 000 Geological Series	
Scale:	
1:170,000	
Projection:	Datum:
HH94	WGS84
Central Meridian/Zone:	
Date:	Compiled by:
16/10/2012	ALLK
Project No:	Fig No:
453803	4-4
Revision: A Date: 07 11 2012	



Data Source: RSA 1:500 000 Hydrogeological Series	
Scale: 1:170,000	
Projection: HH94	Datum: WGS84
Central Meridian/Zone:	
Date: 16/10/2012	Compiled by: ALLK
Project No: 453803	Fig No: 4-5
Revision: A Date: 07 11 2012	

The general locality, topography, geology and slope classification maps covering the study area are provided in Figures 4-2 to 4-5 below.

4.2 General Mining Activities in the Study Area

The study area falls within a region of South Africa notorious for its coal deposits. Other mining and quarrying activities are also present in the general Mpumalanga area, however coal mining has been identified as the main mining activity with the relevant study area.

The coal deposits in the study area are exploited by various separate small to large scale mines/collieries.

The largest operational mine in the area is Arnot, which is owned by Exxaro Resources Pty (Ltd) (Exxaro), this mine extracts coal using both underground and opencast operations and produces 5Mtpa of power station coal. Arnot uses mechanised mining methods and continuous mining processes.

Other operation also under Exxaro's control includes the Glisa and Strathrea collieries. The Glisa colliery employs both opencast and underground mining methods whereas at Strathrea Colliery only surface mining methods are utilised. The visual surface extent of the Glisa Colliery falls outside of the study area; however the exact areas affected by underground workings could not be determined during this desktop study.

The Belfast Colliery, in close proximity to Glisa has been decommissioned according to the Department of Resources (DMR), this colliery however falls outside of the study area.

Two relatively small areas were identified in Google Earth where evidence of mining activities was noted. However the operators of these pits could not be identified. It is suspected that these areas may form part of Arnot's mining lease and are being mined as part of the Arnot operation, however no confirmation of this could be obtained as yet.

The approximate location and surface extent of current mining activities identified within and in close proximity to the study area have been outlined and are illustrated in Figure 4-2 to Figure 4-5 above. The areas indicated in Figure 4-6 below show the small scale mining activities noted of unidentified operators within the study area.

4.3 Sourcing Information from current mining operations

As indicated by the DMR, government departments only keep records of decommissioned operations. As the operations that will potentially influence the proposed routes under investigation are currently in operation, the relevant information needs to be directly sourced from these companies.

During the Stage 1 investigation various officials from the Exxaro operations were contacted to try and source the relevant information; however to date this information has not yet been made available to SRK to utilise. The mining operations requested that a formal request be made to them by ESKOM before releasing any information.

After further discussion with the business unit manager of the Arnot mining operation, Mr Chris Ballot, the following was indicated:

- Arnot mine is willing to provide SRK with the relevant detailed information of the mining areas under their control coinciding with the proposed routes,
- They will only be able to provide this information at a later stage due to unavailability of key personnel that would need to assist in this regard.

