BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

Design of an Optimal Open Pit Layout for Tiira Gold Mine using Geotechnical properties

By

OPIYO KENEDY

BU/UG/2012/113

Tel: +256 779 753 548

E-Mail: kenopiyo113@gmail.com

Supervisor: Ms. Nangendo Jacqueline

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EXECUTIVE SUMMARY

Geotechnical properties plays an important role in the stability of any excavation in mines. This makes it an important factor of considering in order for safety to be realized to enhance operation in mines.

Tiira Gold Mine is a surface and underground mine located in Busia district in Eastern Uganda at approximately 200 km east of the capital, Kampala. The Company's office is six kilometres northwest of Busia town at about 34°00'E, 00°30'N (UTM 616500E and 56700N).

Boniface pit is the current operational open pit with about 2 benches, pit height of 15m, bench width of about 10m, bench height of 5m, bench angle of 80^0 and the angle of repose of overburden is 60^0. The pit however is not stable to support further operation due to no proper design thus having a risk of being abandoned for the sake of safety.

This open pit mine has been designed to maximize safety and productivity. The study was conducted basing on several analysis both from the field and laboratory to come up with an optimal design. The findings indicated that the surface rock mass of Tiira mine is very weak with a uniaxial compressive strength of about 10.234MPa, shear strength of about 10.459MPa, the general rock quality being 24.335% and a rock mass rating of 26. This indicates that for the rock to be excavated using open pit method, the slope angle should be relatively smaller and the bench should be wider to enhance safety for the practitioners and equipment.

The open pit design was designed with a bench angle of 60^0 and an overall slope angle of 32^0 having a ditch that extends 2.89m on the exposed runoff surface and 3m deep to provide a water collection point at every level of operation. Safety was also increased with the FOS of the pit being 3.21.

DECLARATION

I, Opiyo Kenedy registration number BU/UG/2012/113 declare that the entirety of work contained in this project report is my original work except where explicit citations have been made. Therefore, it has never been submitted to any institution of higher learning for any academic award.

Sign: .....

Date: 27/05/2016.....

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ACKNOWLEDGEMENT

Most importantly, I thank God for the gift of life and ingenuity He has offered to me to accomplish this project report and gather all the necessary knowledge to compile it.

My sincere appreciation goes to my supervisor Ms. Nangendo Jacqueline for the guidance and time she gave me in achieving this project.

I am greatly indebted to my mum; Miss Arop Vento Lilly, Brother Elio, Dr. Marco Gigante and the other family members. They have been there for me amidst all challenges. In scarcity of resources, they have sacrificed their time, spared their advice and the very last of their property for me. Surely, there is nothing I can give to pay them other than praying for God's providence and blessings upon them.

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Great appreciation also goes to the management and staffs of Tiira Gold mine, Rorima Mining Company, African Drilling Exploration Services (ADT) and Uganda Industrial Research Institute (UIRI) of for their support in access of the site, field data and field test, technical guidance and laboratory test for the samples provided to accomplish the project.

APPROVAL

I affirm that Opiyo Kenedy, registration number: BU/UG/2012/113 compiled this project report under my supervision, and it can be submitted to the University management for an academic award.

Ms. Nangendo Jacqueline

Supervisor

Sign.....

Date.....

DEDICATION

I dedicate this report to my beloved mum; Ms. Arop Vento Lilly, my life mentor; Br. Elio Croce, Mr. Marco Gigante, my brothers, sisters, relatives and friends who have worked tirelessly to support me in all aspects of life and enable me make it up to this academic level. May the Almighty God reward them abundantly for their unceasing love and care towards me.

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LIST OF ACRONYMS

2D	Two Dimension
BIF	Banded Iron Formation
CAD	Computer Aided Design
GDP	Gross Domestic Product
GPS	Global Positioning System (a satellite navigational system).
kg	Kilogram
LRP	Long Range Planning
SRP	Short Range Planning
RMR	Rock Mass Rating
RQD	Rock Quality Designation
UCS	Uniaxial Compressive strength
UTM	Universal Transverse Mercator

CHAPTER ONE: INTRODUCTION

1.1 Back ground

Tiira Gold Mine is operated by Greenstone Resources ltd which is a gold mining company. It is located in Busia district in Eastern Uganda at approximately 200 km east of the capital, Kampala. The Company's office is six kilometres northwest of Busia town at about 34°00'E, 00°30'N (UTM 616500E and 56700N) (Hester, 2009).

It is an underground and surface gold mine which utilizes underground as the main production sector. However, they also use surface operation is on four different open pits i.e. Davies pit I located at about (36N, UTM 0619661E and 0057036N), Davies pit II at (36N UTM 0619597E and 0057199N), BIF pit at (UTM 0619445E and 0056535N), and Boniface pit at (36N UTM 0619411E and 0056967N).

Boniface pit is the current operational open pit with about 2 benches, pit height of 15m, bench width of about 10m, bench height of 5m, bench angle of 80^0 and the angle of repose of overburden is 60^0. The pit however is not stable to support further operation due to no proper design thus having a risk of being abandoned for the sake of safety (see appendix 1 and 2).

A proper open pit layout design is therefore needed to support the economic surface extraction of gold ore by Greenstone Resources Ltd since surface mining is restricted to recovery of gold-bearing vein material from shallow excavations. In Uganda, mining industry provided over 30% of GDP. In a move in 2005 to revive this industry, various aid groups, led by the World Bank, provided a low interest 'soft' loan to Uganda to stimulate interest in the country's mining potential. Some US$10.4 million from this source paid for up-to-date airborne geophysical surveys over approximately 80% of the country not previously surveyed in recent times (Hester, 2009)

In fiscal year 2004-05, mining and quarrying accounted for 1% of the GDP (Bank of Uganda, undated, p. 146; International Monetary Fund, 2006, p.184; 2006). The mining and quarrying sector grew by 16.9% in fiscal year 2004-05 compared with 5.4% in fiscal year 2003-04. Growth in the mining and quarrying sector was attributable to higher production surface mining of cobalt and limestone. (Bank of Uganda, undated, p.149) (Yager, 2007).

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