

**EVALUATION OF GEOLOGICAL CONDITIONS ALONG THE
PROPOSED NORTHERN COLLECTOR TUNNEL USING
ELECTRICAL RESISTIVITY TOMOGRAPHY METHOD IN
GATANGA, KENYA.**

**By:
Kamau Samuel Runo
I56/80912/2012**

**This dissertation has been submitted to the Department of Geology in
partial fulfillment of the requirements for the Degree of Master of
Science in Engineering Geology, the University of Nairobi**

August 2015

DECLARATION

I hereby declare that the thesis is my original work under the supervision of Dr. Zacharia Kuria and Dr. Edwin Dindi, Department of Geology, University of Nairobi during the year 2015 as part of Masters of Science program in Engineering Geology. I further declare that this work has not been submitted to any other university or institution for the award of any degree or diploma and all sources of material used for the thesis have been duly acknowledged.

Kamau Samuel Runo.
I56/80912/2012

Signature..... Date.....

This desertation has been submitted for examination with our knowledge as university supervisors

Supervisors

Dr.Zacharia Njuguna Kuria
Senior lecturer,
Department of Geology,School of Physical Sciences,
University of Nairobi

Signature..... Date.....

Dr. Edwin W. Dindi
Senior lecturer,
Department of Geology, School of Physical Sciences,
University of Nairobi

Signature..... Date.....

PLAGIARISM

This dissertation is the result of desktop data analysis of previous work done and field investigation carried out in Gatanga area between 2013 and 2015. Where other peoples work has been used, they have been acknowledged and cited in the reference section.

DEDICATION

To all my family members.

ABSTRACT

The proposed Northern collector Tunnel is located in Gatanga area within the southern slopes of the Abardare ranges in Kenya. Geologically, the area is composed of volcanic rocks comprising of the basalts and the pyroclastics. The mode of formation and deposition of these rocks make them prone to changes due to the dynamics of the earth and therefore influence on their mechanical behavior. Success of any tunnel project during implementation and after commissioning is influenced by the geological conditions. This study set out to investigate the geological conditions at the proposed tunnel location, 800 m length ERT Profile was carried out along the tunnel and supported by other short profiles at the valleys in each site and the results analyzed. The choice of ERT method was dictated by its widely known applicability in investigation of buried objects and structures, and also in exploration for underground water. The results of the study have shown that the upper most rocks have weathered to red brown soils. The basaltic agglomerates are the main rocks in the area and are overlain by pyroclastic rocks of varying thickness.

Although no geological structures that are clearly observed at the earth's surface the resistivity contrast between the rocks and the results from drill core logs reveals highly fractured rocks under the ground and these fractures are traced to correspond to the steep slopes at some sections along the tunnel route. The study also revealed ground water occurrence in all sections of the tunnel. The study recommends for the mitigation measures through pre-installation of horizontal drainage pipes below the adits to invert pore water pressures reducing seepage ingress and maintenance of relatively low hydraulic gradient compared with critical gradient for piping failure.

ACKNOWLEDGEMENT

I would like to especially thank my supervisors, Dr. Zacharia Njuguna Kuria and Dr. Edwin W. Dindi, for their encouragement and very helpful advice to me throughout my research. I have been very fortunate that they were my supervisors, and have learned many lessons in working under their guidance and leadership that I will remember for an extremely long time.

Special thanks to the entire staff in the department of Geology under the chairmanship of Dr. Ichangi, they ensured the environment was good for the research and were ready to assist when called upon.

I also acknowledge with gratitude the support of Engineers Kamau and Kiprono of Athi Water Service Board and Madam Lucy of Water Resources Management Authority (Murang'a Sub-region) for their co-operation and input during data collection.

I also owe a lot of thanks to my fellow classmates, Mr. Julius Odida and Mr. Leslie Dullo for the comradeship we experienced and for the countless useful conversations we had, often as we solved problems together.

Finally I would like to thank all my friends and family for their support and kindness to me throughout my research and during the writing this dissertation. There is one person to whom I am eternally grateful. She stayed with me throughout and her love and encouragement for me never stopped. We started as firm friends and she became my wife. To her I dedicate this dissertation. Thank you Mary.