

Arnot to Gumeni High Voltage Lines-Stage 1-Undermining study (Interim Report)

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Executive Summary

This report contains the interim results of a Stage 1 desktop investigation carried out for the proposed high voltage line routes between the Arnot and Gumedi Substations, located in Mpumalanga Province.

The Stage 1 desk study scope broadly involved identifying historic, existing and planned mining operations along the proposed routes. This required obtaining the necessary freely available information on the nature of the workings as well as freely available information on the geology of the area and/or any other relevant info that would assist forming an understanding of potential interactions between mining and the proposed powerline routes.

Limited information could be obtained from the relevant mines due to concern regarding intellectual property. SRK is however confident that this information will be released in future stages of the study. The following was concluded from the information that was freely available for review:

- 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.
- 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.

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. Additional work recommended includes:

- Obtaining the information held by 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 necessary, 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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Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa)(Pty) Ltd (SRK) by Baagi Environmental Consultancy. The opinions in this Report are provided in response to a specific request from Baagi Environmental Consultancy to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

1 Introduction and Scope of Report

SRK Consulting (SRK) was appointed by Baagi Environmental Consultancy to carry out a study to determine the interaction between proposed high voltage overhead power lines and existing and planned mining activities coinciding with the proposed power line routes.

This report provides the interim results for the initial desktop part of the study (Stage 1). The recommended requirements for a more detailed Stage 2 investigation are also provided within this report. SRK can provide a proposal in order to complete the Stage 2 work if so required by the client.

2 Scope of Work

Terms of Reference as provided by the client

The following Terms of Reference were provided by Baagi Environmental Consultants in an email dated 25 August 2012.

The “geophysics impact assessment” will cover the following key aspects:

- A. Description of current mining operations within the study area. This must outline important characteristics and components thereof, which may be influenced by the proposed transmission line, or which may influence the proposed transmission line during construction and operation.
- B. Determine the extent of the undermining (from mining maps) workings as accurately as possible at estimated tower positions i.e. tunnel depths, widths and heights, pillar sizes and spacing's.
- C. Determine the underlying geology and characteristics thereof with respect to the influences of mining in it. Determine from Logs of the mine bore holes describing layering, sampling, water inflows etc.
- D. Determine if pillar extraction could be in the future plans of the mining operators.
- E. Identify possible burning zones (from previous burnings and similar coal grades) and the long-time probability of burning (self-combustion to coal grade).
- F. Mining engineering programs (CSIR-Miningtek) should be used to determine estimated tunnel roof weathering collapses, overburden depths and safety factors.
- G. Determine/estimate the probability of ground surface settlements looking at settlements of nearby mines.
- H. The identification of the potential impacts (positive or negative, including cumulative impacts, if relevant) of the proposed transmission line on mining during construction, operation and decommissioning. This aspect of study must identify the sensitive “no go” areas and should also include an analysis of construction constraints associated with the areas.
- I. The identification of mitigation measures for enhancing benefits and avoiding or mitigating negative impacts and risks (to be implemented during design, construction and operation of the transmission line).
- J. The formulation of a simple system to monitor impacts and their management based on key indicators.
- K. The specialist will be required to adhere and comply with the NEMA regulations as well as provincial and national authorities' policies, such as the Mpumalanga Conservation Plan.

- L. The specialist will be required to attend two integration meetings and where necessary the specialists will be requested to attend public participation meetings.
- M. The specialist should highlight assumptions, exclusions, gaps in knowledge and key uncertainties.

SRK proposed to split the study into two stages. Stage 1 would comprise a desk study and broadly address Items A to D above. At the completion of Stage 1, the general nature and scale of the mining operations would be known and it will then be possible to provide a detailed scope, programme and cost for Stage 2 of the study which would broadly address items E to M above. As mentioned this report covers only the Stage 1 scope.

Stage 1 Desk Study Scope of work

The Stage 1 desk study scope broadly address items A to D above and involved the following:

- Identify historic, existing and planned mining operations along the proposed routes,
- Obtain the necessary freely available information on the nature of the workings.
- Obtain freely available information on the geology of the area and/or any other relevant info that would assist in covering items A to D in the clients scope of work.

