Eskom	Standard	Technology

Title: **GEOTECHNICAL DESKTOP STUDY REPORT FOR KOMATI POWERSTATION**

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1. Introduction

A desktop study is required as a pre-feasibility investigation, so that the consultant/contractors appointed to carry out a geotechnical investigation may efficiently choose suitable sites for a preliminary geotechnical investigation. It is also used to plan and develop the necessary investigation methods required to obtain parameters that can be used to choose a final site to be developed and also during the design and construction phase of a Substation related project.

Eskom supports a diversified and balanced energy mix, with renewables forming an integral part of this diversified energy mix. Eskom therefore aspires to expand its renewables portfolio through Battery storage, Wind turbines and PV systems at Eskom owned power stations and selected greenfield sites.

The proposed Solar PV plant, Battery Storages and Wind turbines for Komati Power Station is located within the boundary of Eskom-owned land. The area is in Mpumalanga province between Middleburg and Bethal. The area is 1623 m above the sea level. Suitable areas for renewable energy project was identified considering the wetlands, ash dams, existing underground and above ground services (electrical cables and overhead lines). The site is generally flat and partially identified as suitable for the installation of a Solar PV plants, Battery storages and Wind turbines.

2. Supporting clauses

2.1 Scope

The desktop study covers a short description of the site, its topographical features, vegetation that is on the site, Climate considerations in relation to the Weinert N-value, seismic assessment of the site, geological information and geotechnical constraints on the proposed site. The information can be obtained from perusal of available maps, relevant literature and information obtained from site walkover surveys.

2.1.1 Purpose

The purpose of this document is to record all necessary and required information used to choose a suitable site/s and plan a geotechnical investigation efficiently for Substation development related projects.

2.1.2 Applicability

This document shall apply to the Substation Engineering Department in Transmission Technology.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] ISO 9001 Quality Management Systems.

[2] TMH1:1979. Standard methods of testing road construction materials.

[3] SAICE Site Investigation Code of Practice

[4] SAICE Code of practice for the safety of persons working in small diameter Shafts and test pits for Civil Engineering Purposes.

[5] SAIEG Guidelines for Soils and Rock profiling in South Africa.

[6] SANS 1936 Part 1 – 5. Development on Dolomite Land.

[7] SANS 10160: Basis of structural design and actions for buildings; Part 5: Basis for geotechnical design and actions.

[8] SANS 10160-4:2011: Seismic actions and general requirements for buildings

2.2.2 Informative

[1] Brink A.B.A. (1979) Engineering Geology of Southern Africa. Volume 1 – 4. Building Publications, Pretoria.

[2] 1:250 000 Geological Series 2628 EAST RAND Map

2.3 Definitions

2.3.1 General

Definition	Description
Weinert N-value	Climatic descriptor with respect to the weatherability of rocks

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
SANS	South African National Standards
SAICE	South African Institution of Civil Engineering

2.5 Roles and responsibilities

The appointed Technician/Technologist/Engineer shall ensure that this document is compiled using the standards noted in this document or any other approved appropriate form of literature and shall also ensure that the document is issued with all required associated documentation.

2.6 Process for monitoring

Not applicable.

2.7 Related/supporting documents

Not applicable.

3. Geotechnical Investigation Desktop Study Information

3.1 INTRODUCTION

The main aim of the investigation is to conduct a desk study for the proposed site to evaluate if the site is suitable for a proposed substation development.

For the evaluation of the proposed site during the desk study, factors such as the geology, vegetation, topography and drainage were considered. Information collected during this investigation is suitable for the site selection and verification purposes, once the final design is required, a detailed geotechnical investigation will be required to provide design parameters and confirm findings of this investigation.

3.1.1 Proposed Development

The proposed Solar PV plant, Battery Storages and Wind turbines for Komati Power Station is located within the boundary of Eskom-owned land. The area is in Mpumalanga province between Middleburg and Bethal. The area is 1623m above the sea level. Suitable areas for renewable energy project were identified considering the wetlands, ash dams, existing underground and above ground services (electrical cables and overhead lines). The site is generally flat and partially identified as suitable for the installation of a Solar PV plants, Battery storages and Wind turbines.

The proposed development would include the installation of the following equipments:

- Solar PV plants
- Battery Storages
- Wind Turbines
- Power Transformers.
- High Voltage Switchgear.
- Low Voltage switchgear.
- Instrument Transformers
- Surge Arrestors
- Control Building and ancillary buildings
- Platforms
- Steel Structures and foundations
- Access roads

3.1.2 Objective of the Investigation

The primary objective of this investigation is to conduct intensive desk study of the proposed site selected to determine if it is suitable for the proposed green energy initiative.