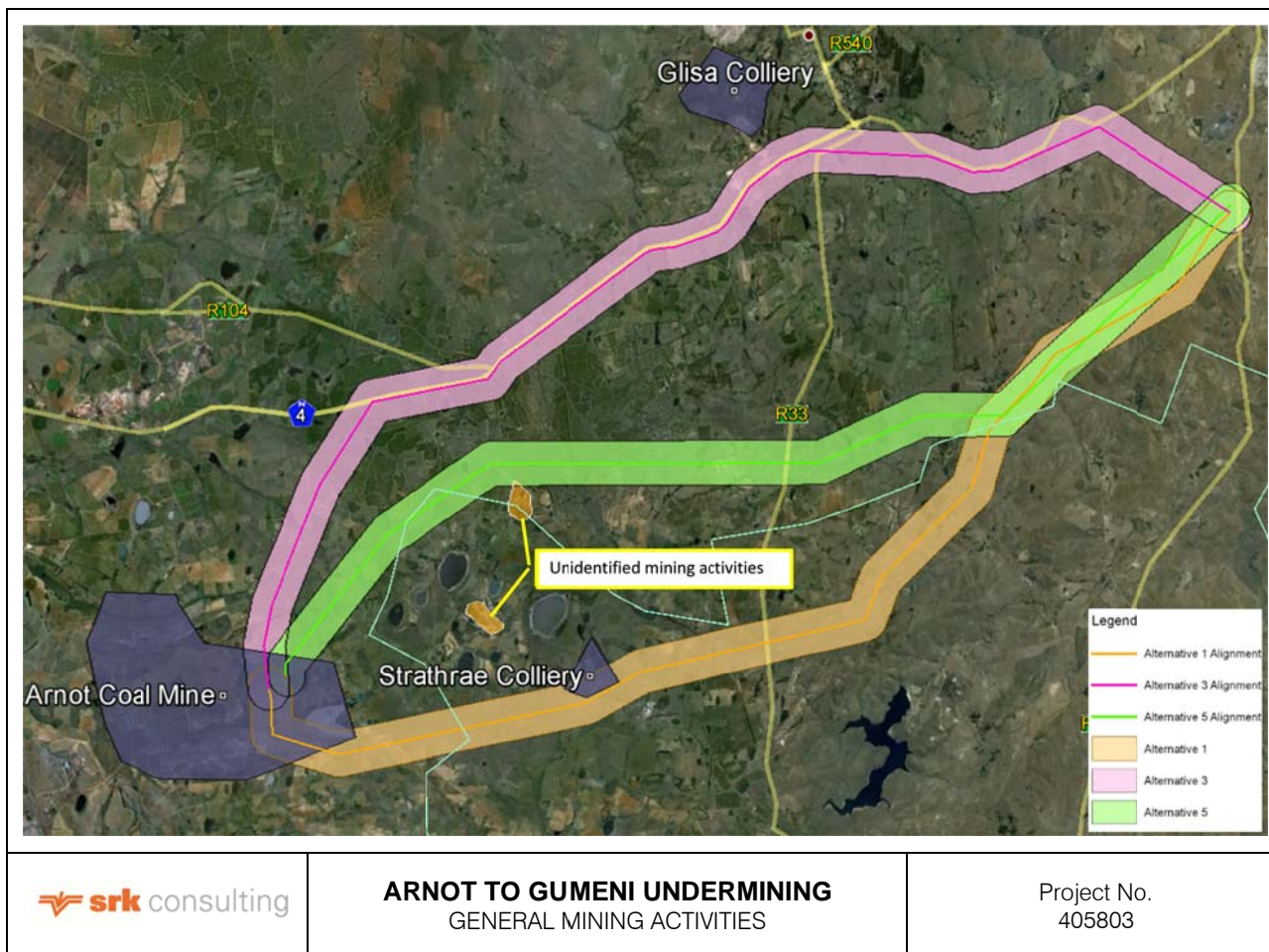


Figure 4-6 Extract from Google Earth imagery showing location of general mining activities identified

The Strathrea and Glisa operations indicated that they would require a formal information request letter from ESKOM.

SRK is however confident that this information can be obtained and evaluated and included in an update of this Stage 1 study interim report and/or, where warranted used for further detailed assessments during a Stage 2 investigation where and if required.

4.3.1 Mining Activities interaction with Route 1

From freely available information it is shown that approximately 18km from Arnot substation, Route 1 passes the Strathrea Colliery. Areas close to the Strathrea operation may be influenced in future should these mining operations extend in a southerly direction.

Sections along the first few kilometres of the route from the Arnot substation traverse areas falling within the Arnot colliery mining lease area and may be influenced by some undermining activity.

The exact extent of interaction areas can only be confirmed once the necessary information has been made available by the relevant mining operators.

4.3.2 Mining Activities interaction with Route 3

It is believed that sections along the first few kilometres of the route from the Arnot substation traverse areas falling within the Arnot colliery mining lease area. The extent of areas possibly

affected negatively by underground activities is not yet confirmed as detailed information is still to be sourced from the respective operations.

4.3.3 Mining Activities interaction with Route 5

It is believed that sections along the first few kilometres of the route from the Arnot substation traverse areas falling within the Arnot colliery mining lease area. The extent of areas affected by underground activities is not yet confirmed.

A small opencast mining area was noted along this route. Further investigation into the owner of this mining operation and planned future extensions will need to be investigated.

4.4 Potential Future mining development

From internet research it has come to light that the Glencore group recently acquired some of the main coal mining operations in the area including the Klippan and Grootpan collieries situated to the west of the study area. A planned colliery named Wonderfontein is due to start operations in 2013. From discussion with relevant persons from the DMR and also local mining operators it is possible that this future operation may be situated within the study area. No concrete information confirming the location of this new mining development could however be sources.

