STUDY REPORT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED COPPER MINING IN MUKURUNI, THARAKA WARD, MWINGI NORTH, KITUI COUNTY (LAT. 37^0 59' 34.897'', LONG. 0^0 23' 13.313'')

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AUGUST, 2023

SUBMISSION OF DOCUMENTATION

I, **Dr. Festus Mutiso,** submit this Environmental and Social Impact Assessment Study Report for the **Proposed Copper Mining in Mukuruni, Tharaka Ward, Mwingi North Sub-County, Kitui County**. To the best of my knowledge, all information contained in this report is accurate and a truthful representation of all findings as relating to the project.

***Signed at** KITUI **on this.....day of August** 2023*

Signature……..

Designation: *Lead Environmental Consultant, NEMA Reg. No. 6467*

SUBMISSION OF DOCUMENTATION

Mr. Sameet Patel, on behalf of PM Resources (Africa) Ltd, submit this Environmental and Social Impact Assessment Study Report for the **Proposed Copper Mining in Mukuruni, Tharaka Ward, Mwingi North Sub-County, Kitui County**. To the best of my knowledge, all information contained in this report is accurate and a truthful representation of all findings as relating to the project.

***Signed at** KITUI **on this.....day of August** 2023*

Signature……..

Designation: DIRECTOR

ACRONYMS

CLPs	Consents, Licenses and Permits
CSR	Corporate Social Responsibility
EAC	East African Community
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Co-ordination Act
EMP	Environmental Management Plan
GOK	Government of Kenya
KEBS	Kenya Bureau of Standards
KM	Kilometers
KPLC	Kenya Power and Lighting Company
KRA	Kenya Revenue Authority
KVA	Kilo Volts Amperes
KWS	Kenya Wildlife Service
NEAP	National Environment Action Plan
NEC	National Environmental Council
NEMA	National Environment Management Authority
PIN	Personal Identification Number
PPE	Personal Protective Equipment
PPM	Parts Per Million
SWM	Solid Waste Management
TOR	Terms of Reference
WRA	Water Resources Authority
WTO	World Trade Organization

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EXECUTIVE SUMMARY

Introduction

PM Resources (Africa) Ltd is a limited company duly registered in Kenya. A feasibility study undertaken by the company has identified commercially viable copper ore deposits in Tharaka ward. The company is proposing to carry out Copper Mining as provided by the Mining Act 2016. The Act provides for small scale mineral mining by an individual, community or a company. The Act reads in part "The following types of mineral rights may be granted in respect of authorizing small scale operations: a reconnaissance permit, a prospecting permit and a mining permit to a citizen of Kenya or a body corporate, where no less than sixty percent of the shareholding is held by citizens of Kenya".

The company's proposed mining area covers approximately 64Km^2 (see attached map). Within the proposed mining area, the company has obtained land consent from the local land owners (see annexed land consents). In order to start mining of copper, the company is required to obtain a mining license from the directorate of mines. However, such a license can only be given upon submission of a NEMA license for the proposed project. It is against this background that the project proponent initiated this ESIA process primarily to get an environmental impact assessment license and subsequently apply for a mining license.

The proposed Copper mining project is located in Mukuruni, Tharaka ward, Mwingi North Sub-County, Kitui County (Figure 1 & 2). The land parcels selected for the proposed copper mining lies on latitudes and longitudes of 37^0 59' 34.897'' and 0^0 23' 13.313'' respectively. The proposed project site has a general elevation of 677m above the sea level. The proposed copper mining is sparsely populated and predominantly agropastoral. Though the larger Tharaka ward is extremely dry to support meaningful rain-fed agriculture, some areas have deposits of copper that can be commercially exploited. The proponent is proposing to use mechanized mining technology coupled with chemical and manual technologies to exploit the

copper ore. Under mechanized technology, the proponent is proposing to use tractors, excavators, compressors amongst others. Chemical technology will be used in isolated cases and will make use chemical explosives for mild blasting. Manual undertaking will employ the use of light and hand operated tools. Since the copper ore is near the earth's surface, the proponent is proposing to use surface/open pit mining method to extract copper ore. This method is the most widely used technique of mining copper today and cause less environmental degradation compared to sub-surface/closed pit mining method. This will be accomplished by creating and using benches or terraces to gradually reach deeper under the earth's surface.

Since the inception of the Environmental Management and Coordination Act 1999(EMCA, 2015 Amended Act), it has now become a legal requirement for all projects listed in the second schedule to undertake Environmental Impact Assessment (EIA). Environmental concerns now need to be part of the planning and development process and not an afterthought, it is therefore advisable to avoid land use conflicts with the surrounding area so as to ensure sustainable development. Towards this end, to avoid unnecessary conflicts that may retard development in the country, the proponent undertook this Environmental Impact Assessment (EIA) and incorporated environmental concerns as advised by the Authority.

Environmental Impact Assessment is a tool that strives to strike a balance between environmental conservation and sustainable development. It has been identified as a key component in new project implementation. According to section 58 of the Environmental Management and Coordination Act (EMCA) No.8 Second Schedule 9 (1), and Environmental (Impact Assessment and Audit) regulations, (2019, Amendments), new projects must undergo Environmental Impact Assessment. A Report of the same must be submitted to National Environment Authority (NEMA) for approval and issuance of EIA License. This is necessary as many forms of developmental activities cause damage to the environment and hence the greatest challenge today is to maintain sustainable development without interfering with the environment.

For a long time the world over, policy makers directed all the efforts in economic development without due regard to the resource base on which the economic development depend on. As a result, there has been unprecedented environmental degradation due to lack of environmental conservation resulting to unsustainable development. More recently investors and developers, spurred on by regulators world over, have recognized the need for change in order to safeguard the environment.

In reference to the above, environmental concerns have now been integrated in the planning and implementation processes of any proposed projects in Kenya. The key objective is to mitigate conflicts with the environment at the vicinity during implementation and operation phases. In addition, it is now mandatory for Environmental Impact Assessments (EIAs) to be undertaken on the following:-

a) Any activity out of character with its environment.
b) Any structure of a scale not in line with its surrounding
c) Major Change in land use.

The second schedule of EMCA 1999 (2015, Amended Act) list all the activities that should undertake EIA before commencement. Quarrying for mineral material and crushing of rocks activities are among the list.

The environmental management is regulated by the National Environmental Management Environment (NEMA) in Kenya, which is constituted as per the provision of Environmental Management and Co-ordination Act 1999(EMCA, 2015 Amended Act) which is the supreme environmental legislation. Pursuant to the prevailing legal requirements as envisaged in the Environmental Management and Coordination Act 1999(EMCA, 2015 Amended Act) and to ensure sustainable environmental management, the project proponent undertook this EIA report for the proposed Copper mining; and incorporated substantial environmental aspects as required by NEMA. This ESIA project report thus provides relevant information and environmental and social considerations on the project. The proponent's intention is to seek

approval from NEMA to carry out the proposed copper mining. Environmental Experts who are registered by the Authority conducted the assessment.

Scope, Objectives and Terms of Reference

The major objective of this ESIA project report is to evaluate the effects/impacts of proposed copper mining in relation to the environment i.e. physical, biological, and social-economic environments. It aims at assessing and prediction of all the positive and negative impacts of the project on the environment and recommends measures to reinforce the positive and reduce the negative impacts of the project. The output of the study was the production of an Environmental Impact Assessment project report for submission to NEMA for the purposes of seeking an EIA license.

Positive Impacts of the Project

The proposed development has positive impacts to the society both at local and national level which includes the following:-

- Increased employment opportunities
- Gains in the Local and National Economy
- Exploitation copper as a natural resource
- Income generation to the company
- Improvement of feeder roads to the project site
- Promotion of the mining industry
- Optimum land use
- Complimentary spin-off benefits in other economic sectors such as retail and informal sector.
- Boosting host community development goals through corporate social responsibility
- Participation and increased human productivity amongst others.

Anticipated Negative Impacts

Against the background of the above positive impacts, there are negative impacts anticipated from the implementation of the subject project. These shall be experienced during site preparation, operation phase and decommissioning phase.

The impacts have been elaborated as follows:

- Impact on soil (soil erosion of exposed surfaces), cause of soil degradation.
- Increased noise and vibrations from controlled excavation during operation phase.
- Air pollution as a result of dust emissions from excavation works and vehicular traffic
- The health and safety of workers and immediate residents and neighbours may be compromised due to pollution, accidents, and disturbance
- Increased waste generation (both solid and liquid)
- Increased energy consumption
- Increased risk of accidents and injuries to workers
- Clearance of vegetation on mining site
- Challenges of traffic control at the site
- Occupational Health and Safety (OHS) issues of workers
- Disputes and conflicts may also arise out of contractual obligations of the lessee and lesser
- Effects on biodiversity mainly plant and animals micro and macro organisms
- Risk of water pollution due to acid mine drainage
- Risk of soil erosion and siltation
- Risk of mine dumps
- Risk of acid rock drainage
- Risk of dissolution and transport of metals and heavy metals by run-off and ground water

Proposed Potential Mitigation Measures

To minimize the occurrence and magnitude of the negative impacts, mitigation measures have been proposed against each of the anticipated impacts. Other measures have been integrated in the project designs with a view to ensuring compliance with applicable environmental laws and guidelines. The measures include the following:

- Strictly use open pit mining method and avoid closed pit mining
- Mined pits should be closed and rehabilitated
- Storm water accumulating in mining pits should not be used for human and livestock consumption due to likely presence of heavy metals
- Strictly use storm water collecting in mining pits to sprinkle on dusty surfaces during mining
- Strictly avoid pumping of waste water from mining pits on vegetated areas and water points
- The site should be fenced off during construction to keep off the general public
- Sensitive and risky areas to be secured by danger tape as required by law
- Cautionary signages such as “KEEP OFF CONSTRUCTION SITE, NO ENTRY TO THE MINE WITHOUT PPE, BEWARE OF FLYING/FALLING ROCKS OR STONES, MEN AT WORK, HEAVY TRUCKS TURNING” etc must be posted strategically.
- Provision of a well-equipped first aid kit as required by OHS and OSHA guidelines for workplaces
- Soil compaction and watering of loose soils to minimize air pollution and erosion by the agents of soil erosion i.e. water, human/machinery and wind.
- The proponent will sensitize the workers to avoid unnecessary destruction of vegetation during site preparation including extraction routes
- Construction of silt fences and sediment traps to reduce soil erosion
- Construction of sound barriers and sensitizing workers on the need to switch off engines whenever possible; ensuring that the machineries are well maintained,

installing silencers whenever possible and ensuring that the work is carried out within the specified time frame.

- Workers to be provided with full protective gear (PPE) to beef up on their health and safety standards and should be sensitized on health, safety and environmental conservation aspects.
- To reduce the health and safety risks, effective emergence response plans will be adopted. There should be a specific area for hazardous material storage, machinery maintenance activities and refuelling and these should be clearly indicated and adhered to.
- Fuel storage points to be mounted with danger signages such as "HIGHLY INFLAMMABLE, NO NAKED LIGHTS, NO SMOKING"
- Provision of sound waste management systems and procedures. The proponent will put in place effective and efficient waste disposal systems. Waste, including excavated soil and debris should be properly kept and used for backfilling or dumping mined pit.
- If blasting is to be done, then the proponent must:-
  - ❖ Obtain blasting permit and adhere to blasting license regulations as required by law
  - ❖ Engage the services of a trained and licensed blaster
  - ❖ The blaster to undertake mild/controlled blasting
  - ❖ The blaster to use few shot holes per Rock blasting episode
  - ❖ Obtain a noise permit from NEMA before Rock blasting
  - ❖ Sensitize the local community on the expected Rock blasting and hours for blasting
  - ❖ Give warning like whistling and evacuate all people and livestock in the vicinity of rock blasting area
  - ❖ Post sentries with red and green flags on both ends of the road to warn and keep off traffic during Rock blasting
- Access the project site through the existing access roads and ensure minimal disturbances.

- Attending to the corporate social responsibility needs of Ndwila residents to ensure harmony and support by residents.
- In case of damage to residents' structures due to mining activities, the proponent should dispatch a team to inspect the damage and agree on a solution
- Disputes in contractual arrangements are to be resolved as stipulated in agreements between parties to the contract.
- Adapt Environmental Management and Monitoring Plans within the site.
- Upon decommissioning of the project, rehabilitate the open mine pits by backfilling with appropriate soil and planting native plants.

Environmental and Social Management Plan

A comprehensive environmental and social management plan has been prepared to assist the contractor address the identified adverse environmental impacts of the project. Strict adherence to the environmental management plan and observation of principles of best practice for projects of this nature is recommended to ensure environmental sustainability of the project.

Conclusion and Recommendations

The assessment has concluded that the project proponent has identified commercially viable deposits of copper at the proposed project site. As required by the Mining Act, 2016, the proponent has obtained consent from the land owners as well as from the County Government of Kitui. Additionally, the proponent has, obtained some of the requisite approvals and is proposing to start copper mining upon issuance of EIA license and mining license. The proponent is proposing to use surface/open pit mining method. Mechanized technology will be coupled with chemical and manual technologies to extract the copper ore since the ore is near the surface. Chemical technology will be used in isolated and special cases especially where the rocky surface is hard for mechanical extraction.

The assessment has also established that the proposed project will bring about positive and negative impacts to the natural and social environment. Key among the positive impacts include employment of local people, exploitation of copper as a natural resource, payment of taxes amongst other. Likely negative impacts include loss of vegetation, risk of accidents, noise pollution, dust generation amongst others. It should, however, be noted that the likely negative impacts can be adequately mitigated by implementing the provided environmental and social management plan (ESMP). There was a need to identify negative environmental impacts of the project, during the early stages of planning and design. This strategy will ensure protection and conservation of the environment and guarantee a respectful and fair treatment of all people who will be affected by the project.

In order to minimize the negative impacts that will emanate from the implementation of the proposed project, a number of mitigation measures have been proposed to be implemented during construction, operation and decommissioning phases of the project. The aim is to ensure that environmental management considerations are incorporated at every stage of the implementation. In mitigation, the proponent has been advised to give the first priority to avoidance of negative impacts followed by minimization and compensation as the last option in the hierarchy. The most important thing is to make sure the occurrences of adverse impacts that have the potential to degrade the environment are minimised as much as possible. Unless otherwise stated, the proponent is advised to observe the general and specific industry standards for mining activities with major focus on the Mining Act, 2016 and other pertinent legislations.

Mining activities engender a certain degree of risks to workers and as such the proponent is strongly advised to pay special attention to OHS and OSHA guidelines and other pertinent legislative provisions applicable to the proposed project. It is envisaged that strict adherence to the provided Environmental and Social Management Plan (ESMP), Nema EIA license conditions and mining permit conditions will not only avoid or minimize the projected negative impacts but will go a long way in ensuring that the proponent remains compliant. Further, ESMP has allocated specific mitigation responsibilities to various actors in the project. All actors are advised that it is their full mandate to translate the provided ESMP into practical actions for full compliance. Additionally, the proponent is expected to ensure optimization of all the likely positive impacts.

To this end, it is evident that all the likely negative impacts can be mitigated adequately by implementing the developed ESMP. Further, the proposed project site is sparsely populated and the copper ore occur is isolated belts and thus implementation of the project will be compatible with existing land uses. Further, the proponent has followed due process to acquire land consent from the local land owners and the County Government of Kitui. On the

basis of these findings, it is recommended that Nema licenses the proposed project provided that the ESMP is fully translated into practical actions.

1.0 INTRODUCTION

1.1 General overview, justification and rationale for Comprehensive ESIA

PM Resources (Africa) Ltd is a limited company duly registered in Kenya. A feasibility study undertaken by the company has identified commercially viable copper ore deposits in Mukuruni, Tharaka ward. The company is proposing to carry out Copper Mining as provided by the Mining Act 2016. The Act provides for mineral mining by an individual, community or a company. The Act reads in part "The following types of mineral rights may be granted in respect of authorizing mining operations: a reconnaissance permit, a prospecting permit and a mining permit to a citizen of Kenya or a body corporate, where no less than sixty percent of the shareholding is held by citizens of Kenya".

The company's proposed mining area covers approximately 64Km^2 (see attached map). Within the proposed mining area, the company has obtained land consent from the local land owners and the County Government of Kitui(see annexed land consents). In order to start mining of copper, the company is required to obtain a mining license from the directorate of mines. However, such a license can only be given upon submission of a Nema license for the proposed project. It is against this background that the project proponent initiated this ESIA process primarily to get an environmental impact assessment license and subsequently apply for a mining license.

The proposed Copper mining project is located in Mukuruni, Tharaka ward, Mwingi North Sub-County, Kitui County (Figure 1 & 2). The land parcels selected for the proposed copper mining lies on latitudes and longitudes of 37^0 59' 34.897'' and 0^0 23' 13.313'' respectively. The proposed project site has a general elevation of 677m above the sea level. Immediate neighbours to the proposed project sites are farmlands and grazing fields. The proposed copper mining is sparsely populated and predominantly agropastoral. Our client is proposing to use surface/open pit mining method. Basically, mining activities usually alter the biophysical and social environments of the mining areas. Control measures and procedures are thus inevitable to limit its impacts to acceptable levels. Generally, mechanized mining activities in Kenya are subject to government regulations relating to environmental protection and safety of the working conditions discussed later in this

report. The proponent is proposing to use mechanized mining technology coupled with manual technologies.