3.1.3 Method of Investigation

The desk study includes perusal of available information, such as Aerial photographs, Topographical maps, Geological maps and review of available geotechnical reports in the surrounds of the proposed site.

3.2 SITE DESCRIPTION

3.2.1 LOCATION

Komati power station is situated in Mpumalanga halfway between Middelburg and Bethe, corner of R35 and R542.

Site	Latitude (S)	Longitude (E)	Comments
Proposed Site	26°05'26.4"	29°28'18.0"	N/A

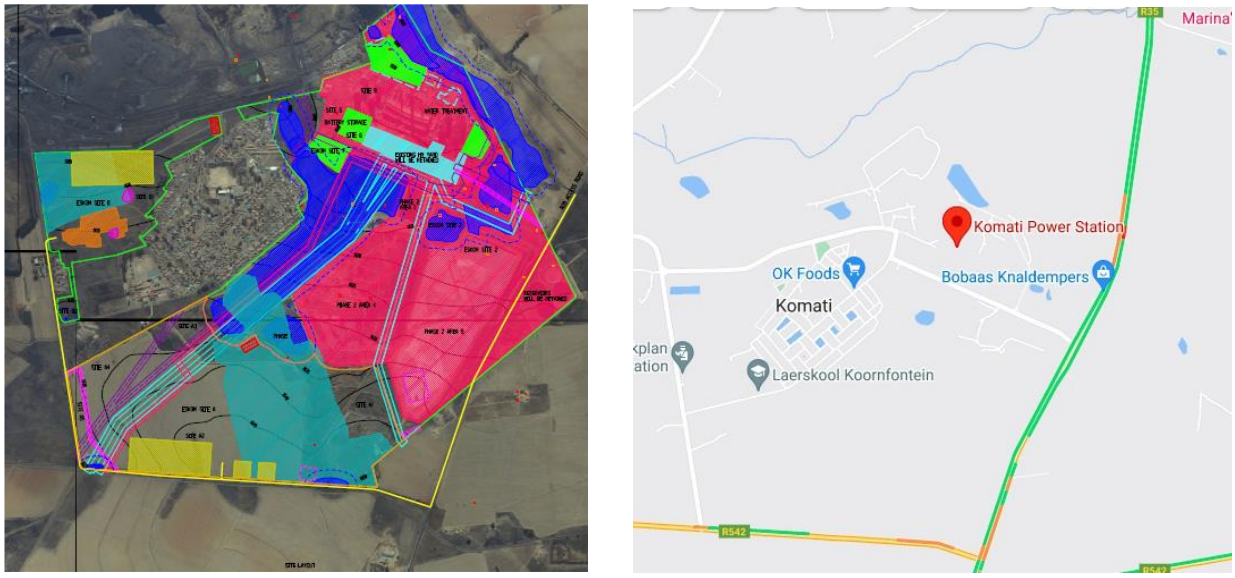

Figure 1: Insert satellite image figure for Komati Power Station area for Geotechnical Investigation

3.2.2 VEGETATION

There is farming vegetation on the proposed site. The vegetation on the selected site would have to be cleared during construction for the proposed development. Tree cutting to be conducted in accordance with environmental regulations and relevant authorities should be consulted.

3.2.3 CLIMATE

According to the Engineering Geology of Southern Africa, Volume 1, the proposed site is in the climate zone which is referred to as “Sub-humid moist zone”. In this zone the soil are potentially highly compressible.

The “Weinert N-Value” that describes the climatic environment of the area is less than 5. Where “N” is less than “5”, chemical decomposition is predominant.

In this study area, rocks anticipated to be particularly deeply weathered, often to depth of several tens of meters, and decomposition is pronounced.

3.2.4 SEISMICITY

The SANS code (Seismic actions and general requirements for buildings) SANS 10160-4:2011, shows that the site is situated in the area where the peak ground acceleration has a probability of being exceeded in 50 year period is 0.1g.

Figure 2 also shows the zone (zone 1) where compliance with the minimum requirements is specified by the code. Zone 1 is defined as “Regions of natural seismic activity”.

