Substation

BRAAMHOEK TRANSMISSION INTEGRATION EIA

BRAAMHOEK SUBSTATION

SCOPING REPORT

DRAFT FOR PUBLIC COMMENT

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1. INTRODUCTION

In December 2002, the Department of Environment Affairs and Tourism (DEAT) awarded Eskom environmental authorisation for the construction of the Braamhoek Pumped Storage Scheme in the Drakensberg on the provincial border between the Free State and Kwa-Zulu Natal. A condition (no. 6.2.37) of the authorisation is that Eskom undertakes "a comprehensive Environmental Impact Assessment for all access roads and power lines that connects the scheme to the national transmission grid".

Eskom Transmission is tasked with connecting the scheme to the National Grid, and has assumed responsibility for the EIA for the power lines. The extent of the development to effect this connection includes:

- The construction of a 400kV Transmission Substation, to be called the Braamhoek Substation, near the scheme,
- Provide an initial connection to the National Grid via a 'turn-in' from the nearby Majuba-Venus #2 400kV Transmission line,
- Ensure the reliability of the network by linking Braamhoek Substation directly to the Venus Substation near Estcourt with a new 400kV Transmission line.

Location information and co-ordinates for all the main locations in this report are given in Appendix 1.

Following a Pre-feasibility Study completed in October 2004, applications for permission to undertake Environmental Impact Assessments (EIAs) were submitted to the Department of Environment Affairs and Tourism (DEAT) in November 2004. DEAT approval was granted for detailed Scoping Studies for each of the projects, and this report presents the findings of the Scoping Study for the Braamhoek Substation. Separate reports are published for each of the three projects, but these need to be read in conjunction with the Public Participation Process report that covers all three projects.

A suite of reports are published in support of the Braamhoek Transmission Integration EIA:

- Braamhoek-Venus 400kV Line – Draft Scoping Report
- Braamhoek Turn-in – Draft Scoping Report
- Braamhoek Substation – Draft Scoping Report *(This report)*
- Appendix A – Public Participation Process *(to be read in conjunction with all of the above)*

2. STUDY BACKGROUND

2.1. BRAAMHOEK PUMPED STORAGE SCHEME

Towards meeting predicted future electricity demand, Eskom is implementing its Integrated Electricity Plan (IEP) that considers combination of initiatives including:

- Demand side management – implementing energy saving measures and encouraging non-peak load use where possible in domestic, commercial and industrial sectors.
- Increasing base-load capacity - bringing previously mothballed power stations back into operation and the development of new base-load (= continuous load) power stations (hydro-power, coal and gas fired, nuclear power).
- Increasing peaking capacity – provision of generation capacity that can be 'turned-on and switched-off' at short notice to meet daily peak loads. These include combined-cycle gas turbines and pumped storage hydro schemes, such as the Braamhoek Pumped Storage Scheme (PSS).

It is understood that over the last two decades Eskom has investigated close to 90 possible pumped storage scheme sites across the country, including over 20 in Kwa-Zulu Natal. Between 1989 and 1995 a shortlist of sites was drawn up, including the Braamhoek PSS site. It was subsequently selected for implementation and an EIA was undertaken. Depending on peak demand capacity requirements, other sites may also be identified for development in the future. As mentioned above, environmental authorisation and Record of Decision (RoD) for the Braamhoek PSS was issued in December 2002.

It is clearly necessary for the Braamhoek PSS to be connected to the National Grid, and as such the 'need and desirability' of the three Transmission projects associated with the Braamhoek PSS is not questioned further. It has been noted during the public consultation process on this study that there has been considerable debate surrounding the Braamhoek PSS. **It is important to note here, therefore, that it is not within the focus of this EIA to question the need for the Braamhoek PSS nor its environmental authorisation**.

Instead, it is necessary to review the manner in which the Braamhoek will be connected to the National Grid, and the following sections set out the Transmission project proposals, and a Pre-feasibility study that was undertaken.

2.2. TIMEFRAMES

Based on the latest growth predictions, it is expected that power from Braamhoek PSS will be required by 2012. It is expected that the first unit of the scheme will be commissioned in 2011. The next three units will be commissioned every three months thereafter, with the last unit being commissioned in 2012. In order to meet this commissioning date, the design of the scheme commenced in 2004 and construction must begin in 2007.