The rationale for the Study Report is to achieve two twin objectives. First, the report is made to assist the proponent acquire EIA license which is a prerequisite for a mining license. Secondly, the report has been done to integrate environmental and social aspects in the planning and implementation processes of this proposed project and to mitigate adverse impacts and enhance the positive impacts. Besides, Environmental Impact Assessment (EIA) for such projects is now a legal requirement. The ultimate objective of an EIA is to provide decision makers, relevant institutions/organizations, proponent and other stakeholders with the foreseeable environmental impacts of a proposed activity and therefore enable planning ahead taking into account all predictable outcomes and adequately providing for adequate mitigation measures for environmental sustainability.

The purpose of the Study Report is to accommodate the potential environmental (physical, ecological and cultural/socio-economic) concerns and address them adequately throughout the project cycle. The report is expected to raise both the potential positive and negative impacts likely to emanate from the proposed project. Integrating Sustainable Environmental Management principles in the planning, implementation and throughout the project cycle is vital in reducing/mitigating conflicts and enhancing environmental conservation.

1.2 Objectives

The main objectives of this Comprehensive ESIA study report were:-

- To establish the baseline conditions for the proposed site.
- To evaluate the anticipated environmental impacts both positive and negative.
- To recommend measures to enhance the positive impacts and measures to reduce the negative impacts
- To develop a restoration plan
- To develop an Environmental and Social Management Plan (ESMP)

1.3 Terms of Reference (TOR)

The following are the Terms of Reference in conducting this exercise:-

i. Evaluating the environmental and social impacts on the following aspect of environment:-
    a. Air quality, ground and surface water, flora and fauna, social and economic aspect, existing land use, visual impacts, transportation impacts, and the effects of noise/vibration from the proposed operations.

ii. Generation of baseline information, establishing the current status of the proposed site and its environs, identification of predictable effects of the development on the environment (including infrastructure, occupational health and safety issues) and direction & magnitude of the changes, analysis of the compatibility of the proposed project with the surrounding land uses (as per the prevailing policy and legal framework)

iii. Proposing potential mitigation measures to be undertaken throughout the project cycle and develop a restoration plan for the used material sites and open mine pits.

iv. To develop an Environmental and Social Management Plan (ESMP).

1.4 Scope of Environmental and Social Impact Assessment

This Study Report has been conducted as per the above TOR and as set out in EMCA, 1999 (2015, Amended Act) and the Environmental (Impact Assessment and Audit) Regulations, 2003 (2019, Amendments). The assessment covers the following areas:-

- The exhaustive study of the proposed physical location of the proposed project within the project site.
- A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project.
- The technology, procedures and processes to be used, in the implementation of the project.
- The materials to be used in the construction and implementation of the project.
- The products and waste to be generated by the project.
- A description of the potentially affected environment.

- The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- To recommend a specific environmentally sound and affordable wastewater management system.
- Analysis of alternatives including project site, design and technologies.
- An environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- Provide an action plan for the prevention and management of the foreseeable accidents and hazardous activities in the cause of carrying out development activities.
- Propose measures to prevent health hazards and to ensure security in the working environment for the employees, residents and for the management in case of emergencies.
- An identification of gaps in knowledge and uncertainties that were encountered in compiling the information.

1.5 Methodology

Since the proposed project is copper mining, an environmental project report is seen to be adequate. The general steps followed during the assessment were as follows:

i. Environment and social screening, in which the project was identified as among those requiring Environmental and Social Impact Assessment under schedule 2 of EMCA, 1999
ii. Environmental scoping that provided the key environmental issues
iii. Desktop studies and interviews
iv. Physical inspection of the site and surrounding areas
v. ESIA Public participation via public meeting and the use of questionnaires
vi. Reporting

Project Cost

The proposed project has an estimated project cost of Twenty Million Kenya Shillings only (KShs. 20 Million).

2.0 PROJECT DESCRIPTION AND ACTIVITIES

2.1 *The Project Description and layout plan*

PM Resources (Africa) Ltd is a registered ltd company in Kenya. The company has been carrying out mineral prospecting in sections of Tharaka Ward (Figure 1 & 2). A feasibility study undertaken by the company has identified commercially viable deposits of copper. The company has obtained mining consent from the local land owners and the County Government of Kitui and as such proposing to carry out Copper Mining as provided for in the Mining Act, 2016. The proponent is proposing to use surface/open pit mining method since the copper is near the surface. Mechanized mining technology coupled with isolated cases of chemical and manual undertakings will be employed to extract the copper. The site proposed for mining is currently used for rain-fed agriculture though the returns are almost negligible due to erratic and unreliable rainfall regime. Subsistence livestock keeping is also done at the proposed project site and its environs.

Mining of copper can be done using two methods: surface/open pit mining method and sub-surface/underground mining method. The proponent is proposing to use surface/open pit mining method to extract the copper ore since it is near the earth's surface and it is the most widely used technique of mining copper today. This will be accomplished by creating and using benches or terraces to gradually reach deeper under the earth's surface. Sub-surface/Underground mining method will be avoided due to its complexity and pronounced negative environmental impacts. This method is suitable when the copper ore is not near the earth's surface. Miners dig a shaft into the ore deposit vertically or a horizontal tunnel (or adit) in order to do this. Mining then follows the vein of ore and the underground mine develops. Both methods have pronounced environmental impact as they leave behind large pits and tunnels after mass movement of materials. They usually accelerate land degradation and erosion especially after the soil has been set loose. Biodiversity (plant and animals), water, soil amongst others are largely affected.

Copper mining can be done using three technologies mainly manual, mechanized and chemical. The latter is best suited for large scale copper mining. The proponent is proposing to combine mechanized, chemical and manual technologies. Under manual technology various light and hand operated tools and equipment will be used. Under

mechanized technology, various earth-moving equipment including shovels, dozers, hauling trucks and loaders will be used to remove and transport the ore. Chemical technology will make use of mild blasting and this will be used under special cases especially where the rocky surface is hard for mechanical extraction. However, the first step will be to loosen the rock in the ore body so that it can be moved and processed. Excavation and grinding equipment will be used to accomplish this task. The excavated copper ore will be transported to an offsite crusher point. At the crusher plant, the copper ore will be grind then transported for final processing. Trucks and tractors will be used for this purpose.

2.2.1 Mining license

According to Mining Act, 2016, mining can only proceed after securing a mining license. The Act provides for granting of license for mineral mining upon recommendation of the Mineral Rights Board to the Cabinet Secretary. To this end, the proponent should work towards securing of the mining license in compliance with existing legislative provisions and the principles of best practices for projects of this nature.

2.2.2 Noise permit

The law requires that the proponent obtains a noise permit from the County Government of Kitui prior to mining. The permit stipulates conditions that must be observed by the proponent as per the noise and excessive vibrations regulations.

2.2.3 Rock blasting permit

Should the proponent opt to use explosives to blast the rocks, the existing legal framework require him to obtain a Rock blasting permit from Department of Mines and Geology. The permit will authorize the miner to carry out controlled blasting in accordance with provisions of sub legislation 78(1) of explosives Act Cap 115 Laws of Kenya. The miner can only be granted the permit on condition that a registered blaster is engaged to undertake the Rock blasting.

2.2.4 Sign board

As a legal requirement, erection of a clearly labeled sign post will be mandatory to inform the general public of the nature of project under construction. The project's sign board must be erected to make the public aware of the development and to keep away intruders, which will indicate the following:

- The developer's name and address
- The local authority approval number
- The project engineer
- The project quantity surveyor
- NEMA, NCA and Physical Planning approval numbers
- Other professionals involved in the project.

2.2.5 Fencing of the mining pits

As a legal requirement, the proponent will be expected to secure the mining pits by fencing. Erection of a clearly labeled sign post will be mandatory to inform the general public of the nature of project under construction. Sensitive/risky areas will be clearly marked by a danger tape to warn workers and the general public.

2.2.6 Signages at the proposed copper mining site

The law requires the miner to post cautionary signages at the proposed Small scale copper mines to warn the workers and the members of the public. The mine point should be clearly demarcated using route markers. Such signages include among others "KEEP OFF MINING SITE, NO ENTRY TO THE MINE WITHOUT PPE, BEWARE OF FLYING/FALLING ROCKS OR STONES, MEN AT WORK, HEAVY TRUCKS TURNING". Signages to indicate flow of traffic and speed limit must be clearly posted at the site to avoid incidences of injury and possible liability issues arising.

2.2.7 Temporary site pit latrine

As required by environmental impact assessment and audit regulations, a temporary site pit latrine will be put up by the miner prior to the commencement of the project. This

facility is specifically made to ensure proper disposal of human wastes during site preparation and mining period and thereby ward-off waste-related health problems.

2.2.8 Site camp and office

Site camp for miners is mandatory. The camp should house the site office, site pit latrine, machines site, storage yard among others. The camp should contain the basic requirements for human habitation. These include camp houses, latrines, clean water amongst others.

As required by law, the proponent will be required to put up a site office. Important documents such as project operational permits, project plans among others should be kept in the office during the construction phase. The documents should be open for inspection by the government parties with interest in the project.

2.2.9 Provision of workers with personal protective equipment (PPE)

OHS and OSHA regulations and other pertinent legislations for workplaces require that the miner provides workers with appropriate and fitting PPE. Such PPE include aprons, gloves, dust coats, gumboots, helmets, ear muffs amongst others. Depending on the work assignment, every worker at the mine site is expected to be in full working gears to ward-off possible injury/accidents that may also result to liabilities to the proponent.

2.2.10 Site First aid kit

OSHA guidelines for worksites of this nature require that in absence of a clinic or medical facility, the proponent is supposed to provide a first aid kit. The kit should contain adequate fill content for worksites of this nature and magnitude.

2.2.11 Preparatory work

The initial activity on the proposed project is the preparatory works for the site which will normally entail the provision of an access road, site office, soil stripping, installation of service lines and other basic facilities required for project operation. The project site is generally characterized by short shrubs, cropland and scattered indigenous trees making the site clearance fast. After complete clearance and demarcation of the site, the

proponent will erect site camp that will house office, site pit latrine, machines site, storage yard among others.

2.2.12 Copper Ore Mining and Transportation

There will be provision of the excavators, compressors and drilling machines. Care will be taken while siting excavation points to avoid interferences with the nearby homes and environment. The excavator will scoop and load the rocks/stones into lorries, which will transport the material into the site storage yard or the crushing plant in a different site. In cases where the rock is hard for the excavator then drilling machine will be used and explosives put into the drilled hole for controlled blasting. Blasting will be used in special and mandatory cases only.

There will be several trucks depending on the quantity of the copper ore to be transported to crusher site and transfer to the refining site. These transportation trucks will alternate at a given time sequence to control traffic and the emission of dust and noise to the workers and neighboring areas.

2.2.13 Crushing of Rock

The proposed project will not entail installation of a crusher. Trucks will transport the excavated copper ore to off-site crusher site where the ore will be crushed before final processing/refining.

2.2.14 Storage of Excavated ore at the mine

Where applicable, the copper ore will be loaded into trucks immediately after excavation to avoid over-pilling of the same in the mine area and make navigation difficult. However, a temporary holding/yard will be available for storage of the excavated materials before transfer to the crusher site. Any residues from the mining site will be stored in a designated point to be used later to backfill the mined pit upon project decommissioning.

3 BASELINE INFORMATION OF THE STUDY AREA

3.1 Location and size

The proposed Copper mining project is located in Mukuruni, Tharaka ward, Mwingi North Sub-County, Kitui County (Figure 1 & 2). The land parcels selected for the proposed copper mining lies on latitudes and longitudes of 37^0 59' 34.897'' and 0^0 23' 13.313'' respectively. The proposed project site has a general elevation of 677m above the sea level. The proposed mining are is approximately 64km^2 (Figure 2).

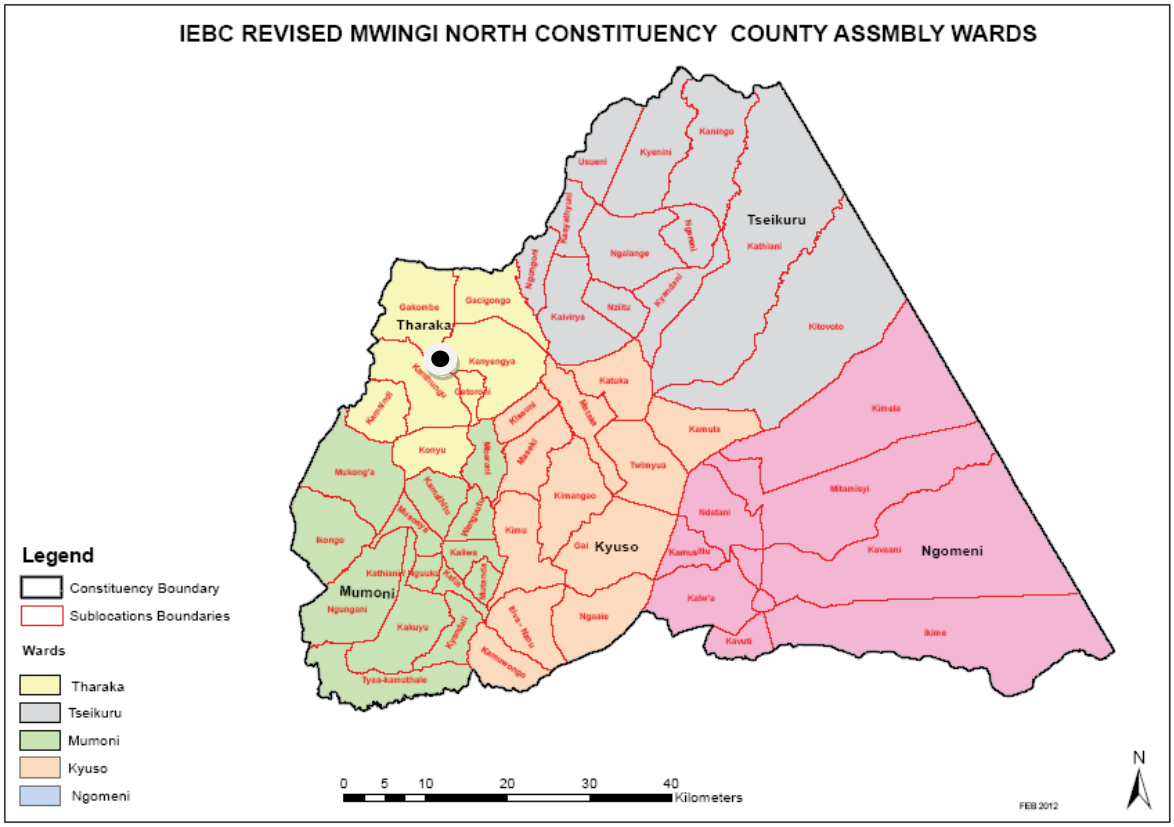

Figure 1: Location of Tharaka Ward in Mwingi North

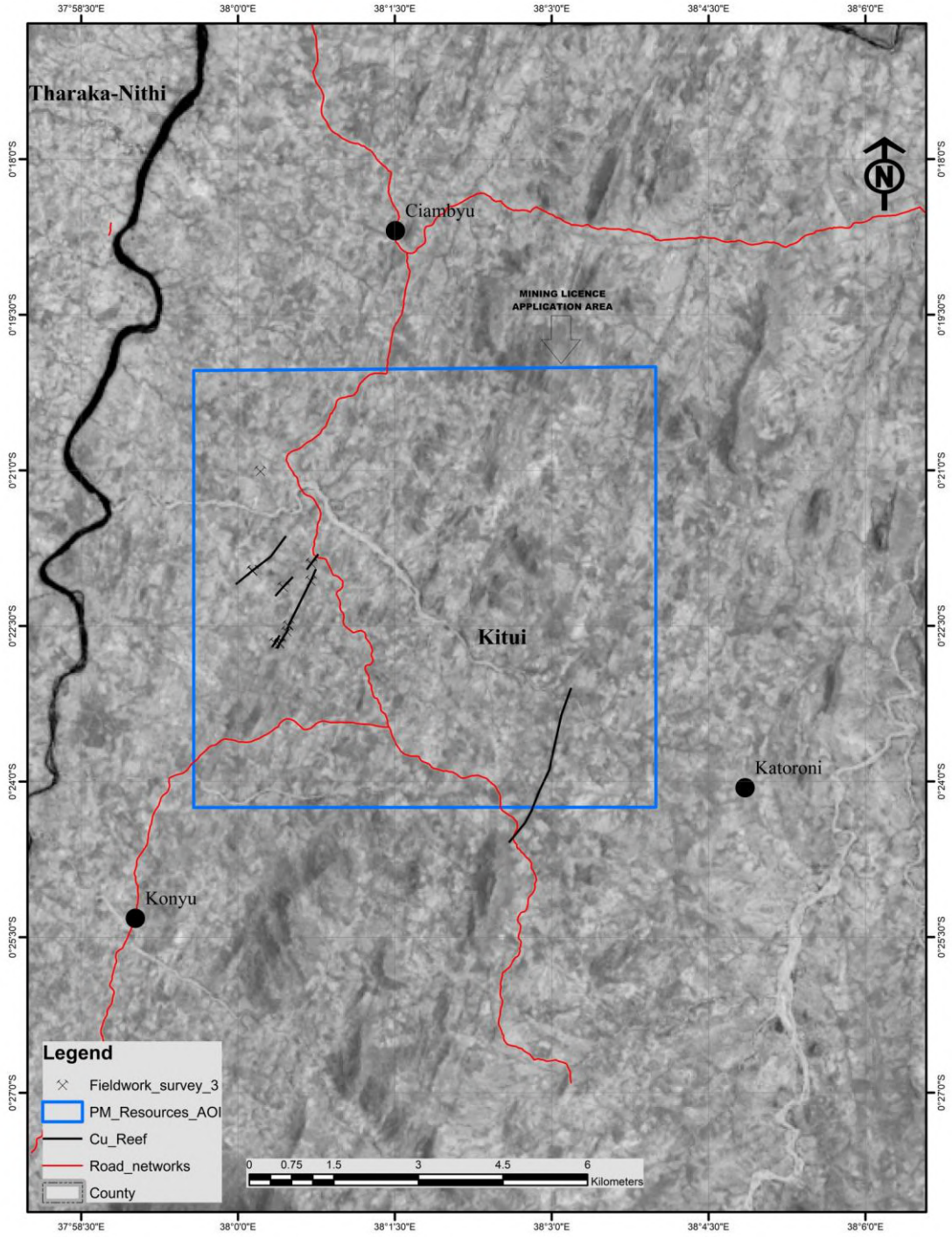

Figure 2: Location of the mining area in Tharaka Ward

3.2 *The Physical Environment*

3.2.1 Topography

The terrain of the project area is generally uneven with a general elevation of 677m above sea level. The main relief features are the Muumoni hills (Plate 1) including other isolated hilltops. Broadly, the proposed mining area lies within 37^0 59' 34.897'' and 0^0 23' 13.313'' latitudes and longitudes respectively.