Deliverables include the desk study report, together with plans, and where appropriate cross sections, of the alternative routes identifying the geology and the general nature of historic, existing and planned mining operations. The report and drawings will identify areas where the route alternatives intersect mining operations, where further investigation is necessary to identify the potential impact of the mining operations on the transmission lines and conversely the transmission lines on the mining operations.

Stage 2 Further Studies

This stage will aim to fulfil the full requirements of the study as proposed by the client, and will broadly concentrate on Items E to M above. Where possible additional details in relation to Items A to D will also be gathered.

The detailed scope and programme will be informed by the findings of Stage 1. It is anticipated that this stage may involve further desk study, site inspections and possibly fieldwork such as geophysical surveys or exploratory holes.

3 Available Information

The following data and literature was freely available and consulted and assessed as part of this desk top evaluation:

- Shape files of the project plan identifying route alternatives 1, 3 and 5 forming part of the final study area as received from the client on 15 October 2012;
- South Africa 1:500 000 scale Geological series map;
- South Africa 1:500 000 scale Hydrogeological series map;
- South Africa 1:50 000 Topographic data from map sheet numbers: 2529DB, 2530CA, 2529DD, 2530CC;
- Google Earth;
- Brink A.B.A., (1979). *Engineering Geology of Southern Africa. Volume 1: The first 2000 million years of geological*, Chapter 8-10.

- Brink A.B.A., (1979). *Engineering Geology of Southern Africa. Volume 3: The Karoo Sequence*, Chapter 1-8.
- List of operational mines as provided by DMR

4 Desk Top Review

4.1 General Route Description

The alternative routes have been evaluated in Google Earth to form a general understanding of the study area. Long sections created in Google Earth of these routes are shown in Figure 4-1 below.

4.1.1 Route 1

Proposed Route 1 exits the Arnot substation site and then runs south around Rietkuil before turning to follow an easterly to north easterly direction towards the Gumeni substation site. The route is approximately 56.8km in length. From long sections generated in Google Earth and evaluation of the available information the first half of the route gently undulates and climbs and drops between 1614mamsl to 1736mamsl in the first 25km of the route. The last section of the route traverses via relatively steep secondary river valleys compared to the first portion of the route, before reaching the Gumeni site.

According to Google Earth satellite imagery the predominant land use along this route is that of maize and cattle farming.

The general locality, topography and geology covering the study area related to the alternative routes are provided in Figures 4-2 to 4-5 below.

4.1.2 Route 3

Proposed Route 3 is approximately 59.7km in length and exits the Arnot substation site in a northerly direction for approximately 3km before turning into a north north east direction towards the N4 highway. Route 3 joins the N4 highway approximately 12.3km from Arnot substation and then runs parallel to this feature up to 52.5km along the route before veering off in a south easterly direction towards the Gumeni substations site. From long sections generated in Google Earth and evaluation of the available information the route traverses terrain that is gently undulating but increasing in elevation from about 1662mamsl to 1950mamsl in the first 45km. In the last 10km of the route some steep drops and climbs are noted where the route traverses secondary river valleys before reaching the Gumeni site.

According to Google Earth satellite imagery the predominant land use along this route is that of maize and cattle farming.

The general locality, topography and geology covering the study area related to the alternative routes are provided in Figures 4-2 to 4-5 below.

4.1.3 Route 5

Proposed Route 5 is approximately 52.6km in length and exits the Arnot substation site's north eastern most corner traversing in a generally north easterly direction towards Gumeni. The last 14km closely coincide with Route 1. . From long sections generated in Google Earth and evaluation of the available information Route 5 and Route 1 traverse very similar terrain (Figure 4-1 refers).

According to Google Earth satellite imagery the predominant land use along this route is that of maize and cattle farming. The general locality, topography and geology covering the study area related to the alternative routes are provided in Figures 4-2 to 4-5 below.