The given timeframe for starting the construction of the Transmission infrastructure is 2007.

2.3. TRANSMISSION PROJECT PROPOSALS

The new power station will require two connections to the National Grid to provide the necessary reliability of supply. The three main elements required to achieve this are:

a) A new substation at the power station site = the Braamhoek Substation
b) Two independent links to the Transmission network (=National Grid). These could either be achieved by 'turn-ins' from existing lines, or by new lines connecting to nearby Transmission substations.

Appendix 3 of the *Braamhoek-Venus 400kV Line – Draft Scoping Report* presents an Eskom statement on the need for the 400kV Transmission lines to the National Grid. Two options for connecting to the grid are proposed, and these became the focus of a pre-feasibility study prior to the start of this EIA (see next section). It is understood that Eskom considered some 20 different options before arriving at the two preferred options. These included different combinations of turn-ins and new lines within the existing Transmission Grid shown below.

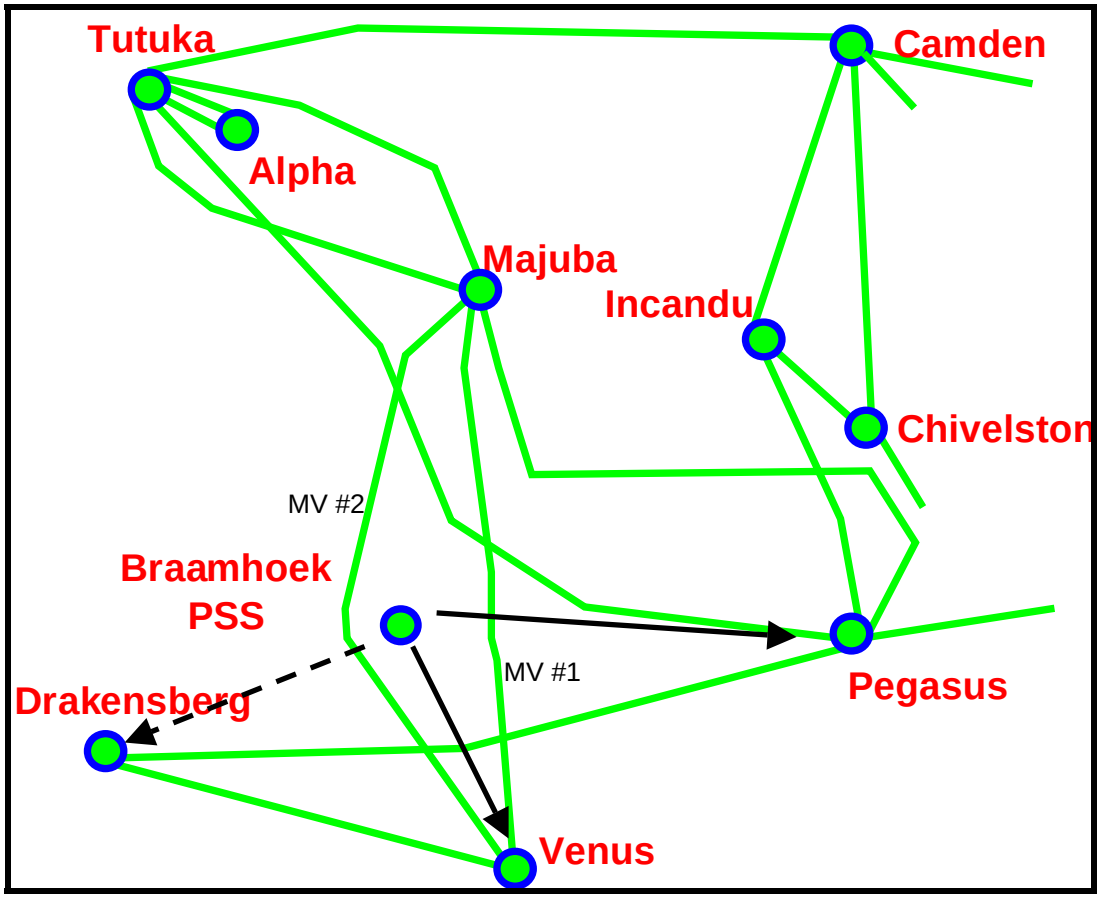

Figure 1: Location of Braamhoek PSS within the Transmission Grid

The two nearest 400kV Transmission lines that may be turned in to the Braamhoek substation are the Majuba-Venus #1 and Majuba-Venus #2 lines (MV #1 and MV #2 lines in Figure 1). The nearest point to the MV #1 line is 25km, while MV#2 is some 10km from Braamhoek. For