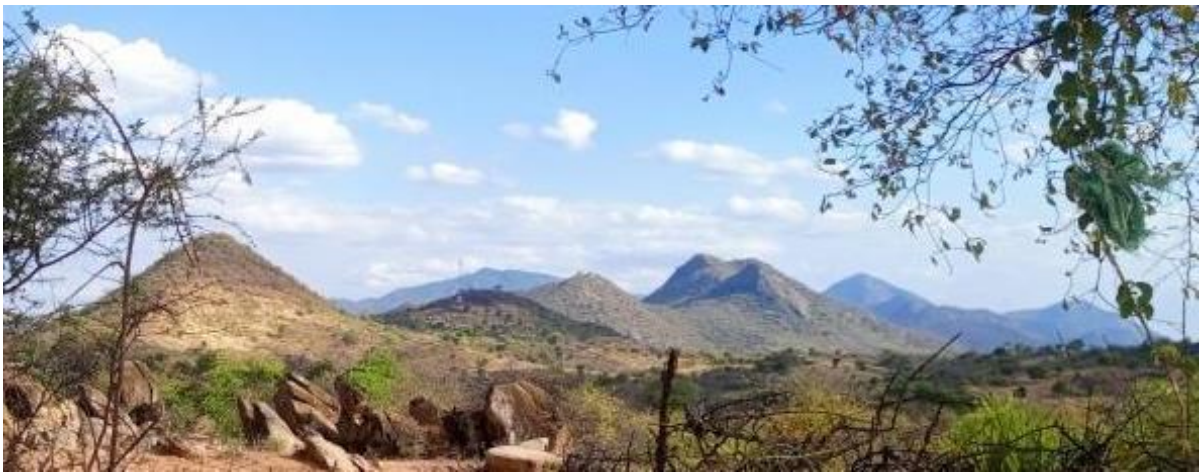

Plate 1: Sections of Muumoni hills at the background of the proposed project site

3.2.2 Climate: Meteorology

The climate in the project area is hot and dry with moderate rainfall typical of arid and semi-arid climatic zone. The project area has two rainy seasons with two peaks in April-May (long rains) and November-December (short rains). The rest of the year is hot and dry. The rainfall ranges from 500 mm to 1050 mm with 40-percent reliability.

Air temperature ranges between 16°C and 34°C with mean maxima of 28°C and minima of 22°C. Relatively lower temperatures are experienced between June and August while high temperatures are experienced in January-March and September-October, peaking just before the onset of rains. The highest temperatures (of the order 34°C) are experienced in February. The prevailing wind is generally easterly. Wind speed is approximately 15 km hr^{-1}.

3.5 Hydrology and Water Resources

The project area largely depends on water from water pans and rivers. Though boreholes exist, the water quality is poor due high mineral content thus making it unsuitable for most

of the domestic uses. Roof catchment water harvesting in homesteads also acts as key source of water.

Generally, the proposed project area has scarce water resources due to erratic and unreliable rainfall regime. Due to poor land use practices, land has been rendered bare and soil compaction is prevalent due to overgrazing activities. As such, during rain seasons, water is lost as surface run-off to neighbouring streams. The streams and rivers form part of the drainage pattern of the area.

All the streams in the project site drains into Katse river which subsequently drains into Tana river. The river flows in the project area neighbourhood are characterised by very low flows (base flows) in dry season and high flows during rainy seasons, i.e. April-May and November-December. Most of the ephemeral streams generally become dry within one month after the rainy season (Borst and De Haas, 2006). The flows are usually fast and turbid due to high sediment concentration associated with soil erosion in the catchment area.

Plate 2: Sections of a small seasonal stream at the proposed project site environs

Shallow wells have also been constructed along seasonal streams. Such wells provide water for domestic and livestock consumption. Sand dams have, also, been constructed along rivers near the project site. The rivers, earth dams, shallow wells, sand dams and boreholes play a significant role in providing water to the local community particularly

during the dry seasons. However, most of the dams are small and dry up during the extended dry seasons due to the high water abstraction and evaporation rates.

3.2.3 Soils

The proposed project area is overlain by red well drained sandy loam soils which have quartz and feldspar grains and felsic gravel rock fragments. The soil depths (thickness) vary from between 1m (upslope) at the project site to nearly 2.0m at the downslope. Generally, soil types include nitisols which are well drained, porous, with high moisture and stable structure, vertisols characterized by pockets of Black cotton, poor drainage, high organic matter and andosols which are well drained, porous and contain high organic matter.

3.2.4 Geology

Copper ore veins characterize the proposed project site and the larger Tharaka ward. The project site has a similar geology composed of high grade regional metamorphic granitoid granulites which are composed of quartz and feldspars (over 90%) and mafic hornblende and pyroxenes (about 10% or less). The rocks have good quality engineering properties comparable to those of granites which support any heavy engineering structures.

3.2.5 Current land use of the project site and adjacent properties

The area falls under ecological zones IV and V. Zone IV is land with less potential for agriculture and carries essentially savannah woodland with an annual rainfall ranging 500-800mm. Zone V is typically rangeland dominated by *Commiphora* and *Acacia* species and bushes. The project site is predominantly agropastoral. Rain-fed agriculture is a challenging venture due to erratic and unreliable rainfall regime. However, the savannah woodland plant formation is suitable for pastoral activities. Many residents practice subsistence and commercial livestock farming (Plate 3) though the livestock is occasionally wiped out by periodic droughts.

The socio-economic activities in the proposed mining site are rainfed agriculture and livestock farming. The main crops targeted for agriculture include maize, green grams, beans, and assorted fruit species such as *Mangifera indica* (mango), *Carica papaya* (paw paw), *Psidium guajava* (Guavas) among others. Livestock keeping is practiced with goats,

cows, donkeys among others being the main players. Mineral deposits especially copper ore exist in most of the sections of Tharaka ward.

Plate 3: Livestock keeping at the proposed project environs

3.3 Biological environment

3.3.1 Biodiversity

The proposed project area and its environs are rich in biodiversity particularly flora. The flora will be affected by moderately by the proposed mining of copper. Minimal wildlife particularly small game exists at the proposed project site. The wildlife will not be affected by the proposed copper mining. Hilltops such as Muumoni hills form biodiversity hotspots in the neighbourhood of the project area and the larger Kitui County. Over 748 different vascular plant species in 116 families and 420 genera have been recorded in Kitui and Mwingi regions. Such high plant diversity is remarkable as it represents close to 15% of the dryland flora in Kenya, and way above the well-known Kakamega rainforest with about 420 plant species (Malonza et al 2006). The neighbourhood hills contribute greatly to diversity of species with domineering families as Leguminosae (Mimosaceae, Papilionaceae, Caesalpiniaceae), Euphorbiaceae, Acanthaceae, Gramineae, Rubiaceae, Compositae, Malvaceae and Labiatae. Common genera include *Acacia, Ficus, Euphorbia, Hibiscus, Crotolaria, Commiphora* and *Combretum species.* The *Ficus* genus is the main riverline vegetation while the acacia is typical of arid and semi-arid region of not only the project site but also the neighboring expansive Yatta plateau.

3.3.2 Vegetation

3.3.2.1 Farm forestry

The project area and its environs are extremely dry hence tree planting in form of farm forestry is limited. Isolated cases of on-farm tree planting were evident on selected farms in the proposed mining area. The on-farm vegetation will not be affected by the proposed copper mining. On-farm trees greatly contribute to the vegetation diversity in the project area and its environs. Farm forestry was characterized agroforestry tree species with a wide range of benefits such as fruits, shade, fodder, live fence, nitrogen fixing, fuelwood, timber among others. Common species in the project area neighbourhood include *Eucalyptus camandukensis Grivellea robusta, Mangifera indica, Morus alba, Psidium guajava, Carica papaya, Tamarindus indica, Vitex payos, Jatropha carcus, Mellea volkensii, Cajanus cajan* among others.

3.3.2.2 Indigenous vegetation

The proposed project site and its neighbourhood are rich in natural vegetation (Plate 4). Some of the indigenous trees will be cleared to pave way for the mining pits. The indigenous vegetation forms typical savannah woodland vegetation at the proposed project sites and their environs. Key indigenous species in the proposed project area and its environs are *Grewia bicolour, Vangueria infausta, Garcinia livingstonei, Acacia tortilis, Acacia mellifera, Acacia seyal, Acacia senegal, Lannea alata, Balanites eagyptica, Acacia xanthophloea, Caesalpinia volkensii, Ficus sur, Acacia seyal, Acacia nilotica, Rubus pinnatus, Caesalpinia decapetala, Maytenus senegalensis, Rhus vulgaris, Sesbania sesban, Euphorbia candelabrum, Terminalia brownii, Plectranthus barbatus, Pappea capensis, Acacia tortilis, Premna resinosa, Zanthoxylum chalybeum, Vangueria apiculata, Vangueria madagascariensis, Cordia africana, Euphorbia turicali, Acacia brevispica* among others. The indigenous species provide a range of benefits to the locals such as fuelwood, timber, poles, posts, vitos, fodder, shade, soil conservation, nitrogen fixing among others.

Plate 4: Indigenous species at the proposed project area

The indigenous vegetation has been negatively impacted by past and present anthropogenic activities in the project site and its environs. Some of the anthropogenic activities recorded include: vegetation clearance to pave way for farming activities, provide fuelwood, construction materials amongst others.

3.3.3 Demographic patterns

The Tharaka Ward, which houses the proposed mining site, has a population of 5,935 (KNBS, 2009). The population in the proposed mining area is sparsely distributed. Broadly, Kitui County has a population of 1,149,332 (KNBS, 2009) and an area of 30,462 km².

There are several religions represented in the project site. The two largest congregations are Catholic and the Protestants. The area has high proportion of females to males (105:100) and a dependency ratio of 100:135. The labour force is robust (47%) with youth comprising 21% of the population. The life expectancy is 52 years as compared to 55 countrywide. More than 50% of the population lives below absolute poverty level. Human activities such as clearing of land for residential structures, agriculture, settlements, charcoal making among others have resulted to land degradation.

3.3.4 Infrastructure development

3.9.1 Roads

The proposed project area is served by a network of feeder roads (Plate 5) which connect it to the Ciambui-Katse road. The road network is in a poor state and is occasionally maintained by the County government of Kitui.

Plate 5: Sections of a feeder road that serves the proposed project area

3.9.2 Electricity

Some sections of the proposed project area and its immediate environs are well supplied with electricity. Shopping centres and institutions within the proposed project site are well supplied with electricity (Plate 6) from the main grid.

Plate 6: Power line supplying electricity to some sections of the project site

3.9.5 Liquid Waste Management

The proposed project area is predominantly agropastoral hence negligible liquid waste is generated. Existing buildings in the project area have storm water management structures. However, as the proposed project becomes operational and other development projects come up, liquid waste generation will increase and call for prudent management. Storm water accumulating in mine pits will form the bulk of liquid waste in the proposed project area

3.9.6 Solid Waste Management

As a predominantly agropastoral area, the proposed project site generates minimal solid waste. However, the proposed project will generate substantial solid waste. Rejected rocks and overburden are expected to form the bulk of solid waste from the proposed project. Such solid waste will be used to backfill open pits open completion of copper mining.

4 RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORK

4.1 Mining policy and Environmental legislation

There has been a clear lack of a formal mining policy in Kenya. Mineral exploitation and mining has been carried under the auspices of the Mining Act, Cap 306 (now the Mining and Minerals Act) administered by the Department of Mines and Geology in the Ministry of Mining. The Department has the responsibility of undertaking geological surveys, geo-scientific research, coordination and regulation of the activities of the mining sector. All un-extracted minerals under or upon any land, as per the Act, are vested in the Government, subject to any rights, which under the Act, have been granted to any other person. The reviewed Mining and minerals Act law provide for lesser discretionary powers to the licensing authorities and hence provide for greater security of tenure. Similarly, there is now a planned mining policy, which will cover environmental protection, local processing, technology transfer and royalties and taxes.

Kenyans laws now require that the resulting open pits be rehabilitated appropriately, so that the natural environment is protected.

4.2 The Mining and Minerals Act, Cap 306

The Act is the main legislative tool that governs the prospecting and extraction of all minerals including quarrying activities in the country. The Act vests all un-extracted minerals under or upon the land in the hand the government. Under the Act, it is an offence for any person to mine without authority. The Act lists areas or land where no person should mine unless with respective authority (Section 7).The proposed site is not near such areas. The Act provides for compensation by the miner for disturbance, nuisance or damage to lawful occupiers of the lands. The Act is however silent on EIA but this is covered by EMCA, 1999 though the two needs to be harmonized.

4.3 Environmental Policy Framework

Environmental Impact Assessment (EIA) critically examines the effects of a project on the environment. An EIA identifies both negative and positive impacts of any development activity or project, how it affects people, their property and the environment. EIA also

identifies measures to mitigate the negative impacts, while maximizing on the positive ones. EIA is basically a preventive process. It seeks to minimize adverse impacts on the environment and reduces risks. If a proper EIA is carried out, then the safety of the environment can be properly managed at all stages of a project-planning, design, construction, operation, monitoring and evaluation as well as decommissioning. The assessment is required at all stages of project development with a view to ensuring environmentally sustainable development for both existing and proposed public and private sector development ventures. The National EIA regulations were issued in accordance with the provisions of Environmental Management and Coordination Act (EMCA) of 1999. The EIA Regulations must be administered, taking into cognizance provisions of EMCA 1999 and other relevant national laws.

4.4 Institutional Framework

At present there are over twenty (20) institutions and departments that deal with environmental issues in Kenya. Some of the key institutions include the National Environmental Council (NEC), National Environment Management Authority (NEMA), the Kenya Forest Service, Kenya Wildlife Services (KWS) and others.

4.4.1 National Environment Management Authority (NEMA)

The objective and purpose for which NEMA is established is to exercise general supervision and co-ordinate over all matters relating to the environment and to be the principal instrument of the government in the implementation of all policies relating to the environment. However, NEMA mandate is designated to the following committees:

4.4.2 National Environment Council (NEC)

EMCA 1999 No. 8 part iii section 4 outlines the establishment of the National Environment Council (NEC). NEC is responsible for policy formulation and directions for purposes of EMCA; set national goals and objectives and determines policies and priorities for the protection of the environment and promote co-operation among public departments, local authorities, private sector, non-governmental organizations and such other organizations engaged in environmental protection programmes.

4.4.3 National Shelter Strategy to the Year 2000

This strategy followed the international Year of shelter for the homeless in 1987 and was formulated to advocate a change in policy in order to allow other actors to come in and assist the government in providing housing. The government was to simply facilitate other actors such as the proposed borehole project developers to invest in shelter.