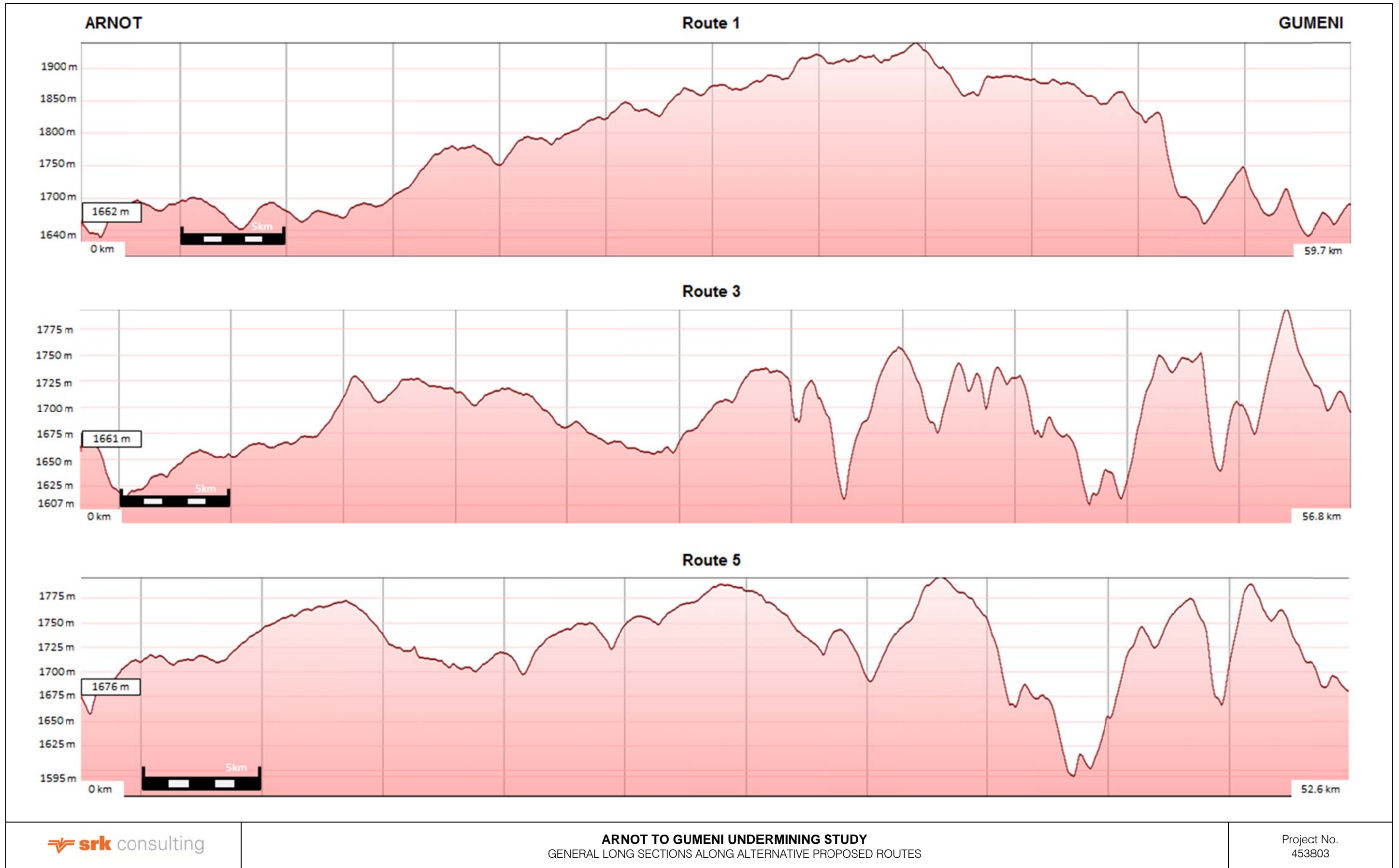