A more recent data produced by the Council of Geoscience is presented in Figure 3, showing peak ground acceleration with a 10% probability of being exceeded in 50 years. On this figure, the five sites are classified with ground acceleration of 0.1g (98cm/sec^2)

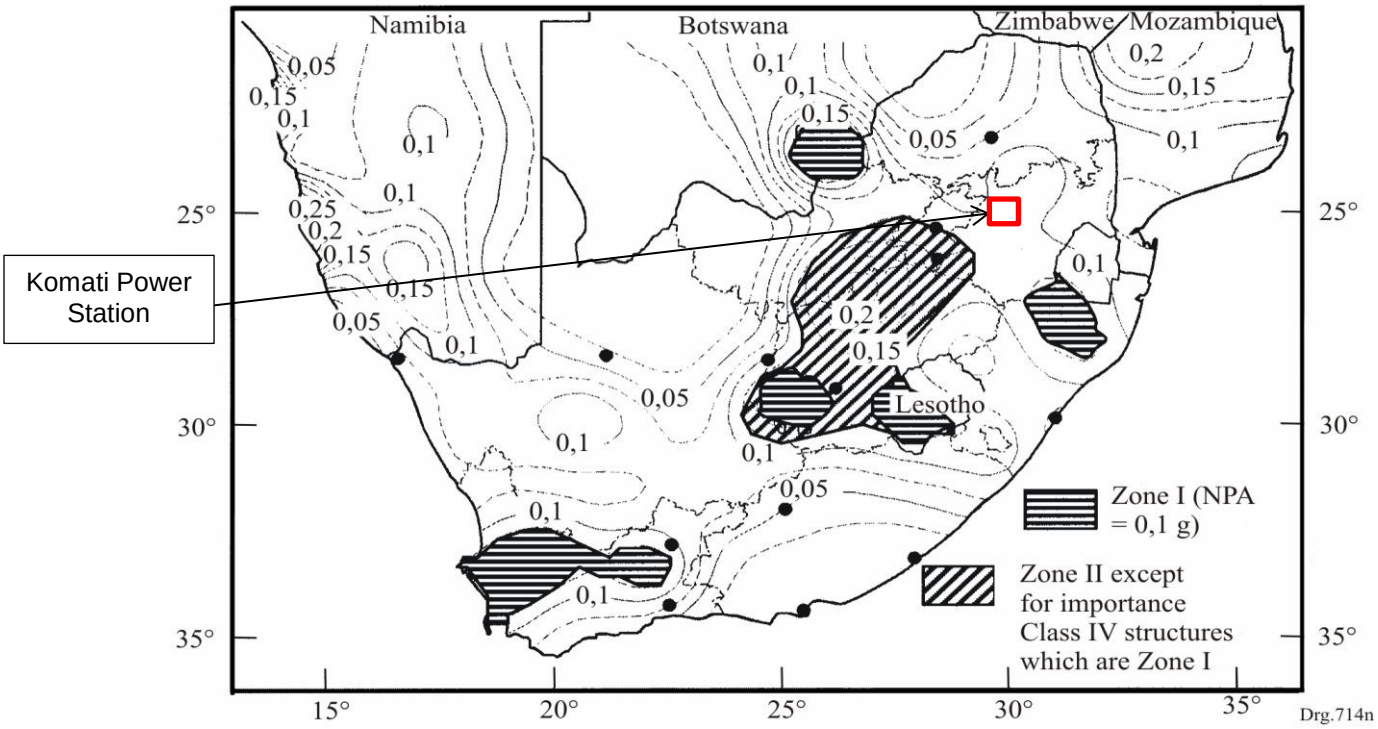

Figure 2: Seismic Hazard map and Zones [1]