4.4.4 The National Poverty Eradication Plan (NPEP)

The NPEP has the objective of reducing the incidence of poverty in both rural and urban areas by 50 percent by the year 2015; as well as strengthening the capabilities of the poor and vulnerable groups to earn income.

4.5 Environmental Legal Framework

Environmental Management and Co-ordination Act No. 8 of 1999, provide a legal and institutional framework for the management of the environmental related matters. It is the framework law on environment, which was enacted on the 14th of January 1999 and commenced in January 2002. Topmost in the administration of EMCA is National Environment Council (NEC), which formulates policies, set goals, and promotes environmental protection programmes. The implementing organ is National Environment Management Authority (NEMA). EMCA comprises of the parts covering all aspects of the environment.

Part VIII, section 72 of the Act prohibits discharging or applying poisonous, toxic, noxious or obstructing matter, radioactive or any other pollutants into aquatic environment. Section 73 requires that operators of projects, which discharge effluent or other pollutants, submit to NEMA accurate information about the quantities and quality of the effluent. Section 74 demands that all effluent generated from point sources are discharged only into the existing sewages system upon issuance of prescribed permit from the Local Authorities. Figure 3 below shows the EMCA Institutional Framework.

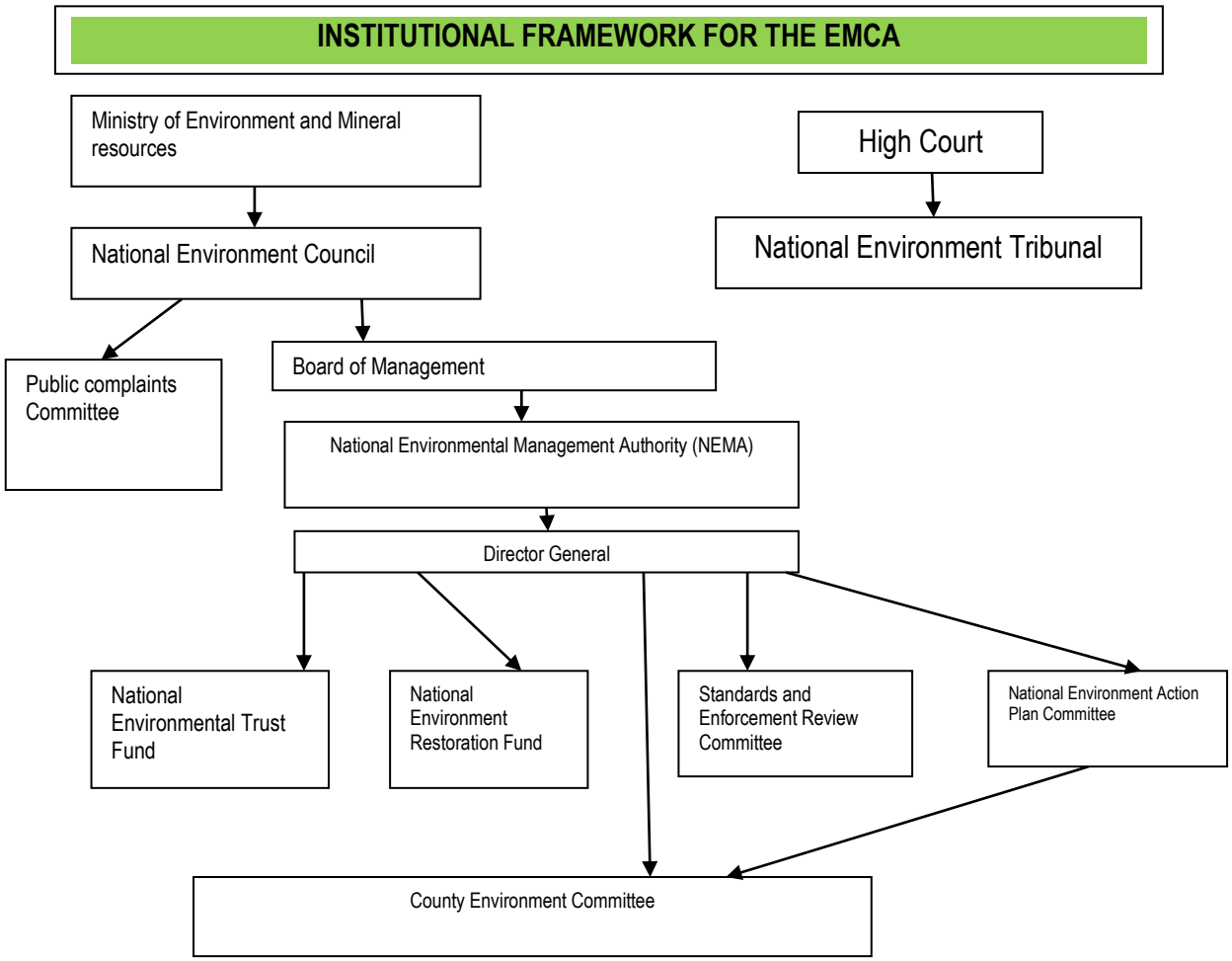

Figure 3: The EMCA, 1999 Institutional Framework

4.5.1 The Mining Act 2016

Part vi (general provisions on mineral rights) of the Act states in part that "The Cabinet Secretary, on the recommendation of the Mineral Rights Board, may grant, deny or revoke a mineral rights. A mineral right may be granted in respect of a large scale operation or small scale operation. According to the Act, the licenses and permits may be granted for a mineral right under this Act to authorize a mineral right holder to engage in large scale operations which shall include reconnaissance license, a prospecting license, a retention license and a mining license or small scale operations, which shall include a prospecting permit or a mining permit."

Our client is proposing to carry out small scale mining. Apart from adhering to the other provisions of the Act, he is expected to obtain a mining permit for full compliance.

4.5.2 Public Health Act (Cap. 242)

Part IX, section 115, of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires that Local Authorities take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 as waste pipes, sewers, drains or refuse pits in such state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to health.

4.5.3 Physical Planning Act, 1999

The Local Authorities are empowered under section 29 of the Act to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section, therefore allows for the prohibition or control of the use and development of land and buildings in the interest of proper and orderly development of an area.

Section 30 states that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective Local Authority.

4.5.4 Electricity Power Act No. 11 of 1997

The Electric Power Act No. 11 enacted in 1997 deals with generation, transmission, distribution, supply and use of electrical energy as well as the legal basis for establishing the systems associated with these purposes. In this respect, the following environmental issues will be considered before approval is granted:

1. The need to protect and manage the environment, and conserve natural resources;
2. The ability to operate in a manner designated to protect the health and safety of the project employees; the local and other potentially affected communities.

Under schedule 3 of the Electric Power (licensing) Regulations 2003, it is mandatory to comply with all safety, health and environmental laws. Moreover, schedule 2 (regulation 9) of the Electric Power (licensing) Regulations 2003 stipulates that licensing and authorization to generate and transmit electrical power must be supported by the following documents that are approved by NEMA.

1. Environmental Impact Assessment Report (EIA) or
2. Initial Environmental Audit Report (IEA) and
3. Environmental Management Plan (EMP)

4.5.5 Penal Code Act (Cap.63)

Section 191 of the penal code states that if any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same Act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons /institution, dwelling or business premises in the neighbourhood or those passing along public way, commit an offence.

4.5.6 Way leaves Act Cap 292

According to the Way leaves Act cap 292 Section 2, Private land does not include any land sold or leased under any Act dealing with Government lands. Section 3 of the Act states that the Government may carry any sewer, drain or pipeline into, through, over or under any lands whatsoever, but may not in so doing interfere with any existing building. Section 8 further states that any person who, without the consent of the Permanent Secretary to the Ministry responsible for works (which consent shall not be unreasonably withheld), causes any building to be newly erected over any sewer, drain or pipeline the property of the Government shall be guilty of an offence and liable to a fine of one hundred and fifty shillings, and a further fine of sixty shillings for every day during which the offence is continued after written notice in that behalf from the Permanent Secretary; and the Permanent Secretary may cause any building erected in contravention of this section to be altered, demolished or otherwise dealt with as he may think fit, and may recover any expense incurred by the Government in so doing from the offender.

4.5.7 The Land Registration Act, 2012

The Land Registration Act is place to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes. This Act applies to Subject to section 4, this Act shall apply to:

(a) Registration of interests in all public land as declared by Article 62 of the Constitution;

(b) Registration of interests in all private land as declared by Article 64 of the Constitution; and

(c) Registration and recording of community interests in land.

Section 24 states that: (a) the registration of a person as the proprietor of land shall vest in that person the absolute ownership of that land together with all rights and privileges belonging or appurtenant thereto; and (b) the registration of a person as the proprietor of a lease shall vest in that person the leasehold interest described in the lease, together with all implied and expressed rights and privileges belonging or appurtenant thereto and subject to all implied or expressed agreements, liabilities or incidents of the lease.

4.5.8 The Environment and Land Court Act, 2011

This Act is in place to give effect to Article 162(2) (*b*) of the Constitution; to establish a superior court to hear and determine disputes relating to the environment and the use and occupation of, and title to, land, and to make provision for its jurisdiction functions and powers, and for connected purposes.

4.5.9 The National Land Commission Act, 2012 (No. 5 of 2012)

Section 5 of the Act outlines the Functions of the Commission, pursuant to Article 67(2) of the Constitution as follows 5(1):-

(*a*) to manage public land on behalf of the national and county governments;

(*b*) to recommend a national land policy to the national government;

(*c*) to advise the national government on a comprehensive programme for the registration of title in land throughout Kenya;

(*d*) to conduct research related to land and the use of natural resources, and make recommendations to appropriate authorities;

(*e*) to initiate investigations, on its own initiative .or on a complaint, into present or historical land injustices, and recommend appropriate redress;

(*f*) to encourage the application of traditional dispute resolution mechanisms in land conflicts;

(*g*) to assess tax on land and premiums on immovable property in any area designated by law; and

(*h*) to monitor and have oversight responsibilities over land use planning throughout the country.

4.5.10 The Land Act, 2012

This is an Act of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes. Part viii of this Act provides procedures for compulsory acquisition of interests in land. Section 111 (1) states that if land is acquired compulsorily under this Act, just compensation shall be paid promptly in full to all persons whose interests in the land have been determined. The Act also provides for settlement programmes. Any dispute arising out of any matter provided for under this Act may be referred to the Land and Environment Court for determination. The proponent has acquires land for the proposed project in accordance with this Act.

4.5.11 The Environment Management and Coordination Act (2015)

The Environmental Management and Coordination Act, 1999 came into force on 14th January 2000. Its overall objective is to provide for the establishment of an appropriate legal and institutional framework for the management of the environment. The Act provides framework legislation for several statutes in Kenya, which contain environmental provisions, and has direct relevance to the existing development. The Act entitles every person in Kenya to a clean and healthy environment.

Though there are other sectoral laws on environmental conservation, this is the supreme Act. It provides guidelines on issues of environment, stipulates offences and penalties and

establishes NEMA. The second schedule of the Act lists the type of projects, which must be subjected to the EIA. The proponent appointed experts to conduct the EIA project report to seek approval before implementation as required by NEMA.

4.5.12 The Environment (Impact Assessment And Audit) Regulations, 2019

In exercise of section 147 of the EMCA, the Minister made these regulations which have provided the framework for carrying out EIAs and EAs in Kenya. This EIA project report is conducted in conformity with these regulations and EMCA, 2015.

4.5.13 The Environmental Management and Co-ordination (Water Quality) Regulations, 2006

These regulations set the standards of domestic water and waste-water. The regulations are meant for pollution control and prevention and provides for protection of water sources. *The miner is advised to exercise maximum caution to avoid interference with the any water resource in the project environs.*

4.5.14 Environmental Management and Co-ordination (Waste Management) Regulations 2006

This regulation defines the responsibilities of waste generators and stipulates the duties and requirements for transportation and disposal of waste. It provides for mitigation of pollution and provides for hazardous and toxic wastes. The regulations require a waste generator to dispose waste only to a designated waste receptacle. The proposed project will generate toxic waste in form of spent oil and tyres. This will be disposed-off as per the provision of this act. It will also generate non-toxic waste in form of gravel, quarry chips and quarry aggregate. These will be kept in a separate site near the pits and will be used to backfill the mined pit during decommissioning phase. The proponent therefore will comply with these regulations.

4.5.15 The Explosives Act (Cap 115)

The Act regulates the purchase, assemblage, manufacture and use of explosive materials. Explosives are used routinely in many quarries for blasting and lessening of rocks. The Act also stipulates conditions for use, precautionary measures and storage requirements. The

Act requires one to seek authority to acquire, transport and use blasting materials. The Act makes it an offence liable for penalties to any person causing an explosion where life or property is endangered.

4.5.16 Public Health Act – (Revised 1986)

The primary purpose of this Act is to secure and maintain public health. Some of its provisions relevant to this project include prohibition of nuisance activities such as dust or noise or other condition deemed to the injurious or dangerous to health. Under this Act, every health authority or local authority is mandated to take all lawful, necessary and reasonably practicable measures to prevent all injurious conditions in premises, construction condition or manner of use of any trade premises.

4.5.17 Water Act, 2016

The Act deals with control and conservation of water resources. It prohibits activities that may cause pollution to sources of water likely to be used for human consumption or domestic use or in the manufacture of food for human consumption. There is no river or surface water near the proposed project site therefore; the surface water is not at a risk of pollution. Adequate measures are also adapted to control erosions and runoff that may affect the quality of water.

4.5.18 The Traffic Act

This regulates emissions from motor-vehicle engines whether stationary or mobile, with regard to air pollution management. The Act is applicable thus to trucks, generators, compressors, stone cutting machines and other fuel-oil engine machinery used at the proposed excavation and mine sites.

4.5.19 The Workman's Compensation Act, Cap 236

In its Third Schedule, the Act Specifies the nature of occupations and the diseases they can cause. The Act lists a number of chemicals, which are likely to cause diseases. The list has been found to be too restrictive in light of the fact that presently there are literally thousands of chemicals; hence, the list should be substituted with a more comprehensive

one. Furthermore, the Act is insufficient in giving levels of concentrations, which could be injurious.

4.5.20 Employment Act No 11 of 2007

The Act is enacted to consolidate the law relating to trade unions and trade disputes, to provide for the registration, regulation, management and democratization of trade unions and employers organizations and federations. Its purpose is to promote sound labour relations through freedom of association, the encouragement of effective collective bargaining and promotion of orderly and expeditious dispute the protection and promotion of settlement conducive to social justice and economic development for connected purposes. This Act is important since it provides for employer – employee relationship that is important for the activities that would promote management of the environment within the energy sector.

4.5.21 Labour Institutions Act No. 12 of 2007

The purpose of the Act is to establish labour institutions and to provide for their function, powers and duties. The Act provides for the establishment of National Labour Board, which provides advice to the Minister on all matters concerning employment and labour.

4.5.22 Penal Code Cap 63

Section 191 of the penal code states that if any person or institution that voluntarily corrupts or foils water from public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same act says a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons/institution, dwelling or business premises in the neighbourhood or those passing along public way, commit an offence.

4.5.23 Building Code 1997

Such plans are expected to provide for public buildings and factories among others. The By-Laws covers factory chimney shafts, stairs, lifts, rain water disposal, refuse disposal, ventilation of buildings, drainage, sanitary conveniences, sewers, septic and conservancy tanks, fire and means of escape in case of fire. Compliance with this Act in up scaling of

power supply is necessary. Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local authority for a permit to connect to the sewer line and all the wastewater must be discharged into sewers. The code also prohibits construction of structures or buildings on sewer lines and under power lines.

The Proponent shall comply with the provisions of the Code in seeking the required authorizations from the Local Authorities as stipulated.

4.5.24 OSHA's General Industry Standards

A number of occupational activities performed in construction and operation of mine sites fall under OSHA's General Industry Standards. Contractors must be aware of the following regulations in order to stay compliant.

4.5.24.1 The Right-To-Know Law

The Right-To-Know Law, officially known as The Hazard Communication Standard. Its purpose is to ensure that hazards in the workplace are identified and evaluated, and that the information concerning these hazards is communicated to both employers and employees. This transfer of information is to be accomplished by means of a comprehensive hazard communication program that includes container labeling and other forms of warning including Safety Data Sheets (SDSs) and employee training.

4.5.24.2 Personal Protective Equipment (PPE) Standards

A key component of the PPE Standard is the hazard assessment of the work area as required under the General Requirements. According to OSHA, Hazard Assessment and Equipment Selection states that the employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment. If the assessment determines that hazards are present, or likely to be present, the employer shall:

- Select and have each affected employee use PPE that will protect from the identified hazards
- Inform each affected employee of the selection decision
- Select PPE that properly fits each affected employee

- Document that the hazard assessment has been performed through a written certification that identifies the workplace evaluated; the person certifying that the evaluation has been performed; the date(s) of the hazard assessment

In addition, the employer is also required to train the affected employees on the proper use of the selected PPE

4.5.24.3 Respiratory Protection Program

This program ensures that all employees are properly protected from respiratory hazards. According to the standards, creating and maintaining an individualized written respiratory protection program is the responsibility of all employers who provide respirators to their employees. The program must be administered by a suitably trained program administrator.