reasons of network stability only one of these may be considered for turning in to Braamhoek, and the shorter of the two has clear preference in this instance.

There are also three Transmission substations to connect to; Drakensberg, Venus and Pegasus, and are each a similar distance from Braamhoek at around 80km. However, Drakensberg Substation will require a substantial upgrade, making it considerably more expensive than the other two. Technical analysis of Venus and Pegasus showed both to have very similar electrical performance, and it was left to environmental considerations to determine which would be the preferred option. As a result, Eskom commissioned a pre-feasibility study on these two options prior to the start of the EIA, the outcome of which is summarised in the *Draft Scoping Report: Braamhoek-Venus 400kV Transmission Line*.

3. TECHNICAL DETAILS OF THE PROPOSED SUBSTATION

The typical substation size and equipment includes the following:

- New station, transformers, reactors, etc.
- No PCBs[1], but cooling oils still needed for equipment
- Max height of infrastructure expected at 45m
- The substation area will be 400 x 400m, though the actual footprint of the constructed area is understood to be approx. 320 x 160m
- Located close to tunnel outlet
- Connected to National Grid via 400kV Turn-in from Majuba-Venus#2 (ie two new 400kV lines from the existing line)
- Plus a 2nd 400kV connection direct to Venus (Estcourt), this being necessary to ensure the required reliability of supplyAn important aspect of the proposed Braamhoek Substation is that it will be constructed on a working platform created during the power station tunnel construction. Spoil and waste rock material will result from the tunnelling process. It is intended that some of the suitable material will be used for the surfacing of the access roads and the rest will be used for creating a terraced working platform for the power station construction. This platform will be located near the access tunnel and exploratory tunnel portals and will be used as a construction camp and storage area for the power station construction. Once this phase is complete, the substation will be constructed on this platform, thereby causing minimal additional damage to the local area.

[1] PCB = Poly Chloro Biphenyl – a chemical substance formerly used in transformer cooling oils, but now known to have carcinogenic properties and banned on use in new installations under the Basl Convention.

Figure 3: Example of similar substation type (Pegasus Substation, Dundee)

4. PROPOSED STUDY APPROACH

Due to the unusual circumstances pertaining to these projects, in particular the existing servitudes along the Majuba-Venus #1 and #2 400kV Transmission lines, and the location of the Braamhoek substation on ground that will have already been disturbed and used during the construction of the power station, it was considered reasonable to undertake a detailed Scoping Study for each of the three projects in the study. The Pre-feasibility Study Report was submitted to DEAT and the DAEA-KZN at the Pre-application Meeting and it was agreed to proceed on this basis. The application forms and Plan of Study were therefore prepared and submitted describing this approach, and these were approved by DEAT and the DAEA-KZN.

4.1. BRAAMHOEK SUBSTATION

The anticipated environmental impact of the substation is expected to be much lower than is usually associated with substations of this size. Braamhoek Substation will be one element of the Braamhoek PSS development and the wider site area has already been committed to the construction of the PSS. Eskom is the landowner of the site. The substation itself is expected to utilise a working platform prepared for the construction of the access tunnels.

Three possible substation sites have been identified by Eskom, though it is understood only one will allow the use of the working platform described above. This site is located near the tunnel portals on the farm Zaaifontein and will require no overhead cabling from the tunnel portal to the substation (other two sites are on the farm Bramhoek). This is the preferred site

and will be given the greater focus in the Scoping Study. Other sites were inspected, and the findings are presented in Section 6.