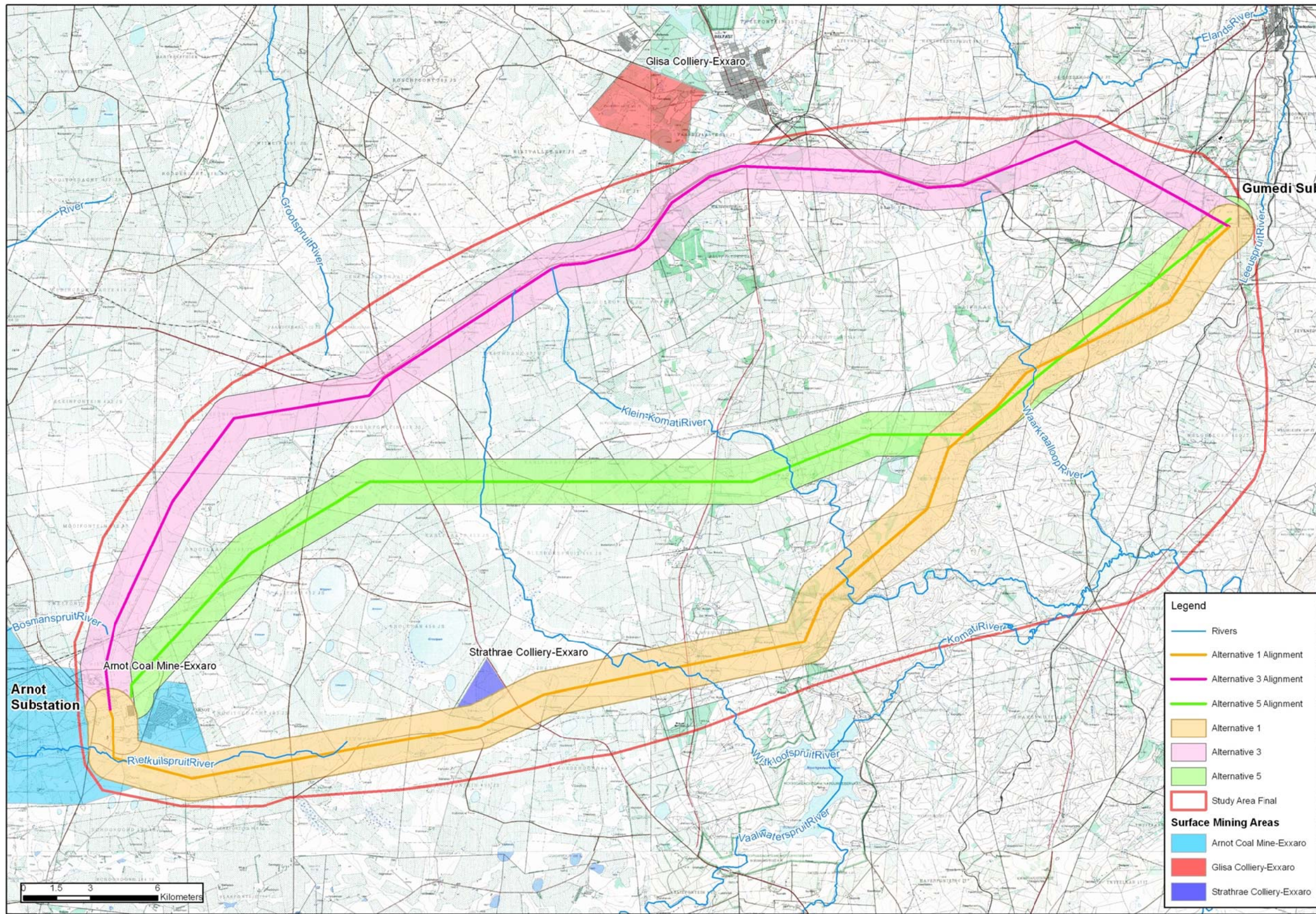