When establishing a Respiratory Protection Program, the blaster must first identify what airborne contaminants are present. The SDS required under the Hazard Communication Standard contains this important information. Once the contaminants are identified, the blaster will need to conduct air monitoring to determine whether employee exposures exceed OSHA's permissible exposure limit (PEL) for the identified contaminant(s). The established PEL(s) are also printed on the SDS.

If, after conducting the air monitoring, the employer determines contaminant concentrations are above the PEL, the employer must implement engineering controls (ventilation systems) or administrative controls (job rotations) to reduce the employee exposure. If neither of these options are feasible, the employer must then provide appropriate respiratory protection to the employee.

4.5.24.4 Eye/Face and Wash/Shower Requirements

When it comes to emergency eye/face wash and shower requirements, OSHA has two different types of regulations, general and specific. This standard states where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the area for immediate emergency use. This Emergency Eye Shower and Wash Equipment standard aids employers in selecting and installing emergency equipment to meet OSHA requirements

4.5.24.5 Medical and First Aid Regulations

In 1998, OSHA revised its Medical Services and First Aid regulation. The revision states; In the absence of an infirmary, clinic, or hospital in near proximity to the workplace which is used for the treatment of all injured employees, a person or persons shall be adequately trained to render first aid. Adequate first aid supplies shall be readily available. Included in the revision was Appendix A, a non-mandatory guideline that contains examples of minimal contents for first aid kits.

The regulation identifies the fill content that should be adequate for small worksites. The employer is responsible for determining the need for additional first-aid kits, quantities and the types of supplies at the worksite for large/larger worksites

4.5.25 Occupational Safety and Health Act (OSHA 2007)

Before any premises are occupied, or used a certificate of registration must be obtained from the chief inspector. The occupier must keep a general register. The Act covers provisions for health, safety and welfare.

4.5.25.1 Health

The premise must be kept clean, daily removal of accumulated dust from floors, free from effluvia arising from any drain, sanitary convenience or nuisance and without prejudice to the generality of foregoing provision. A premise must not be overcrowded, there must be in each room 10 meters of space for each employee, not counting space 14 feet from the floor and a 9 feet floor-roof height.

The circulation of fresh air must secure adequate ventilation of workrooms. There must be sufficient and suitable lighting in every part of the premise in which persons are working or passing. There should also be sufficient and suitable sanitary conveniences separate for each sex, must be provided subject to conformity with any standards prescribed by rules. Food and drinks should not be partaken in dangerous places or workrooms.

Provision of suitable protective clothing and appliances including where necessary, suitable gloves, footwear, goggles, gas masks, and head covering, and maintained for the use of workers in any process involving expose to wet or to any injurious or offensive substances.

4.5.25.2 Safety

Fencing of premises and dangerous parts of other machinery is mandatory. Training and supervision of inexperienced workers, protection of eyes with goggles or effective screens must be provided in certain specified processes. Floors, passages, gangways, stairs, and ladders must be soundly constructed and properly maintained and handrails must be provided for stairs.

Special precaution against gassing is laid down for work in confined spaces where persons are liable to overcome by dangerous fumes. Air receivers and fittings must be of sound construction and properly maintained. Adequate and suitable means for extinguishing fire must be provided in addition to adequate means of escape in case of fire must be provided.

4.5.25.3 Welfare

An adequate supply of both quantity and quality of wholesome drinking water must be provided. Maintenance of suitable washing facilities, accommodation for clothing not worn during working hours must be provided. Sitting facilities for all female workers whose work is done while standing should be provided to enable them take advantage of any opportunity for resting.

Section 42 stipulates that every premise shall be provided with maintenance, readily accessible means for extinguishing fire and person trained in the correct use of such means shall be present during all working periods.

Section 45 states that regular individual examination or surveys of health conditions of industrial medicine and hygiene must be performed and the cost will be met by the employer. This will ensure that the examination can take place without any loss of earning for the employees and if possible within normal working hours.

Section 55B provides for development and maintenance of an effective programme of collection, compilation and analysis of occupational safety. This will ensure that health

statistics, which shall cover injuries and illness including disabling during working hours, are adhered.

4.5.26 The Kenya Roads Act

An Act of Parliament to provide for the establishment, powers and functions of the Kenya Roads and for connected purposes. The Act provides for Kenya National Highways Authority) Regulations, 2013. The following Regulations apply under the Hire services for bridges.

(1) The Authority may, on request by a person, hire out to the person a modular bridge for temporary crossing.

(2) A person who hires a modular bridge from the Authority for temporary crossing shall pay to the Authority hiring charges at the rate of twenty five thousand per metre per month or any amount not exceeding twenty five thousand per metre per month.

(3) The hirer shall execute a bank guarantee equivalent to ten percent of the total hire amount which shall be refundable on delivery of the bridge in a good condition to the Authority at the end of the lease period.

(4) The hirer shall be responsible for the repair or replacement of the bridge in case of any damage occasioned to the bridge for the duration of the lease period,

(5) The Authority shall determine the extent of damage that may require replacement by the hirer.

4.5.27 The National Construction Authority Act, 2011, No. 41 Of 2011

An Act of Parliament to provide for the establishment, powers and functions of the National Construction Authority and for connected purposes. The Act provides the following:

(1) The object for which the Authority is established is to oversee the construction industry and coordinate its development.

(2) Without prejudice to the generality of subsection (1), the Authority shall— 2011 *National Construction Authority* No. 41 7:-

(a) Promote and stimulate the development, improvement and expansion of the construction industry;

(b) Advise and make recommendations to the minister on matters affecting or connected with the construction industry;

(c) Undertake or commission research into any matter relating to the construction industry;

(d) Prescribe the qualifications or other attributes required for registration as a contractor under this act;

(e) Assist in the exportation of construction services connected to the construction industry;

(f) Provide consultancy and advisory services with respect to the construction industry;

(g) Promote and ensure quality assurance in the construction industry;

(h) Encourage the standardization and improvement of construction techniques and materials;

(i) Initiate and maintain a construction industry information system;

(j) Provide, promote, review and co-ordinate training programmes organized by public and private accredited training centers for skilled construction workers and construction site supervisors;

(k) Accredit and register contractors and regulate their professional undertakings;

(l) Accredit and certify skilled construction workers and construction site supervisors;

(m) Develop and publish a code of conduct for the construction industry, and

(n) Do all other things that may be necessary for the better carrying out of its functions under the act.

4.5.28 Planning and Building Regulations, 2009

These Regulations cover provisions for national, regional and local physical planning, siting, site operations, building design, building and infrastructure services, disaster risk management on construction sites and maintenance of all buildings as contained in these Regulations. The regulations have the following provisions:

(a) An application shall be made to The Authority by the land owner for authorisation to commence land planning and or plot sub-division.

(b) No person shall design or cause to be designed any building on land where land development plans have not been approved in accordance with these Regulations.

(c) Any person who contravenes the provisions of this Regulation shall be guilty of an offence

4.5.28 Forests Conservation and Management Act 2015

The Act highlights the integration of the community on the management, utilization and conservation of forests and its resources. It prohibits wanton destruction of the forests. The contractor is expected to adhere by the provisions of this Act.

4.5.29 More General provisions from the Mining Act

When the holder of any exclusive prospecting license or location granted under this Act discovers on any land comprised in such license or location any minerals of economic value other than those for which the license was granted or location was registered, he shall immediately report the discovery thereof to the Commissioner. Payment of compensation to owners and occupiers of land

Whenever, in the course of prospecting or mining operations, any disturbance of the rights of the owner or lawful occupier of any lands or nuisance or damage to such lands or to any crops, trees, buildings, stock or works thereon is caused, the holder of the prospecting right, exclusive prospecting license or location under which such operations are or were carried out, and his successors in title thereto, shall be liable, on demand duly made, to pay to such owner or occupier fair and reasonable compensation for such disturbance or nuisance or damage, as the case may be, according to their respective rights or interests (if any) in the property concerned.

(2) (a) If such a person or his successor in tide fails to pay compensation when demanded under subsection (1), or if an owner or occupier is dissatisfied with the compensation offered, such an owner or occupier may, within one month of such a demand having been made, refer the matter to the court.

(b) The court shall assess and determine the amount of compensation to be paid.

(3) The sum awarded shall be paid by such holder or successor in title, as the case may be, to the person entitled thereto within fourteen days of the date on which the amount of the final award is notified to such holder or such successor in title, as the case may be, or shall pending the disposal of any appeals thereon be paid into court.

4.5.29.1 Grant of leases

The Commissioner may in respect of land for the time being vested in or on behalf of the Government grant a lease to the holder of a location, or to any person whose agent is the holder of a prospecting right in respect of that location issued lo him as such agent, in respect of the whole or any part of the area covered by any such location and upon such terms and conditions as he may determine.

5 PUBLIC PARTICIPATION AND CONSULTATION

5.1 Introduction

Public consultation and participation process is a policy requirement by the Government of Kenya and a mandatory procedure as stipulated by EMCA 1999 (2015, Amended Act) section 58, on Environmental Impact Assessment for the purpose of achieving the fundamental principles of sustainable development. Therefore, this chapter describes the process of the public consultation and public participation followed to identify the key issues and impacts of the proposed project. The objective of the consultation and public participation was to:

- Disseminate and inform the stakeholders about the project with Special reference to its key components and location.
- Gather comments, suggestions and concerns of the interested and affected parties about the project.
- Incorporate the information collected in the EIA study

In addition, the process enabled,

1) The establishment of a communication channel between the general public and the team of consultants, the project proponents and the Government.
2) The concerns of the stakeholders be known to the decision-making bodies at an early phase of project development

5.2 Methodology used in Public consultation

The exercise was conducted by a team of experienced registered environmental experts and field assistants. The following process in carrying out the entire public consultation was involved:

- Key informant interviews and discussions
- Field surveys and observations
- Completion of the pre-designed questionnaires which captured all the phases of the proposed development
- Public meeting

- Key stakeholders' meeting

The purpose for such interviews was to identify the positive and negative impacts and subsequently promote proposals on the best practices to be adopted and mitigate the negative impacts respectively. It also helped in identifying any other miscellaneous issues, which may bring conflicts in case project implementation proceeds as planned. The information gathered enabled the identification of the specific issues from the stakeholders' response, which provided the basis upon which the aspects of the Environmental Impact Assessment was undertaken.

5.3 Public Participation and Consultative Meeting

A public participation and consultative meeting (Plate 7 and Table 1) was held at the project site on 17th August 2023. The members of the public gave their views and opinions concerning the proposed project. The meeting had a total of 121 (55 males and 66 females) participants from the project locality. Out of 121 participants, 56 youth attended the public participation and consultative meeting (See annexed attendance register).

The public meeting brought together members of the local community, local leadership and other stakeholders with interest in the project. Further, household surveys were conducted. The exercise was conducted via interviews under the guidance of questionnaires developed to capture the concerns, comments and issues that the stakeholders, neighbours and business people around the project site have regarding the proposed project. Information from the public meeting and questionnaires allowed for the synthesis and analysis of issues that arose. The list of public meeting participants is shown in the Table 1 below and the questionnaires administered as well signed list of public meeting participants are attached at the appendix of this report.

Table 1: List of Public meeting participants

S/N	Name	ID/Phone No.
1.	Angelica Mwalya	0705393602
2.	Mary K. Kitundumo	0704613655
3.	Erustus M. Makinyi	0710515813
4.	Lucy Kariuki	0711642949
5.	Josephine Gatiria	0742065093
6.	Purity Gakii	0795346372
7.	Deborah Karuri	0705950557
8.	Purity Gakii	0757267535
9.	Ruth Kariuki	0799565689
10.	Ruth Munanie	0710424918
11.	Mercy Munywoki	0742700036
12.	Muthoni Mutemi	0748739992
13.	Doreen Mureri	0793961026
14.	Beatrice Kangaria	0791716117
15.	Miriam Karithi	0742065082
16.	Catherine Migendi	0113123558
17.	Lenah Gitonga	0110677765
18.	Susan Mwendwa	0742065088
19.	Purity Karithi	0702689499
20.	Elizabeth Ntungu	
21.	Tabitha Kavekye	0790485044
22.	David Muthengi	0705574886
23.	Mwanzia M.Rwejia	0700649092
24.	Mary G.Mwinzanthi	0727325169
25.	Muufa Nyaga	0748190410
26.	Juchua Munyambu	12772042
27.	Joseph Kithumbi	
28.	Newton Magondu	30370942
29.	Joyce Mwikali	0742065084
30.	Zakaria Nyaeri	0740573032
31.	John Kirema Mbui	0727048052
32.	John Kithomo Njeru	0796694089
33.	David Mucurna Kirema	0711449219
34.	Iguna Njeru	3735288
35.	John Muthengi	24991530
36.	Jonthan Rwanda	24185044
37.	Sammy Muriungi	05094548
38.	Kithuku Joel	0725570160
39.	Japheth Kilonchi Kakiri	0705472241
40.	Jackson Mutemi	0740888024
41.	Kimathi Makungi	0706653142
42.	Stephen Nthunga Musee	0110372335
43.	Joseph Nyaga	7727698

44.	Daniel Kibera Mucee	3604721
45.	Alice Kambura Kathandi	0710399793
46.	Josepat Muriungi	
47.	John Munywoki	0703237387
48.	Ribert Mbiti	0114878804
49.	Geoffrey Gitonga	20150044
50.	Kirogi Mihere	37266
51.	Caxton Mule	0768218493
52.	Gitonga Kitondo	3604826
53.	Mukundi Makunyi	0768218493
54.	Mutegi Makunyi	3604826
55.	Peter Tom	0714019949
56.	Marigu Kiambati	0701761472
57.	Murithi Njeru	0790225089
58.	Mauka Mwithi	25034451
59.	Peter Mwangangi	24289627
60.	Murithi Kirimo	31325482
61.	Musa Murithi	29583639
62.	John Mbuvi	0718550794
63.	Stephen Mutegi	27594278
64.	Baraka Mucomba	38574267
65.	Mpurya Kironcho	0712384889
66.	Mutemi Mucee	0115850673
67.	Reuben Mwathi	34483371
68.	Peter M.Mucee	23497365
69.	Muthengi Mutiria	12447042
70.	John Muchiri	20980480
71.	Mutiria Mucee	9931599
72.	Juiana Gacue	274422647
73.	Lucy Gacumbi	25010302
74.	Lyn Ngute	26906330
75.	Magoci Mutiria	20170156
76.	Margaret Ndanu	20208801
77.	Pauline Kathini	20208801
78.	Mary Gatiria	25026995
79.	Mary Kithome	32234443
80.	Dorcas Makena	31555505
81.	Mukwanyaga Kyambati	3752719
82.	Sarah Muthoni	31384172
83.	Regina Kanyua	23498432
84.	Mercy Kathangaru	37334078
85.	Dorcus Mwangangi	38322184
86.	Rael Makasi	0757025675
87.	Charity John	0797906724
88.	Evangeline Gasyoka	0745642668

89.	Murimi Kiria	35439414
90.	Kageni Mwiti	36232995
91.	Hellen Muthoni	40457707
92.	Mwangangi Mucee	
93.	Mwathi mucee	
94.	Rhodah Munanye	3739641
95.	Mercy Munyokis	36170138
96.	Kagende Kimathi	34530545
97.	Josephine Ciandige	
98.	Carolyine Getima	24995754
99.	Peninah Muthoni	35219424
100.	Icumbi Kijiro	9753290
101.	Hellen Gacumbi	S2635690
102.	Josephine Kathomi	0723297593
103.	Reginah Gandige	27593825
104.	Gatiria Kironchi	31293322
105.	Gatiria Kithetu	12447099
106.	Purity Mutemi	31383280
107.	Rose Kathini	26691188
108.	Mercy Vundi	37778131
109.	Jericah Gamiti	0749388810
110.	Cecelia Kayira	3605894
111.	Emily M.Muvengei	13444109
112.	Kanyenyu Kirimu	3735058
113.	Tabitha Kanywa	3735071
114.	Mary Karegi	41126886
115.	Patrick M. Kavuli	3605189
116.	Stella K. Gitonga	0740442433
117.	Jeniffer Karithi	0727758757
118.	Japheth K. Mukuru	0721576149
119.	Joseph M. Mwanbia	0725995764
120.	Joseph N. Kimenchu	0721968377
121.	Dr. Festus Mutiso	0723769694

From the field work, it was apparent that majority of the people interviewed were aware of the proposed project and the direct impacts. The team explained to the participants the likely impacts (positive and negative) expected from the project and the participants in turn gave the team their independent opinions concerning the project. The proposed project was however, well received by the interviewed people as they anticipated numerous impacts both negative and positive alike. The local community people, neighbours, and major stakeholders independently gave their views, opinions, and suggestions as in the

best of their interest and in the interest of the factors that affected the circumstances, influences, and conditions under which their organizations exist.