4.2. PUBLIC PARTICIPATION

A comprehensive public participation programme has been undertaken in this study. It has been structured to encompass all four projects (including the access roads EIA) that are related to the Braamhoek P.S.S. this was thought to be a better process from the public's perspective in that they would not have to participate in two or more consultation programmes and that all issues raised could be collated into one report. Thus a separate report on the public participation process is published in support of this Scoping Report on the Braamhoek Substation. This is entitled *Appendix A – Public Participation Process*.

5. DESCRIPTION OF THE STUDY AREA

The site is located at the base of the Drakensberg escarpment some 40km northwest of Ladysmith in Kwa-Zulu Natal, and some 23km east-north-east of Van Reenen in the Free State. The Braamhoek P.S.S. itself straddles the provincial border between Kwa-Zulu Natal and the Free State, but the proposed Braamhoek Substation will be in Kwa-Zulu Natal.

Three possible sites have been selected by Eskom. These are shown in Appendix 1 and general site data is also given in Appendix 1.

The environment is best summarised as grasslands with wooded gulleys along the mountain streams (see Photo1 and 3 in Appendix 3). The landuse is primarily extensive grazing on what is classified as Moist Highland Grassveld. The grasslands are no longer seen to be in a pristine state as past landuse has resulted in some alien invader species spreading in the area. In particular, stands of wattle have spread along many of the gulleys and streams. However, important plant species may occur there and at least one Red Data specie (*Kniphofia flammula*) and six priority medicinal plants are listed for the area (see Ecology Report, Appendix 6). In all cases the plants are relocatable, and negative impacts can be minimised or avoided.

Habitat for fauna that may be affected by the substation has been impacted by past landuse, but particular species that are reported for the area include Dobson's rough haired golden mole, the Natal leaf-folding frog, the long-toed tree frog and the Natal midlands dwarf chameleon (see specialist report in Appendix 6). Three Red Data butterfly species are also reported for this type of habitat, but likelihood of occurrence at any of the three proposed substation sites is expected to be low.

The area is sparsely populated, with small clusters of homesteads located along the contour at the base of the escarpment. Eskom is the landowner, and it is understood that as part of the development of the P.S.S. all the homesteads in this area will be part of a relocation programme to other parts of the farm.

The scenic quality of the sites and surrounding area is considered to be high. The diverse topography and in particular the massive backdrop of the Drakensberg Mountains, along with the very limited human intrusion, provides a scenery of high visual interest (see specialist report in Appendix 5).

The environment described above does not take into account the planned Braamhoek P.S.S. development and the resulting changes to the environment. Many of the environmental aspects will be altered by the construction and operation of the P.S.S., and as far as possible the assessment of the impact of the substation has tried to take the likely changes into account.

6. DISCUSSION ON ALTERNATIVES

6.1. STRATEGIC ALTERNATIVES

Given the approved location of the Braamhoek P.S.S. there is no strategic alternative available to placing a substation at the P.S.S. site at the base of the escarpment. Strategic alternatives were therefore not considered further.

6.2. LOCAL ALTERNATIVES

Three local alternatives were identified as shown on the map in Appendix 1. Two of the sites are on the Farm Bramhoek, while the eastern most site is situated on the Farm Zaaifontein. In most aspects the impacts are very similar between the environmental issues. The two main differences are:

- The eastern most substation site has two abandoned homesteads and eight ancestral graves within the footprint. The latter have high environmental significance, but are not seen to be a fatal flaw (or 'no go') on this option (See Section 7).
- The eastern most site is also the proposed location of the construction camp and/or construction working platform for the construction of the access tunnels to the P.S.S. infrastructure that will be placed within the mountain.

The second point has significant bearing on the selection of the preferred substation site as it removes much of the environmental impact that would take place if the substation were constructed on the greenfield site as it stands at present, including the impact on the homesteads and graves. This is because the working platform for the tunnel construction will form the foundation of the substation.

The eastern (Zaaifontein) site is therefore the preferred substation location as selection of either of the other two sites will increase the net impact of the overall Braamhoek P.S.S. development.

7. IMPACT ASSESSMENT

The detail of the impact assessment is given in the Impact Tables in Appendix 2. This section presents a summary of the Impact Tables and address certain key aspects that may have arisen during the public consultation process.

7.1. SUMMARY OF IMPACTS

The summary below is derived from the Impact Tables in Appendix 2.