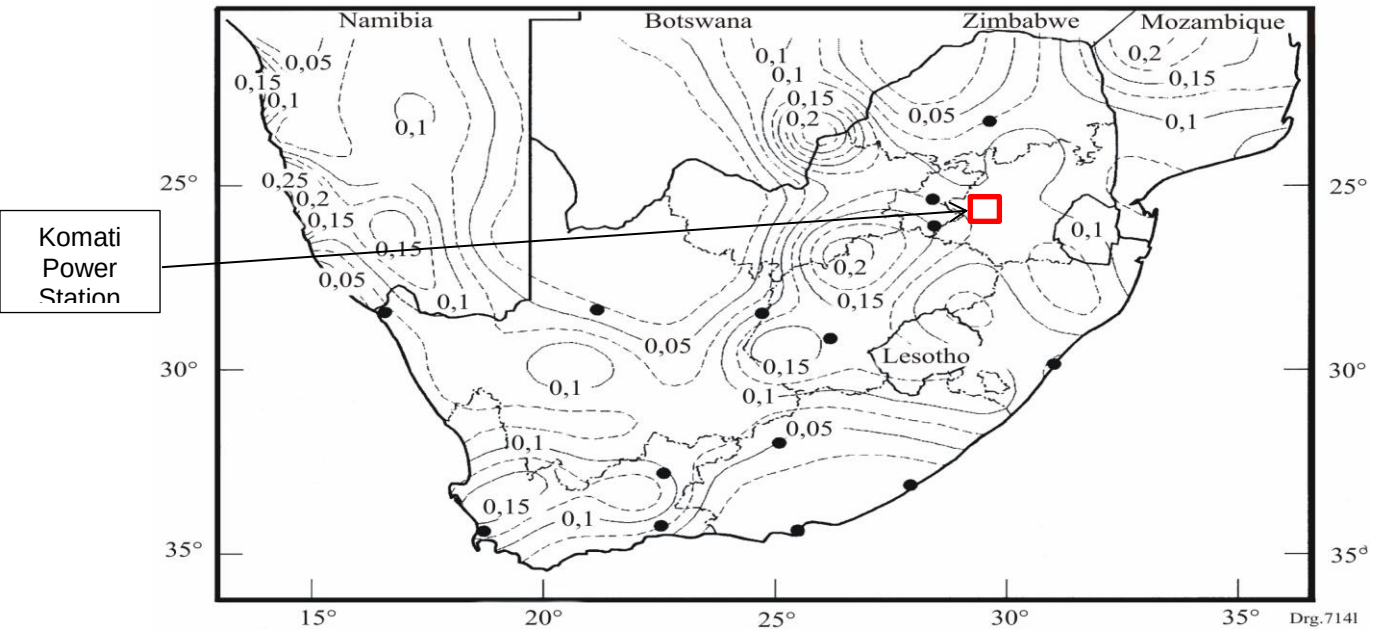

Figure 3: A recent seismic hazard map (2003) obtained from the Council for Geoscience [1]

3.3 REGIONAL GEOLOGY AND GROUND WATER

3.3.1 GEOLOGY

According to the geological map, 1:250 000 Geological Series 2628 EAST RAND map the regional geology of the site comprises of Sandstone, Shale and Coal Beds (**Pv**), the site may have pockets of Dolerite dykes and sills(Jd) from the Vryheid Formation, from the Ecca Group of the Karoo Sequence, as shown in Figure 4 below.

Figure 4: The Regional Geology of Komati Power Station

3.3.2 GROUNDWATER

There is a perennial river above the site and pockets of perennial pans running across or around the site, thus a shallow water table to be expected at some areas of the site. The depth of the water level can be confirmed during a detailed geotechnical investigation phase.

3.4 GEOTECHNICAL PROPERTIES INFLUENCING THE DEVELOPMENT

3.4.1 SOIL PROPERTIES

The area predominantly consists of sandstone, shale and coal beds, sedimentary rock origin. Sandstone can be hard and form a strong hanging wall however in the presence of intercalation with mudrock, it could result in slope stability issues and rock falls in cases when the mudrock disintegrates or slake resulting in the exposure of the sandstone layers. Sandstone intercalating with siltstone in the Vryheid Formation are notorious for porewater pressures in the interfaces, which may result in sliding of the rock.

The engineering properties of coal are not significant in conventional civil engineering applications of engineering geology. It is however important to assess the stability of underground workings and rehabilitation of the area. It is imperative to know the underground mining methods/quality of work or planned mining methods in areas deemed for surface development to not compromise the surface structures during pillar extractions with controlled goafing of the strata, in board and pillars mining method, for example. It is also important to know the rehabilitation strategy once the Life of Mine (LOM) has been reached, to avoid underground fires, which will result in surface subsidences, dolines and sinkholes which are prominent in the Mpumalanga area, a danger for surface developments.

Dolerite, a basic igneous rock origin, which often results in onion skin weathering. This makes the area susceptible to producing problematic soils such as Clay (turf); silty clay changing to sandy clay with depth; corestones; gravel, cobbles and boulders. The engineering impacts associated with these weathered material are expansive clays; low shear strength semi- to impervious soils; poor compaction and workability; unstable slopes and uneven bedrock surface.

3.4.2 EXISTING STRUCTURES NEARBY SITE

The site has various development such as underground mining nearby, surface mining, towns, powerlines, HV yard and a power station undergoing decommissioning, pipe lines, coal stockyard, ashdams and roads.

3.5 CONCLUSION AND RECOMMENDATIONS

Based on the above, it is recommended a feasibility geotechnical study to be conducted before any developments.

4. AUTHORIZATION

This document has been seen and accepted by:

Name and surname	Designation
Sithembiso Mabena	Civil Engineer Substation Engineering
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Andile Maneli	Middle Manager Substation Engineering