Plate 7: Public meeting at the proposed project site

5.4 Issues raised by the would be affected community/stakeholders

This Sub-Section covers the views and opinions of the community members. The consultant responded to issues/concerns raised as outlined in table 2 below and as contained in the annexed minutes of the community consultative meeting.

Table 2: Summary of issues raised and responses

S/N	KEY ISSUES RAISED	BRIEF EXPLANATION OF THE ISSUE/OPINION	RESPONSES/OPINIONS
1.	*Job opportunities*	Mr. Joel wanted to know whether job opportunities will be given to the local residents	▪ The consultant informed the participants that the ESIA report will recommend local people be given the first priority in case of job opportunities ▪ The proponent representative informed the participants that the company will work closely with the local people
2.	*Corporate Social Responsibility*	▪ Mr. Erastus Makonyi wanted to know the	▪ The ESIA consultant informed the participants that the proposals on the

S/N	KEY ISSUES RAISED	BRIEF EXPLANATION OF THE ISSUE/OPINION	RESPONSES/OPINIONS
		kind of projects the proponent will undertake as part of CSR	projects to be undertaken as part of CSR should originate from the local people. Such proposals should be discussed by the proponent and the community and come into agreement on what can be implemented.
3.	*Open pits*	▪ Dorcus Makena raised concern that the mining pits can be a risk to livestock such as goats and cows	▪ The ESIA consultant informed the participants that the mining pits should be secured to keep off livestock from falling or accessing the pits
4.	*Relocation of mining pit*	▪ Grace Kanyonyoo wanted to know whether a mining pit can be relocated to avoid destruction of property	▪ The ESIA consultant informed the participants that the proposed project will not entail relocation of people or their property. In instances where the copper ore occurs in built-in areas, the proponent will opt for a new site to avoid property damage unless there is mutual agreement between the two parties
5.	Price of copper ore per ton	▪ Mr. Japheth Kilonzi wanted to know how much the proponent will pay per ton of copper ore	The proponent representative informed the participants that the price of copper ore per ton will be determined by many factors including the quality of the copper ore and prevailing market prices. However, the proponent will be agreeing with the local people on the prices of the

S/N	KEY ISSUES RAISED	BRIEF EXPLANATION OF THE ISSUE/OPINION	RESPONSES/OPINIONS
			copper ore • The consultant informed the participants that there is need for the local people to be organized into a group so that they can have a better bargaining power.
6.	*Formation of community groups*	▪ Dorcus Makena wanted to know how many groups should the community form	▪ The ESIA consultant informed the participants that since there are an already existing group dealing with minerals, it will be easier for community members to join the group.
7.	Negative impacts to neighbours	▪ Mr. Joel Kithuku was concerned that local community neighbouring mining pits will be negatively affected by the mining activity	▪ The ESIA consultant informed the participants that the ESIA report will capture all the likely negative impacts and propose appropriate mitigation measures to be implemented by the project proponent. This will take care of community members who may be neighbouring mining pits.
8.	Mining land consent	▪ Mr. Kimathi Makonya wanted to know whether a land owner can give land consent to two companies	▪ The proponent representative informed the participants that the law does not allow for a land owner to give consent to two companies.
9.	Other Minerals	▪ Mr. John Muthengi wanted to know what happens if the	▪ The proponent representative informed the participants that if the mining company comes across other

S/N	KEY ISSUES RAISED	BRIEF EXPLANATION OF THE ISSUE/OPINION	RESPONSES/OPINIONS
		company is mining copper and in the process comes across new minerals.	minerals in the process of copper mining, the law requires that the company declares the minerals to the ministry of mining.
10.	Rehabilitation of mining pits	▪ Mr. Joel Kithuku wanted to know the tree species that will be used to rehabilitate mining pits	▪ The ESIA consultant informed the participants that the rehabilitation of mining pits will make use of native trees in the locality.
11.	Converting mining pits into water pans	▪ Mr. Peter Mwangangi wanted to know if mining pits can be converted into water pans to reduce water scarcity in the locality	▪ The ESIA consultant informed the participants that under normal circumstances, the mining pits should be backfilled upon completion of copper mining. However, should the land owner wish to convert a pit into a water pan, then the mining company is supposed to rework on the pit to meet the minimum standards for a water pan.

5.5 Key Stakeholders' Meeting

The public participative and consultative meeting was followed by a key stakeholders' meeting. The key stakeholders' meeting (Plate 8 and Table 3) was held on 21st August 2023. The meeting brought together the local leaders such as the area MCA, chief, ass. Chiefs, village elders, ward administrators, village administrators, church and school leaders. Key opinion leaders and officials of the existing group engaged in minerals were also included in

the meeting. The meeting had a total of 18 (16 males and 2 females) participants from the project locality (See annexed attendance register).

Table 3: List of key stakeholders' meeting participants

S/N	Name	Designation	ID/Phone No.
1	Dr. Festus Mutiso	ESIA Consultant	0723769694
2	John K. Iguna	Village Administrator	0711380667
3	Joseph M. Mwambia	Village Administrator	0725995764
4	Patrick M. Kavuli	Village Elder	0715279970
5	Wilson M. Muthengi	Pastor	0728418607
6	John M. Nthiga	Chairman, Mineral S.H.G	0728921003
7	Jackson Chabari	PLWD	0706623362
8	Peter Musyimi Mati	PA, Area MCA	0723535045
9	Japheth Kilonchi Kakiri	Pastor	0705472241
10	Joseph N. Kimenchu	Chief	0721968377
11	Mucee M. Philip	Head Teacher, Mukuruni Pri.	0713152582
12	Angelica K. Mwalya	Field Assisatnt	0705393602
13	Mary K. Kitundumo	Mineral S.H.G	0704613655
14	Mwangangi Peter	Manager, Water	0728177632
15	Japheth K. Mukuru	Ward Administrator	07211576149
16	Julius K. Nkamba	Ag. Chief	0725252930
17	Bernard Kemboi	ACC	0716526847
18	Muthengi Ndangura	MCA	0723644955

The key stakeholders independently gave their views, opinions, and suggestions on the proposed project as outlined in Table 4.

Plate 8: Key stakeholders' meeting at the proposed project site

5.6 Issues raised during key stakeholders' meeting

This Sub-Section covers the views and opinions of the key stakeholders. The consultant responded to issues/concerns raised as outlined in table 4 below and as contained in the annexed minutes of the key stakeholders' consultative meeting.

Table 4: Summary of issues raised and responses

S/N	KEY ISSUES RAISED	BRIEF EXPLANATION OF THE ISSUE/OPINION	RESPONSES/OPINIONS
1	*Public disclosure*	One of the village elders appreciated the proponent and the consultant for carrying out public disclosure on the proposed project	▪ The consultant informed the participants that public disclosure is enshrined in the Kenya Constitution, 2010. Such disclosure gives an opportunity to the members of the public to air their views and raise their concerns over a project before project commencement.
2	*Fate of public institutions such as churches*	▪ One of the local pastor wanted to know what will happen if copper deposits are in an area with church buildings	▪ The ESIA consultant informed the participants that the proposed copper mining should not cause loss of property. In such an instance, the proponent will be required to carry out mining in a different parcel of land since many parts of the mining area have copper deposits.
3	*Effects of mining on schools, roads and churches*	▪ One of the village administrators was concerned that the proposed project may have negative impacts on schools, roads amongst	▪ The ESIA consultant informed the participants that the purpose of undertaking the ESIA is to ensure that all the likely negative impacts are identified at the early stages of project planning and appropriate mitigation measures are put in place. The copper

S/N	KEY ISSUES RAISED	BRIEF EXPLANATION OF THE ISSUE/OPINION	RESPONSES/OPINIONS
		others	mining will be restricted on private lands where the proponent has obtained land consent but not in public lands or institutions.
4.	*Corporate Social Responsibility*	▪ One the local school principal wanted to know the kind of CSR projects that the proponent will undertake	▪ The ESIA consultant informed the participants that the local community together with local leaders should come up with proposals on the CSR projects that are important to the community. Such proposals should be discussed with the proponent and an agreement reached on the projects that can be undertaken. Implementation of such projects is also based on whether the proponent is making any profits from the proposed project.
5.	Water scarcity	▪ One of the participants was of the opinion that the proponent should consider drilling of a borehole to provide water to the local people	The proponent representative informed the participants that borehole may not be the best water harvesting structure since based on the rock formation, the water is bound to be saline thus unsuitable for domestic consumption. Water pans are likely to provide quality water compared to boreholes at the proposed project site.

5.5 Public participation and consultative meeting, KII and Questionnaire findings

The analysis of public participation, KII and household interviews indicate that all the stakeholders are aware of the proposed project. The stakeholders were in agreement that the proposed project proceeds as planned provided that all the issues raised during stakeholders' engagement are taken care of in the Study Report.

6 POTENTIAL ENVIRONMENTAL IMPACTS

6.1 INTRODUCTION

This Section identifies both positive and negative impacts associated with the proposed Copper mining Project. These impacts are hereby identified at three distinct phases of the project i.e. - Construction Phase, Operation Phase and Decommissioning Phase.

Scale used to quantify the impacts/issues raised

The magnitude and significance of impacts were gauged using an objective scale that took into consideration the following:

- Temporal – short term or long term.
- Spatial – Transboundary/local.
- Severity – Reversible/irreversible, temporary/permanent.

The scale that was applied in the analysis of impacts is shown in the following table.

Table 5: Levels of Scale used in the Project

Value	Description	Scale Description
0	No impact	This means that to the best knowledge of the expert, the particular activity/action will not have any known impact on the environment. Such an impact will not in any way affect the normal functioning of either the human or the natural systems and does not therefore warrant any mitigation.
1	Minimal impact	Any activity with little impact on the environment calls for preventive measures, which are usually inexpensive and manageable. Such activities have minimum impacts on either natural or human environment or both.
2	Moderate impact	A moderate impact will have localized effect on the environment. If the effect is negative and cumulative, action in form of mitigation measures needs to be put in place to ensure that it doesn't become permanent and /or irreversible.
3	High impact	An impact is high if it affects a relatively high area (spatial), several biological resources (severity) and/or the effect is felt for a relatively long period (temporal) e.g. more than one year. In case the effect is negative, such an impact needs to be given timely consideration and proper mitigation measures put in place to prevent further direct, indirect or cumulative adverse effects.
4	Very high impacts	Such an activity rates highly in all aspects used in the scale i.e., temporal, spatial and severity. If negative, it is expected to affect a huge population of plants and animals, biodiversity in

		general and a large area of the geophysical environment, usually having transboundary consequences. Urgent and specialized mitigation measures are needed. It is the experts' opinion that any project with very high negative impacts **MUST** be suspended until sufficient effective mitigation measures are put in place.
5	Not known	There are activities for which impacts are not yet known e.g. some chemicals are suspected to produce carcinogenic effects but this has not yet been confirmed.

6.1 CONSTRUCTION PHASE

6.1.1 Positive Impacts

6.1.1.1 Improvement of feeder roads

The construction phase will entail opening up and improvement of feeder roads to the project area. This will benefit the local people in the locality since most of the existing feeder roads are in a poor state.

6.1.1.2 Improved security

During construction period, the security of the project area will be improved since the proponent will engage security guards to man the construction site. A camp site will be established and security lights will be installed. Improved security will also spill-over to the neighbourhood of the proposed copper mining.

6.1.1.3 Improved business opportunities

During construction period, the informal sector will benefit from the operations. This will involve kiosk operators who will be selling food to the workers on site. This will promote Jua Kali entrepreneurs in the project area.

6.1.1.4 Job Opportunities

There will be job opportunities especially to casual workers. Employment opportunities are a benefit both in economic and social sense. Several workers including geologists, drivers, plant operators, casual laborers, masons, carpenters, joiners, electricians and plumbers are expected to work on the site for a period that the project will start to the end. Apart from

casual labour, semi-skilled and skilled job opportunities will arise during the construction phase of the project. Increased job opportunities will generally improve household income and thereby improve the living standards of the local people.

6.1.1.5 Gains in the Local and National Economy

There will be gains in the local and national economy. Through consumption of locally available materials including: diesel, petrol amongst others. The consumption of these materials will attract taxes including VAT which will be payable to the government. The cost of the materials will be payable directly to the producers.

6.1.1.6 Provision of Market for Supply of Building Materials

The project will require supply of substantial quantities of building materials most of which will be sourced locally within Kitui. This provides ready market for building material suppliers such as material suppliers, hardware shops and individuals with such materials.

6.1.2 Negative Impacts

6.1.2.1 Destruction of existing vegetation

The construction process will involve clearing of the existing vegetation cover. The developer should put in place a landscape plan to replace this with planting of many indigenous and other useful firewood and fodder trees at the project site and its environs.

6.1.2.2 Disturbances to wildlife

The woodland vegetation that characterizes the project site houses a number of small game. Disturbances to the vegetation will in turn disturb the wildlife in habitation. This will greatly affect wildlife in the project locality.

6.1.2.3 Reduction of agricultural land

The proposed project site is currently used for subsistence agriculture. As such, the proposed project will entail land use change from agriculture to mining. However, only some sections of the farmlands will be used for mining. Since the extent of mining is minimal, the impact will be minimal (value of 1).

6.1.2.4 Soil erosion

The site slopes gently and possibilities of soil erosion occurring during construction are high specifically during rainy and windy seasons. Erosion problems become serious when the topsoil is left bare and agents of erosion become active. Soil erosion is an important problem both at its source and downstream of the development site. Lost soil will be deposited in neighbourhood stream and the deposition could alter downstream hydrology and increase flooding. It may also pose a water quality issue directly as a result of siltation and indirectly from contaminants carried with or attached to soil particles.

6.1.2.5 Storm water

There is a likelihood of interference of the construction operation from the storm water runoff either from the site. The situation is made worse due to the site gradient with respect to the neighbouring land as pointed out in 6.1.2.4 above.

6.1.2.6 Noise pollution

The construction works will most likely be a noisy operation due to the moving machines (excavators, compressors, communicating workers) and incoming vehicles to deliver construction materials and workers to site. To be affected mostly are the site workers since noise beyond some level is itself a nuisance if not maintained within acceptable limits.

6.1.2.7 Disposal of excavated soil

Site excavations shall be done to the satisfaction of the Consultant's Engineers specification hence some materials shall be rejected as waste for disposal. Indiscriminate disposal of this category of waste may have adverse impacts on the receiving environment. The proponent is expected to exercise utmost caution while disposing such waste.

6.1.2.8 Oil spills

The machines on site may be containing moving parts which will require continuous oiling to minimize the usual corrosion or wear and tear. Possibilities of such oils spilling and contaminating the soil and water on site are real. Likewise, moving vehicles on site may require oil change. But these dangers are contained by maintaining the machinery in

specific areas designed for this purpose. Nevertheless, the proponent will avoid incidences of such spills and should they occur, immediate clean-up is mandatory.

6.1.2.9 Increased water demand

Both the workers and the construction works will create additional demand for water in addition to the existing demand. Water will be mostly used in sprinkling on dusty construction sites/surfaces, preparation of concrete for construction works and for wetting surfaces, curing or even cleaning completed structures. It is expected that the proponent will use water wisely and recycle where applicable.

6.1.2.10 Dust emissions

Particulate matter pollution is likely to occur during the site clearance, excavation and spreading of the topsoil. There is a possibility of PMB_{10} suspended and settleable particles affecting the site workers and even neighbours health. Such pollution should be mitigated appropriately.

6.1.2.11 Faecal waste management

The construction workers will generate faecal waste during their day-to-day operations. The generated waste needs proper handling to prevent diseases such as diarrhoea outbreak on the site. Provision of adequate site latrine and hand washing points is mandatory.

6.1.2.12 Food kiosks and mushrooming of informal settlement

There is a likelihood of food kiosks mushrooming close to the project site due to the meal demands from the construction workers. Development of these informal settlements may compromise the security and hygiene of the site. Further, the proposed project may involve mushrooming of informal settlements in the surrounding area owing to workers preference to stay near their places of work. It is strongly suggested that the proponent should get his workforce from the local people.

6.1.2.13 Generation of exhaust emissions

Exhaust emissions are likely to be generated by the construction equipment during the construction phase. Motor vehicles used to mobilize the work force and materials for construction would cause a potentially significant air quality impact by emitting pollutants through exhaust emissions. Since the mine will be a central point for material excavation, storage and transfer, such emissions can be enormous and may affect a wider geographical area. The impacts of such emissions can be greater in areas where the materials are sourced and at the construction site as a result of frequent gunning of vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas.

6.1.2.14 Increased runoff from new impervious areas

During site clearance, use of heavy machineries will compact the soil and result in additional runoff through creation of impervious areas and compaction of soils. Impervious areas and compacted soils generally have higher runoff coefficients than natural area and increased flood peaks are a common occurrence in such developed areas.

6.1.2.15 Surface and ground water hydrology and water quality degradation

Changes in surface hydrology alter the flow of water through the landscape. Construction of impervious surfaces such as extraction routes, material storage yard amongst others increase the volume and rate of runoff, resulting in habitat destruction, increased pollutant loads and flooding. Built or paved areas and changes in the shape of the land also influence groundwater hydrology (i.e. recharge rates, flow, conditions).