ISSUE	DETAILS	PHASE OF CONCERN	POTENTIAL SIGNIFICANCE OF IMPACT	
			Before Mitigation	After Mitigation
1. ECONOMIC				
1.1 National and Provincial Impact	National and provincial importance of project in terms of promoting economic growth in the region and South Africa	Operation	High (positive)	High (positive)
1.2 Local Benefits	Economic benefits that the Substation will bring to local communities	Construction & operation	Low to Moderate (positive)	Moderate (positive)
1.3 Job Creation	Employment of local labour (South African citizens and people local to the area) and preference given to a local contractor	Construction & operation	Low to Moderate (positive)	Moderate (positive)
1.4 Tourism	The substation will detract from the aesthetic appeal of the natural environment, and will therefore negatively impact on tourism activities	Operation	Low	Low
2. WELL BEING:				
2.1 Electro-magnetic fields	Impact of electromagnetic fields (EMFs) on animals, people and vegetation	Operation	Low	Low
2.2 Dust & Noise (within plant area)	Dust & noise control during construction	Construction	negligible	negligible
2.3 Corona noise	The effect of the corona (low "buzzing" noise) may be noticeable in properties immediately adjacent to the substation.	Operation	negligible	negligible
2.4 Fire hazard	The construction and operation of the line may alter the occurrence and management of fires in the area. The change in the nature of fire hazards and events can have safety, economic and ecological implications.	Operation & Construction	Low	Low
3. AESTHETICS:				
3.1 Visual impact	Visual impacts will be significant in the local area	Operation	Moderate to low	Moderate to low
3.2 Sense of Place	Negative impact on the spiritual, aesthetic and therapeutic qualities associated with the area in the vicinity of the substation	Operation	Moderate to low	Moderate to low

ISSUE	DETAILS	PHASE OF CONCERN	POTENTIAL SIGNIFICANCE OF IMPACT	
			Before Mitigation	After Mitigation
4. SOCIAL:				
4.1 Relocation of people	Will there be a need to relocate people, and their property/houses? What are the likely impacts? Will they be compensated?	Construction	None	None
4.2 Disruption of social networks and daily movement patterns	The social routine and social networks may be disrupted during the construction process.	Construction	None	None
4.3 Location of construction camps	The siting of construction camps	Construction	None	None
4.4 Gravesites	Protection of gravesites, disinternment of graves	Construction	**High**	Low
4.5 Traffic Safety	Road traffic safety, particularly relating to construction traffic.	Construction	Low	Low
5. LAND ISSUES				
	No relevant issues			
6.FARMING RELATED ISSUES				
6.1 Access to properties and access roads	This is the subject of a separate EIA			
6.2 Loss of agricultural potential	Restrictions on landuse and activities will impact on the agricultural potential of the land.	Construction & Operation	Low	Low
7. NATURAL ENVIRONMENT:				
7.1 Impact on fauna & flora	Impacts on the natural fauna and flora in the area	Construction & Operation	negligible	negligible
7.2 Impact of herbicides	Herbicides will be used during the construction and operation phases of the project to clear and potentially manage the line.	Operation	Potentially high	Low
7.3 Pollution of the watercourse	Oil spillage within the servitude may discharge into the watercourse.	Operation	Potentially high	Moderate to Low
8. CULTURAL AND ARCHAEOLOGICAL SITES				
8.1 Palae-ontological Sites	Impact on fossils.	Construction	negligible	Negligible
8.2 Archaeology	Abandoned homesteads.	Construction	Low	Low
8.3 Cultural, Historical and National Heritage Sites	Rock art features	Construction	Low	Low

8. RECOMMENDATIONS

A number of recommendations are set out in this report, particularly in the Impact Tables in Appendix 2, and these are considered relevant to the future implementation of the project. However, a number of general recommendations are made here.