The location of the new Wonderfontein mine will be confirmed and included in an update of this Stage 1 report.

4.5 Regional and Structural Geology

The 1: 500 000 geological map for the area (Geological Series) shows that the study area is predominately underlain by sedimentary rocks such as sandstones and shale of the Madzaringwe/Vryheid Formation which is part of the Ecca Group forming part of the Karoo Supergroup. The Dwyka group is also present within the study area. Small portions of the study area are underlain by rocks from the Transvaal Supergroup generally comprising meta-sedimentary rocks from the Pretoria Group. Some intrusive Karoo Dolerite is also mapped in the area as well as intrusive rocks forming part of the Rustenburg layered suite.

Mapped faults are shown traversing the study area in the most eastern regions and intersect Route 1 and Route 5 once. Two fault lines intersecting Route 3.

Figure 4-4 and Figure 4-5 above illustrates the site location in relation to the main geological data available for the study area as described above.

The current mining activities identified are all located in areas underlain by rocks from the Karoo Supergroup as coal deposits tend to be concentrated in rocks from the Karoo Supergroup. It is therefore safe to assume that other areas associated with this geological unit, not yet mined, may be associated with exploration and mining activities in future.

4.5.1 Predominant Geology - Route 1

The geology traversed by Route 1 is dominated by the Karoo Supergroup sediments with approximately 35% of the route underlain by lithologies belonging to this Supergroup. Other lithologies include rocks from the Pretoria Group and some intrusive dolerite. These lithologies comprise the remaining 65% of the route ranging between 1.5% to 18% respectively.

4.5.2 Predominant Geology - Route 3

The geology traversed by Route 3 is dominated by the Karoo Supergroup sediments with approximately 74% of the route underlain by lithologies belonging to this Supergroup. Other

lithologies include rocks from the Pretoria Group and some intrusive dolerite. These lithologies comprise the remaining 26% of the route ranging between 1.75% to 10.5% respectively.

4.5.3 Predominant Geology - Route 5

The geology traversed by Route 5 is dominated by the Karoo Supergroup sediments with approximately 75% of the route underlain by lithologies belonging to this Supergroup. Other lithologies include rocks from the Pretoria Group and some intrusive dolerite. These lithologies comprise the remaining 25% of the route ranging between 2.3% to 7% respectively.

5 Conclusions and Recommendations

5.1 General

Routes 3 and Route 5 are most likely to be subject to future interactions with new mining operations as the underlying geology dominating these routes are usually associated with containing mineable coal reserves.

5.2 General undermining risk areas identified

From the limited freely available information that could be gathered for the relevant study area the following can be concluded regarding undermining risk:

- Route 1, 3 and 5 potentially have low to high risk interaction with surface and undermining associated with the Arnot mining operation. The extent of this interaction is believed to be limited within the extent of the route traversing the Arnot mine lease area.
- In addition to above Route 3 may have low to high risk interaction with undermining associated the Glisa mining operation. The extent of this interaction is believed to be limited within the extent of the route traversing the Glisa mine lease area.
- In addition to above Route 1 may have low risk interaction with open cast mining associated with the Strathrea opencast mining operation, should future mining be planned to extend in a southerly direction. The extent of this interaction is believed to be limited within the extent of the route traversing the respective mine lease area.
- In addition to above Route 5 may have low to high risk interaction with opencast mining associated with the unidentified mining operation found approximately 14km along the route from the Arnot substation.

5.3 Further detail investigation required

The investigation summarised in this report was completed to gain a general overview of the site only and forms Stage 1 of the investigation process. The following additional work is recommended:

- Obtain the general information from the relevant mining operators and future operators to confirm the exact zones of potential interaction between the mining activities and the proposed routes. This information can be evaluated and summarised in an update to this interim Stage 1 report.
- Further desk study will be required to identify details of the undermining at the identified interaction zones. This will aid in identifying high risk areas requiring further detail analysis.
- Further desk study to review available geological information in the vicinity of the delineated interaction areas to confirm and assess geotechnical stability.
- Where deemed required, further intrusive investigation to determine the geotechnical parameters relevant to the specific location and design of the powerline structures and infrastructure once such details are more fully known.
- From the above work final risk ratings, monitoring and mitigation measures can be formulated as part of a Stage 2 detailed assessment.

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Reviewed by



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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

6 Selected Bibliography

Brink A.B.A., (1979). *Engineering Geology of Southern Africa. Volume 3: The Karoo Sequence*, Chapter 7-8, pp 177-233.

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