Project related excavation could lead to surface and ground water quality degradation. Contaminated soil or ground water in the path of the project could be disturbed by excavation resulting in a potential transfer of the contamination to surface waters. The excavated area, if linear, could act as a conduit to extend groundwater contamination to new areas. Spills of hazardous materials in excavated areas during construction could introduce contaminants to ground water.

6.1.2.16 Aquatic species and communities

Changes in surface hydrology and water quality can have adverse impacts on aquatic species such as fish, plants and microbes. Increased turbidity, temperature, velocity of flow and pollutant loads can have direct impacts on the species and their habitat.

6.1.2.17 Workers accidents and hazards during construction

During construction of the proposed mine project, it is expected that construction workers are likely to have accidental injuries and hazards as a result of handling hazardous waste and heavy machineries. Injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment.

6.1.2.18 Vector borne and water borne disease incidence

When solid wastes are not well managed there is potential of disease outbreak due to suitable breeding conditions for vectors of cholera and typhoid. If the wastes find their way to water body its quality may be lowered. Malaria outbreak could also be exacerbated by the presence of open water ditches for breeding of anopheles mosquitoes. The major vulnerable groups are children who could be exposed to these conditions.

6.1.2.19 Possible exposure of workers to diseases

During construction phase, workers are likely to be exposed to diseases from building materials. It is therefore recommended that before the construction commences, there is need for the materials to be well inspected according to the occupational health and safety standards.

6.1.2.20 Loss of plant species and communities

Direct impact results from disturbances that cause changes in temperature, light, moisture and nutrient levels. Vegetation removal activities such as clear-cutting and bulldozing works impact negatively on the environment. Indirect impacts result from changes in natural community processes or invasion of non-native plant species. Loss of plant communities also results in decreased water quality, increased erosion as a result of unstable soil, nutrient imbalances in the soil, and/or compaction of soil.

6.1.2.21 Energy consumption

The project will consume fossil fuels (mainly diesel) to run transport vehicles and construction machinery. Fossil energy is non-renewable and its excessive use may have serious environmental implications on its availability, price and sustainability. The project will also use electricity supplied by Kenya Power (KP) Ltd. Electricity in Kenya is generated mainly through natural resources, namely, water and geothermal resources. In this regard, there will be need to use electricity sparingly since high consumption of electricity negatively impacts on these natural resources and their sustainability.

6.2 OPERATIONAL PHASE

6.2.1 Positive Impacts

6.2.1.1 Improvement of feeder roads

The proponent is expected to carry out periodic maintenance of the feeder roads to the proposed project area for efficient movement of mined copper ore. This maintenance will definitely benefit other road users and the local community.

6.2.1.2 Improved security

During operation phase, the proponent is expected to engage the services of security guards. Security lights are expected to be installed at the camp site. The enhanced security will benefit the local residents in the project environs.

6.2.1.3 Employment creation

Employment opportunities are one of the long-term major impacts of the project that will be realized after construction and during the operation and maintenance of the project. These will include engineers, geologists, drivers, plant operators, mechanics, storekeepers, security personnel, solid waste management staff amongst others.

6.2.1.4 Optimal use of land

The land proposed for copper mining is currently a farmland. However, agriculture is not a lucrative land use due to erratic and unreliable rainfall regime. The proposed copper mining is economically Plausible land use. Land is a scarce resource in Kenya and through construction of the proposed project will ensure optimal use of land to the great benefit of the land owner, the local community and the country and its people.

6.2.1.5 Gains in the Local and National Economy

There will be gains in the local and national economy. Through consumption of locally available materials including: fuels and other consumables. The consumption of these materials, fuel oil and others will attract taxes including VAT which will be payable to the

government. The cost of the materials will be payable directly to the producers. Workers will remit taxes inform of PAYE to the government.

6.2.1.7 Expansion of market base for local produce

The workers at the mine will make use of consumables for their domestic uses. This will make use of assorted vegetables, fruits and other food crops. Such products will be sourced from the local groceries, markets, supermarkets and local farmers. This will definitely improve the market base for the same and improve the income of the traders involved.

6.2.1.8 Promotion of the industrial sector

The proposed mining works will extract copper ore. The ore will need to be crushed. This will call for setting up of a crusher plant. Other factories will need to be put in place for refining and processing of the crushed ore into final products. Establishment of the additional plants will definitely spur growth of the industrial sector in the County and Country.

6.2.1.9 Utilization of natural resource

Copper ore is a natural resource whose active utilization for economic gains is encouraged. Exploitation of the copper ore will generate income to the land owner while accruing assorted benefits to the local community and the Country at large. Wise and sustainable exploitation of natural resources for economic growth is always encouraged.

6.2.1.10 Increased government revenue

The proposed Copper mining will generate taxable income to the government and other charges will be payable to the Kitui County and the national government. This will generally increase revenue base to the County and national governments.

6.2.2 Negative Impacts

6.2.2.1 Likely conflicts over benefits sharing

The benefits that will accrue from the mining works will be shared among many actors. Likelihood of conflicts arising over benefit sharing is high. Since the actors have proposed

to establish a strong benefit sharing mechanism before operation starts, this impact is expected to be low (value of 1).

6.2.2.2 Risk of contractual disagreements

Local land owners have given consent to the proponent for copper mining. Contractual disagreements may arise due to failure of one party to honour contractual obligations. However, given that the land owners are members are organized into a group, this impact is expected to be low (value of 1).

6.2.2.3 Impact on the Natural/Physical environment

During the operational phase, the following will happen to cause physical damage to the environment. Mining activities result in significant degradation of the environment as vegetation is cleared to pave way for mining activities. It leaves behind open pits which are prone to soil erosion and water stagnation during rainy seasons. These mining pits interfere with drainage and offer breeding grounds for mosquitoes. Soil stockpiles and mine waste piling all have negative effects on landscape by causing visual intrusion

6.2.2.4 Soil Compaction

Moving heavy machinery will compact the soils as excavation operations take place. Compaction has the undesired effect of hindering air and water penetration beneath the soil surface limiting aerobic activities of the organisms in the process. Compaction will also enhance run-off during the rainy season. Research has shown that heavy machineries destroy soil structure rendering the site unable to support vegetation in future.

6.2.2.5 Soil erosion

Opening up of service minor roads for transporting the excavated copper to the off site crusher plant will entail vegetation clearance. The exposed grounds will be prone to water and wind erosion. This will greatly contribute towards land degradation. Restricting traffic to designated areas and minimizing earthworks is advocated for.

6.2.2.6 Impact on flora

As copper mining progresses along the vein, more vegetation will be cleared. This clearance will spill over to other areas to pave way for the disposal of excavated waste soil, traffic navigation zones and material storage yards. Cutting down/clearing of vegetation is known to have adverse effects on the environment such as reduction of biodiversity, reduction of aesthetic beauty, exposure of soil to surface run-off, reduction of shade and increment in dust pollution among others. However, the mine area is small hence can be easily rehabilitated after decommissioning of the project. On sites for service lines such as water, electricity etc, the proponent will avoid unwarranted destruction of vegetation by strictly restricting clearance on key areas. The miner will also need to restrict traffic on the designated area as per the site plan to reduce unwarranted vegetation clearance or trampling.

Soils' texture and water content can be greatly modified in disturbed sites, leading to plants communities changes in the area. Most of the plants have a low concentration tolerance for metals in the soil, but sensitivity differs among species. Grass diversity and total cover is less affected by high contaminant concentration than forbs and shrubs. Mines waste-material rejects or traces due to mining activity can be found in the vicinity of the mine, sometimes pretty far away from the source. Established plants cannot move away from perturbations, and will eventually die if their habitat is contaminated by heavy metals or metalloids at concentration too elevated for their physiology. Some species are more resistant and will survive these levels, and some non-native species that can tolerate these concentrations in the soil, will migrate in the mine surrounding lands to occupy the ecological niche.

6.2.2.7 Reduction of farmlands

The proposed project site is predominantly agropastoral mainly used for rain-fed agriculture and livestock keeping. Mining works will reduce farming area and thereby impact negatively on food production. However, the impact will be minimal (value of 1) since the area to be mined is small and the owner of the affected farmland will be compensated appropriately.

6.2.2.8 Impact on Air Quality / Dust and Exhaust Emissions

Earth moving activities would lead to the release of dust and smoke from the moving vehicles. A lot of dust will emanate from the site as the ground is opened and large volumes of soil excavated. Movement of the loading trucks and excavating machines will also contribute to release of a lot of dust into the surrounding area. Exhaust emissions are likely to be generated by the construction equipment during the construction phase. Motor vehicles used to mobilize the work force and materials for construction would cause a potentially significant air quality impact by emitting pollutants through exhaust emissions. Because large quantities of building materials are required, such emissions can be enormous and may affect a wider geographical area. The impacts of such emissions can be greater in areas where the materials are sourced and at the construction site as a result of frequent gunning of vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas. This will needless to say contribute to air pollution. The use of poorly maintained vehicles and digging machines will exaggerate the air quality degradation problem. Unless appropriate cautionary measures are put in place, the impact will be moderate (value of 2).

6.2.2.9 Noise Generation

The excavations works will most likely be a noisy operation due to the moving machines (excavators, tractors, compressors, communicating workers) and incoming and outgoing trucks to transfer mined ore to storage yard or crusher plant, move out soil excavated and workers to site. People living in the neighbourhood and the site workers are likely to be affected since noise beyond some level is itself a nuisance and can be controlled within acceptable limits. However, mitigation measures are well discussed in the next chapter.

Further, the noise will disturb livestock, wildlife within the project site. Excessive noises are known to cause abortions among livestock and wild game. Such noise emissions should be minimized as much as possible from the source point while workers should be provided with appropriate personal protective wear wherever necessary. Unless appropriate cautionary measures are put in place, this impact will be moderate (value of 2).

6.2.2.10 Storm water

There is a likelihood of interference of the mining operation from storm water runoff either from the site or from the neighbouring compounds. This may slow excavation works and to some extend call for pumping out of water from the mine.

6.2.2.11 Disposal of Excavated rejected/ unusable materials

Extensive excavation is likely to take place at the project site. The excavation works will result in the generation large amounts of excavated material. Most of the excavated soil will be utilized on site to backfill the open quarries after project completion. Based on the cautionary measures put in place by the proponent, this impact will be minimal (value of 1).

6.2.2.12 Increased Water Demand

Both the workers and the mining works will create additional demand for water in addition to the existing demand. Water will be mostly used in dust reduction by sprinkling on the roads used by trucks and for cleaning and drinking purposes. Both the workers and the mining works will create additional demand for water in addition to the existing demand within the project site. This impact will, however, be minimal (value of 1) since the proposed project is small scale.

6.2.2.13 Water Pollution

Mining can have adverse effects on surrounding surface and groundwater if protective measures are not taken. The result can be unnaturally high concentrations of some chemicals, such as arsenic, sulfuric acid, and mercury over a significant area of surface or subsurface. Runoff of mere soil or rock debris -although non-toxic- also devastates the surrounding vegetation. The dumping of the runoff in surface waters or in forests is the worst option here. The proponent will put in place an efficient waste management scheme that will prevent the accumulation of uncontrolled waste, as well as an efficient collection system and off-site disposal. In well-regulated mines, hydrologists and geologists take careful measurements of water and soil to exclude any type of water contamination that could be caused by the mine's operations. The reducing or eliminating of environmental degradation is enforced by restricting operators to meet standards for protecting surface and ground water from contamination. This is best done through the use of non-toxic

extraction processes as bioleaching. If the project site becomes nonetheless polluted, mitigation techniques such as acid mine drainage (AMD) need to be performed. The proponent is expected to put in place adequate measures to forestall possible water pollution.

6.2.2.14 Disease vector harbour

Collection of water in the opened up pits will form breeding areas for mosquitoes. This may cause human diseases like malaria and cholera. The proponent will ensure unused pits are covered up and water is drained out of the open pits to prevent this.

6.2.2.15 Disruption of wildlife habitat

The rocky terrain and *acacia* dominated site houses a number of wildlife such as squirrels, snakes, frogs, lizards, geckos, rabbits, birds among others. As operation phase starts, the wildlife will be interfered with. Some of these animals will be killed in the process while others will migrate to the neighbourhood. This migration will put pressure on niches that will acts as sinks for the migrants.

Habitat destruction is one of the main issues of mining activity. Huge areas of natural habitat are destroyed during mine construction and exploitation, forcing animals to leave the site. Animals can be poisoned directly by mine products and residuals. Bioaccumulation in the plants or the smaller organisms they eat can also lead to poisoning: donkeys, goats and sheep are exposed in certain areas to potentially toxic concentration of copper and lead in grass. They are fewer number of ants species in soil containing high copper levels, in the vicinity of a copper mine. If fewer ants are found, chances are great that other organisms leaving in the surrounding landscape are strongly affected as well by this high copper levels, since ants are a good environmental control: they live directly in the soil and are thus pretty sensitive to environmental disruptions. However, the magnitude of this impact is expected to be minimal (value 1) because the project is small.

6.2.2.16 Increased energy use

The project will consume fossil fuels (mainly diesel) to run vehicles and other machineries. Fossil fuel is non-renewable and its excessive use has environmental implications on its availability, price and sustainability. The mining will make use of heavy diesel-powered

machineries such as tippers, excavators, dozers, compressors amongst others. This will result to excessive consumption of diesel in the locality. Use of diesel to run generators in case of hydroelectricity power failure will also arise. Unless appropriate cautionary measures are put in place, this impact will be moderate (value of 2).

6.2.2.17 Risk of Acid rock drainage

Sub-surface mining often progresses below the water table, so water must be constantly pumped out of the mine in order to prevent flooding. When a mine is abandoned, the pumping ceases, and water floods the mine. This introduction of water is the initial step in most acid rock drainage situations.

Acid rock drainage occurs naturally within some environments as part of the rock weathering process but is exacerbated by large-scale earth disturbances characteristic of mining, usually within rocks containing an abundance of sulfide minerals. Areas where the earth has been disturbed (e.g. excavation sites and transportation corridors) may create acid rock drainage. In many localities, the liquid that drains from mines can be highly acidic, and in such cases it is treated as acid rock drainage. This impact is expected to be negligible since the proponent will use surface copper mining and not sub-surface.

6.2.2.18 Risk of heavy metals

Dissolution and transport of metals and heavy metals by run-off and ground water is another example of environmental problems with mining especially in copper mines. Water in the mine containing dissolved heavy metals such as lead and cadmium can leak into local groundwater, contaminating it. Long-term storage of tailings and dust can lead to additional problems, as they can be easily blown off site by wind. The impact will be minimal (value of 1) since the area proposed for mining is small.

6.2.2.19 Effects on biodiversity

The implantation of a mine is a major habitat modification, and smaller perturbations occur on a larger scale than exploitation site, mine-waste residuals contamination of the environment for example. Adverse effects can be observed long after the end of the mine activity. Destruction or drastic modification of the original site and anthropogenic substances release can have major impact on biodiversity in the area. Destruction of the

habitat is the main component of biodiversity losses, but direct poisoning caused by mine-extracted material, and indirect poisoning through food and water, can also affect animals, vegetables and microorganisms. Habitat modification such as pH and temperature modification disturb communities in the area. Endemic species are especially sensitive, since they need very specific environmental conditions. Destruction or slight modification of their habitat puts them at the risk of extinction. Habitats can be damaged when there is not enough terrestrial as well by non-chemicals products, such as large rocks from the mines that are discarded in the surrounding landscape with no concern for impacts on natural habitat. Based on the size of the proposed project, this impact is expected to be low.

6.2.2.20 Aquatic organisms

The mining industry can impact aquatic biodiversity through different ways. Direct poisoning is the first one, and risks are higher when contaminants are mobile in the sediment or bioavailable in the water. Mine drainage can modify water pH, and it is hard to differentiate direct impact on organisms from impacts caused by pH changes. Effects can nonetheless be observed and proved to be caused by pH modifications. Contaminants can also affect aquatic organisms through physical effects: streams with high concentrations of suspended sediment limit light, thus diminishing algae biomass. Metal oxide deposition can limit biomass by coating algae or their substrate, thereby preventing colonization. This impacts will be negligible since the proponent will use surface mining method and there are no water resources in the vicinity of the proposed mine

6.2.2.21 Effects of mine pollution on humans

Humans are also affected by mining. There are many diseases that can come from the pollutants that are released into the air and water during the mining process. For example, during smelting operations enormous quantities of air pollutants, such as the suspended particulate matter, SO_x, arsenic particles and cadmium, are emitted. Metals are usually emitted into the air as particulates.

There are also many occupational health hazards. Most of the miners suffer from various respiratory and skin diseases. Miners working in different types of mines suffer from

asbestosis, silicosis, or black lung disease. Humans are also affected by the occurrence of landslides and floods.

6.2.3 Impacts Related to Occupational Health and Safety

6.2.3.1 Dust

Large quantities present in the air may result in respiratory hazard. It may also cause visual intrusion hence presenting accident risks. Dust may also affect the eyes. Unless appropriate precautionary measures are put into place, this impact is likely to be moderate (value of 2).