- It is recommended that Eskom identifies the living relatives of the graves at the site as soon as possible such that the process of grave relocation may start. The timeframes for these procedures can sometime be fairly long.
- Construction camps for the substation should be combined with the construction camps for the Braamhoek P.S.S. and Braamhoek Turn-ins.
- Relocation of dwellings and homesteads are expected to be few, if any within the context of this project, but if so a formal relocation programme should be drafted and implemented. Clear documentation of agreements with owners and relocation activities should be available.
- The construction programme should set out anticipated rehabilitation activities and timing. Emergency rehabilitation measures should also be identified (eg for spillage containment, erosion, plant damage, etc.).
- It is important that Eskom appoints a full time Environmental Control Officer (ECO) for the construction planning and construction phase. This ECO will be able to initiate specialist surveys in the design phase (archaeology and ecology) and will be responsible for drafting a detailed Environmental Management Plan.
- In support of this, it is recommended that the Department of Agriculture and Environmental Affairs – Kwa-Zulu Natal monitor the construction planning and the construction programme.

9. CONCLUDING REMARKS

Given the location of the proposed substation within the area of the larger Braamhoek P.S.S., there are no particular concerns with the eastern site location. Hence, pending any comments from the public on this Draft Scoping Report. It is expected to recommend the preferred site identified in Appendix 1 at the access tunnel portals. This option is seen to offer the least impact on the environment.

APPENDIX 1: MAPS AND LOCATION DATA

BRAAMHOEK P.S.S. - Transmission Integration

General Data Sheet

	Lat.	Long.	
Braamhoek P.S.S.	28° 19'S	29° 35'E.	Farms Braamhoek 1220, Bedford 1845
Braamhoek Sub.1	28° 16.69'S	29° 35.35'E.	Farm Zaaifontein 1070
Braamhoek Sub.2	28° 16.85'S	29° 34.52'E.	Farm Braamhoek 1220
Braamhoek Sub.3	28° 16.60'S	29° 34.18'E.	Farm Braamhoek 1220
Venus Substation	28° 56.28'S	29° 50.74'E.	

The direct distance between Braamhoek and Venus is 79km.

Month	Monthly rain (mm)		Daily Mean Temp (deg C)		Relative Humidity (%)	
	Nr Braamhoek	Nr Venus	Nr Braamhoek	Nr Venus	Nr Braamhoek	Nr Venus
Jan	158	121	20	22	64	68
Feb	141	101	20	22	66	68
Mar	109	95	18	20	66	68
Apr	47	41	16	18	62	66
May	22	20	12	14	58	62
Jun	12	11	10	12	56	60
Jul	12	11	10	12	54	58
Aug	21	21	12	14	54	58
Sep	45	43	14	16	58	62
Oct	84	68	16	18	60	64
Nov	118	102	18	20	64	66
Dec	131	116	20	22	64	68
MAP	900	750				

Frost:	Duration of frost risk period	120 days	mid May-mid August
	Days below zero degrees Centigrade	30 - 40	(average)
Hail risk:	(Average)	5 - 7 days/an	
	High risk area = Spionkop / Winterton	+ 7 days/an	

Snow: The northern sections of the study area regularly (annually) experience snow, and snow loading on the lines will need to be considered in the design. Snow does occur in other areas (particularly western parts of the study area), but the snow is seldom as heavy and is less frequent (estimated once every three to five years on average).

Fire risk: The grassland areas are high-risk fire areas, particularly in the northern and western parts of the study area. Fire management of the veld is a common practice, and co-ordinated burning programmes are in operation within the different Farmers Associations.

Lightning: Lightning ground-flash density is among the highest in the country in this area. Average ground-flash densities of 8 - 9 flashes/km^2/annum are reported for much of the area, though in the western areas these go up to an estimated 10 - 12 flashes/km^2/annum.

Soils:	Western & northern areas	moderate to deep clays (moderate erodability)
	Eastern & southern areas	moderate to deep clay loams (moderate to high erodability)

Slopes: In general, the terrain is described as undulating, though with particularly steep areas in the middle of the study area, along the main river valleys (Tugela, Klip & Bloukrans) and in the northern sections.

Erosion: Erosion is more evident in the eastern areas, but areas of erosion occur in places in much of the study area

APPENDIX 2: IMPACT TABLES

APPENDIX 3: PHOTOGRAPHS

APPENDIX 4: SOCIO-ECONOMIC ASSESSMENT REPORT

APPENDIX 5: VISUAL IMPACT ASSESSMENT REPORT

APPENDIX 6: ECOLOGICAL IMPACT ASSESSMENT REPORT