Figure 4-1 Long sections from Google earth showing rise and fall along various alternative routes



Legend

- Rivers
- Alternative 1 Alignment
- Alternative 3 Alignment
- Alternative 5 Alignment
- Alternative 1
- Alternative 3
- Alternative 5
- Study Area Final

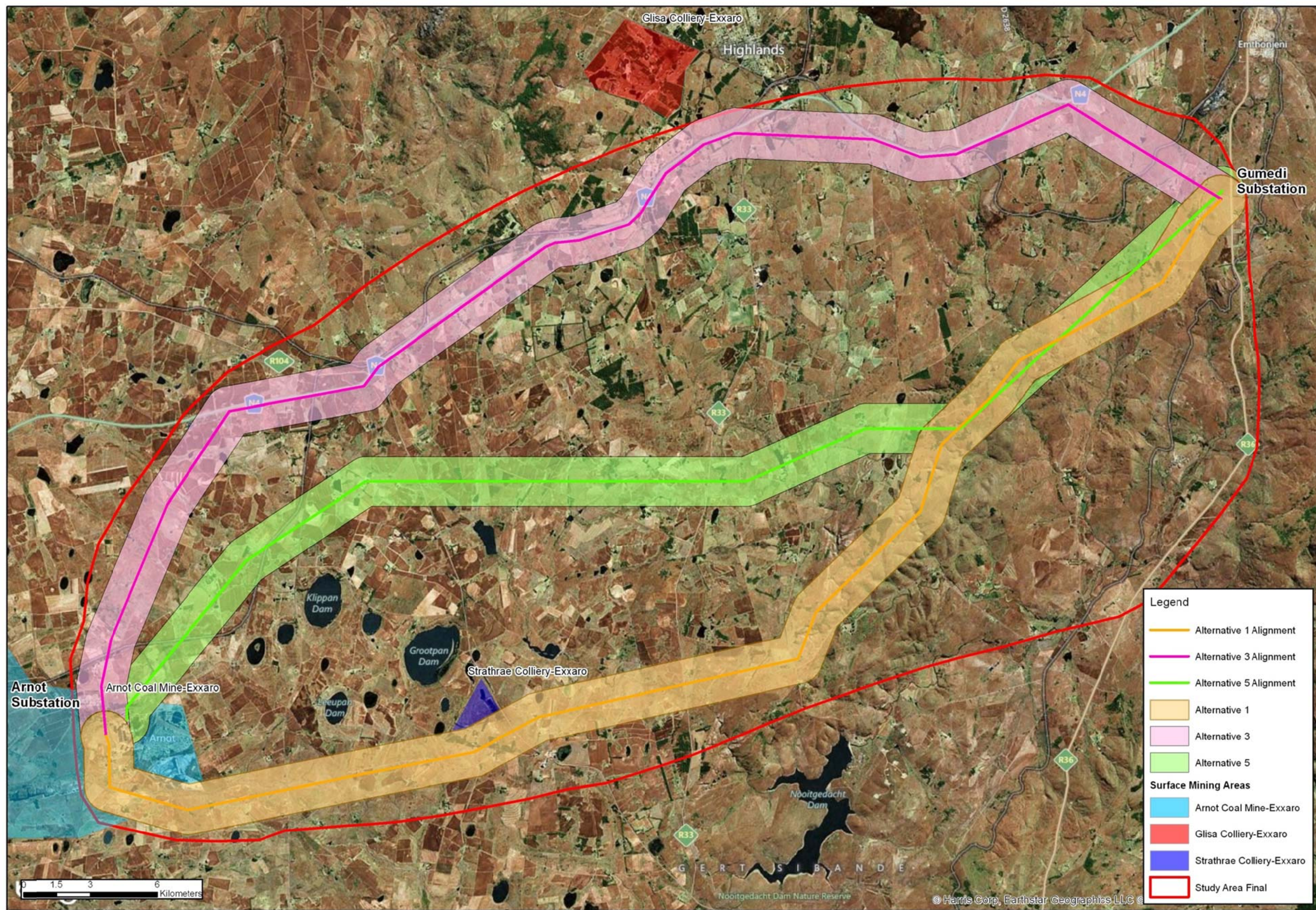
Surface Mining Areas

- Arnot Coal Mine-Exxaro
- Glisa Colliery-Exxaro
- Strathrae Colliery-Exxaro

Data Source:	
Scale: 1:170,000	
Projection: HH94	Datum: WGS84
Central Meridian Zone:	
Date:	Compiled by:
16/10/2012	ALLK
Project No: 453803	Fig No: 4-2
Revision: B Date: 07/11/2012	



ARNOT TO GUMENI POWERLINES UNDERMINING STUDY
 TOPOGRAPHIC MAP SHOWING THE LOCALITY OF THE PROPOSED ALTERNATIVE POWERLINE ROUTES



Legend

- Alternative 1 Alignment
- Alternative 3 Alignment
- Alternative 5 Alignment
- Alternative 1
- Alternative 3
- Alternative 5

Surface Mining Areas

- Arnot Coal Mine-Exxaro
- Glisa Colliery-Exxaro
- Strathrae Colliery-Exxaro
- Study Area Final

Data Source:	
Scale: 1:170,000	
Projection: HH94	Datum: WGS84
Central Meridian/Zone:	
Date:	Compiled by:
16/10/2012	ALLK
Project No: 453803	Fig No: 4-3
Revision: A Date: 07 11 2012	



ARNOT TO GUMENI POWERLINES UNDERMINING STUDY
AERIAL PHOTOGRAPH SHOWING THE LOCALITY OF THE PROPOSED ALTERNATIVE POWERLINE ROUTES