6.2.3.2 Noise pollution and vibrations

The operation works will most likely be a noisy operation due to the machinery activities, explosion of large boulders and rocks, communicating workers and incoming vehicles to deliver materials and workers to site. The noise generated during the operation stage is at best described as part of a normal occupational hazard that workers in the mining industry face. However, it is expected that the proponent will maintain noise levels within acceptable limits. Based on the precautionary measures to be put in place, this impact will be moderate (value 2).

6.2.3.3 Public Health and safety

During operation the movement of copper ore dug out may result in accidents if good supervision is not provided. Accidental cuts and bruises are common among workers as a result of use of machinery, equipment and rocks bruising or injuring the site workers, an impact that need consideration. Based on precautionary measures to be put in place by the proponent, this impact is expected to be minimal (Value of 1).

6.2.3.4 Noise, Fly rock, Air overpressure and ground Vibration

Noise will emanate from mining machinery operations, excavations, crushing, and trucks posing risk to those working nearby i.e. general mine workers, visitors and neighbors. This may cause hearing problems and stress depending on the nature, level and the duration of exposure.

Extensive mining operation has the potential to send some rocks flying precariously within and even out of the mine and this is likely to cause death, accidents and damage to property. If blasting is done, fly-rocks are produced when there is too much explosive energy, stemming is inadequate, or the explosive energy is too rapidly vented through a zone of weakness. In a hard rock mine, it is necessary not only to loosen the rock but to fragment and move it away from the face of the mine to produce a muck pile. Overpressure may vibrate buildings but damage would seem to be rare. Unless appropriate cautionary measures are put in place, this impact will be moderate (value of 2).

6.2.3.5 Risks of Accidents and Injuries to Workers

Workers might be hurt by equipment and machinery during operation phase of the proposed project. It is also expected that workers are likely to encounter occupational health hazards as a result of coming into contact with and handling hazardous waste. Mining machines will pose a certain level of risk. Injuries may arise from flying rocks and debris. Injuries can, also, result from accidental falls from high elevations, injuries from hand tools and mining equipment, cuts from sharp edges of rocks, collapse of rocks among others. Unless adequate measures are put in place, this impact will be moderate (value of 2).

6.2.3.6 Solid waste generation

Substantial amounts of solid waste will be generated during operation phase of the project. These will include sub-standard or rejected rocks, rejected materials, surplus materials, surplus soil, excavated debris amongst others. Solid wastes if not well managed have a potential of causing disease outbreaks due to the fact that their presence provides suitable breeding conditions for vectors of certain diseases such as malaria, cholera and typhoid. Outbreak of diseases such as Malaria could also be exacerbated by the presence of open water ditches for breeding of anopheles mosquitoes. The major vulnerable groups are children who could be exposed to these conditions. The workers on site will also generate feacal waste during their day-to-day operations. The generated waste needs proper handling to prevent diseases, such as cholera, typhoid and diarrhoea outbreak. Unless this is addressed, it can prove to be an environmental/health hazard. However, in

view of precautionary measures to be undertaken, this impact will be moderate (value of 2).

6.3 DECOMMISSIONING PHASE

6.3.2 Positive Impacts

6.3.2.1 Rehabilitation

Upon decommissioning the project, rehabilitation of the project site will be carried out to restore the site to its original status. This will include backfilling the open mine, replacement of topsoil and re-vegetation, which will lead to improved visual quality of the area.

6.3.2.2 Employment Opportunities

For decommissioning to take place properly and in good time, several people will be involved. As a result several employment opportunities will be created during the demolition phase of the proposed project.

6.4.2 Negative Impacts

6.1.1.1 Solid waste generation

Demolition of the mine and associated structures will result in large quantities of solid waste. The waste will contain materials that were used during the construction and operation of the mine such as rocks and related mine spoils, concrete, metal, drywall amongst others. Although demolition waste is generally considered less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. This impact will however be moderate (value of 2).

6.1.1.2 Noise pollution and excessive vibrations

The decommissioning related activities such as demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas. This will be as a result of the noise and vibration that will be experienced as a result

of demolishing and backfilling of the mine and related components. This impact will, however, be minimal (value of 1) since the effects will be short term.

6.1.1.3 Loss of livelihood and economic ruin

The establishment and operation of the small scale copper mine will bring about a lot of positive change to the lives of the people around it and also to the local economy. Decommissioning of the project will thus mean a reverse of these gains whereby many will lose their source of livelihood from jobs to business ventures hence directly leading to a decline of the area's economic status and a drawback to the economy at large. This impact will, however, be minimal (value of 1) since other sources of livelihood would have been established by the time decommissioning phase is reached.

6.1.1.4 Occupational hazards

Demolition works will inevitably expose workers and the public to occupational health and public safety risks. In particular, working with heavy equipment, handling and use of tools engender certain risks. The workers are also likely to be exposed to risk of accidents and injuries resulting from accidental falls, falling objects, injuries from hand tools and other equipment. This impact will be minimal (value of 1).

6.1.1.5 Dust and exhaust emissions

Large quantities of dust will be generated during demolition works. Particulate matter pollution is likely to occur during demolition and transportation of the demolition wastes including backfilling of the mined pits. There is a possibility of suspended and settle-able particles affecting the site workers and the surrounding neighbours' health. Exhaust emissions are likely to be generated during the demolition period by the various machinery and equipment to be used as well as motor vehicles used for the exercise. This impact will, however, be minimal (value of 1).

7 MITIGATION MEASURES AND MONITORING PROGRAMMES

This section highlights the mitigation measures for the expected negative impacts of the proposed project. The potential impacts and the possible mitigation measures have herein been analysed under two categories: Construction and Operational.

7.1 Mitigation of Construction and Operational Related Impacts

7.1.1 Air quality

Controlling dust during operation is useful in minimizing nuisance conditions. It is recommended that a standard set of feasible dust control measures be implemented for all operation activities. Emissions of other contaminants (NOx, CO_2, SOx, and diesel related PMB_{10B}) that would occur in the exhaust from heavy equipment are also included. The proponent is committed to implementing measures that shall reduce air quality impacts associated with earthworks. All personnel working on the project will be trained prior to starting operation on methods for minimizing air quality impacts during operation. This means that workers will be trained regarding the minimization of emissions during operation. Specific training will be focused on minimizing dust and exhaust gas emissions from heavy earth moving equipment. Truck drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon, and minimize idling of engines.

Dust emissions will be controlled by the following measures:

- Watering all active operation areas as and when necessary to lay dust.
- Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.

- Sweep daily (with physical sweepers) all paved access roads, parking areas and staging areas at operation sites.
- Fast growing grasses and trees will be planted around the project area to act as a wind breaks to reduce the uplift of particulate matter that lead to respiratory diseases.

7.1.2 Minimize the effects of noise and vibrations emitted from the site

Significance of noise impacts depends on whether the project would increase noise levels above the existing ambient levels by introducing new sources of noise. Noise impacts would be considered significant if the project would result in the following:

- Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
- Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels.
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

The proponents shall put in place several measures that will mitigate noise pollution arising during the construction phase. The following noise-suppression techniques will be employed to minimise the impact of temporary construction noise at the project site.

- Install portable barriers to shield compressors and other small stationary equipment where necessary.
- Use quiet equipment (i.e. equipment designed with noise control elements).
- Co-ordinate with relevant agencies regarding all substantial operation activities in nearby residential areas.
- Install sound barriers for pile driving activity.

- Limit pickup trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.
- Excavation works should be done during the day when people are away and also the outside environment is also noisy.
- Adhere to the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 regarding noise limits at the workplace.
- Avoid blasting unless mandatory
- If blasting is mandatory, adhere to times stipulated for blasting and settle disputes as stipulated in lease agreements and statutory requirements.

7.1.3 Minimise the effects of exhaust emission

In order to control exhaust emissions the following measures shall be implemented during operation:

- Minimize earthworks
- Where applicable use light and hand operated tools
- Vehicle idling time shall be minimized.
- Alternatively fuelled construction equipment shall be used where feasible.
- Equipment shall be properly tuned and maintained.
- Replace old and energy inefficient machines as need arises

This will also be achieved through proper planning of transportation of materials to ensure that vehicle fills are increased in order to reduce the number of trips done or the number of vehicles on the road.

7.1.4 Hydrology and water quality degradation

Several measures shall be put in place to mitigate the impacts that are likely to lead to hydrology and water quality degradation. The proponent will prepare a hazardous

substance control and emergency response plan that will include preparations for quick and safe clean-up of accidental spills. It will prescribe hazardous-materials handling procedures to reduce the potential for a spill during operation, and will include an emergency response programme to ensure quick and safe clean-up of accidental spills. The plan will identify areas where refuelling and vehicle maintenance activities, storage of hazardous materials if any and excavated soil, will be permitted.

The proponent will strictly ensure that storm water accumulating in the mining pits is not directed to surface or underground water sources. This will avoid risks of contaminating water sources with heavy metals and other pollutants from the mines.

7.1.5 Noise, Fly rock, Air overpressure and ground Vibration

Noise will emanates from excavation machinery operations, excavations, crushing, and trucks, posing risk to those working nearby i.e. general workers, visitors and neighbours. This may cause hearing problems and stress depending on the nature, level and the duration of exposure. Extensive blasting operation has the potential to send some rocks flying precariously within and even out of the proposed site and this is likely to cause death, accidents and damage to property. Fly-rocks are produced when there is too much explosive energy, stemming is inadequate, or the explosive energy is too rapidly vented through a zone of weakness. In hard rock areas, it is necessary not only to loosen the rock but to fragment and move it away from the face of the pits to produce a muck pile. Overpressure may vibrate buildings but damage would seem to be rare.

Mitigation

- The operating hours should be strictly limited to daytime i.e. between 8.00 am to 5.00 pm.
- Screening using baffle moulds material such as already excavated materials i.e. soils and other solid wastes. These should be located on the site boundary to reduce noise for noise-sensitive properties.
- Ear protection is necessary during operations using earmuffs.

- The proponent should conduct awareness and training to the staff on the risks of noisy environment
- Fly rock should be avoided altogether outside the site.
- If the assessment of the danger zone suggests it may extend beyond the site boundary, then a controlled space should be created, where people/animals are either excluded or protected, and not endangered by the blast and the subsequent fly rock.
- Avoid rock blasting unless it is mandatory
- If blasting is to be done, strictly practice controlled blasting and use a registered blaster
- If blasting is to be done, then supervision of the site by a person with knowledge of dangerous blasting activities, process design, controlled drilling and careful observation of mine pit faces, and adherence to accepted blasting practices.
- If blasting is mandatory, appropriate blasting design must be adopted by ensuring the setting-out and drilling of blasts is as accurate as possible and the drilled holes should be surveyed for deviation along their lengths
- Correct stemming will help control overpressure and fly rock and will also aid the control of ground vibration.
- Monitoring of blasting and re-optimizing the blasting design in the light of results, changing conditions and experience should be carried out as standard.
- Avoid blasting in adverse weather conditions i.e. during significant temperature inversions; moderate to strong winds towards sensitive areas; foggy, hazy or smoky conditions with little or no wind; a still cloudy days with a low cloud ceiling; periods when the surface temperature is falling in the middle of the day; periods when strong winds accompany the passage of a cold front; and before mid-morning or after sunset on clear calm days.
- Avoid any blasting during the night.
- Always use few shot holes per blasting episode

- Incase incidental injury and/or damage, dispatch a team promptly to assess the injury/damage and take up compensation and corrective measures

7.1.6 Solid waste

Different types of solid wastes from the site will be generated throughout the excavation activities lifecycle. These will include general extracted debris, vegetation remains, and plastics, worn out tools among others.

Mitigation

- If a camp site exists, designate a garbage collection pit and provide waste bins as additional strategy to manage solid waste
- Soil and earth excavated wastes to be used for backfilling the mined pits.
- Plant matter including grass and shrubs disposed of in appropriate locations without compromising the environment and community at the recipient areas,
- Surface run-off from waste tips should be captured and treated to remove suspended solids prior to discharge.
- Earth excavated from both construction and operation phases will be used for landfill in other abandoned mine pits or other excavated sites within or outside the Kitui County. It is suggested that the proponent identify suitable land fill sites after the necessary consultations,
- Construction debris resulting from the project will be disposed off in sustainable manner such as reuse in road gravelling
- The mine site will be provided with an inbuilt solid waste collection bin with compartments for recyclable materials, biodegradable materials and hazardous materials.
- Waste materials should be segregated/separated i.e. plastic materials, Scrap metals, wood, non-biodegradable, tins and cans etc.
- The chips waste and fines should be reduced at source by sound design and operations

7.1.7 Habitat disturbance/loss

Vegetation usually protects the ground surface from wind and water erosion. It also provides fuel energy and habitats for shelter to small and large organisms to enable them to sustain themselves as species. It stabilizes other physical environmental attributes such as micro-climate, water and soil moisture regimes. So when vegetation is cleared all these are affected.

Mitigation

- Waste water accumulating in mining pits should not be pumped into vegetated areas to avoid soil pollution and subsequent effects on vegetation
- Consider monitoring of soil PH and take corrective actions against major changes
- Strictly reduce dust particulate matter from the mine that may settle on vegetation and affect their photosynthetic ability
- Strictly, reduce any surface run-off from the mine to reduce transport of heavy metals that may contaminate the soil in the neighbourhood and in turn affect vegetation
- Introduce vegetation in already mined areas.
- Quality vegetation should be provided through close monitoring to try and restore or even improve physical and biological environmental attributes.
- Trees should be planted along the site boundaries and cared for and at the same time, trees will also serve as barriers to dust transmission.
- During rehabilitation of mined areas, consider inclusion of grasses since they withstand soil contamination because of mining better that woody vegetation.

7.1.8 Handling Hazardous Wastes

Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided. In addition the proponent is committed to adherence to the occupational health and safety rules and

regulations stipulated in Occupational Health and Safety Act, 2007. In this regard, the proponent is committed to provision of appropriate Personnel Protective Equipment, as well as ensuring a safe and healthy environment for construction workers as outlined in the EMP.

7.1.9 Increased runoff

Increased runoff from de-vegetated grounds and opened pits and trenches causing extreme flooding and overflows of drainage systems shall be mitigated. Surface runoff shall be harvested and stored for reuse. A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structures will be designed. Run-off from mined areas is known to carry assorted heavy metals that may contaminate soil and water resources. All run-off must be confined within the mine.

7.1.10 Possible exposure of workers to hazards

Proposed activities pose potential threats to the health and safety especially to the operators in form of dust and fumes and accidents from fly rock. These in turn become hazardous to the environment. People and especially children go swimming in these deep pools of water and eventually drown. The same happens when animals such as cattle move-in in search of water.

Mitigation

- Risky mining pits must be secured by a danger tape
- Post sensitization signages such as “PUT ON PPE BEFORE ENTRY INTO THE MINE, BEWARE OF FLYING ROCKS etc”
- Fence off the mine site
- Post cautionary signages to indicate mine site

- Training staff and workers on the nature of the environment they are working in and ensure there is an awareness programme concerning the effect of dust, noise and other gaseous emissions to human health.
- Train workers on the possible dangers of using storm water accumulating in the mining pits
- Provide clean drinking water at the mining points
- Always maintain a well-equipped first aid kit
- Put up in place a respiratory monitoring program for mine workers
- The operators should be provided with full safety gear and trained on occupational health and safety.
- A record of incidences and accidents should be kept on any occurrence in the site and the company should develop an effective emergency response plan and enlighten the staff on safety measures and procedures through training and strict adherence to provisions of the Occupational Health and Safety Act of 2007.

Possible exposure of workers to hazards from mining operation site shall be mitigated by occupational health and safety standards enforcement as required in the OSHA, 2007.

7.1.11 Workers accidents during operation and decommissioning

Workers accidents especially in deep pits operation and loading and offloading points shall be mitigated by enforcing adherence to safety procedures and preparing contingency plan for accident response in addition to safety education and training shall be emphasized. A fully equipped first aid kit shall be kept at the site as per OHS and OSHA requirements for worksites of this nature.

7.1.12 Reduction of impacts at extraction sites and efficient use of raw materials

To reduce the negative impacts on availability and sustainability of the materials, the proponent will only extract what will be required through accurate budgeting and

estimation of actual market requirements. This will ensure that materials are not extracted in excessive quantities. Moreover, the proponent will ensure that wastage, damage or loss of materials at the operation site is kept minimal, as these would lead to additional demand for and extraction of materials. A site geologist must always ensure that sub-standard copper ore that may be classified as waste or rejects is not extracted.

In addition to the above measures, the proponent shall consider reuse of extracted but rejected rock materials in other construction works. This will lead to reduction in the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites.

7.1.13 Minimization of vegetation disturbance

Clearance of part of the vegetation and disturbance of the natural ecosystem at the project site to pave way for excavation of copper ore will be inevitable. However, the proponent will ensure proper demarcation of the project area to be affected by the mining works. This will be aimed at ensuring that any disturbance to flora and fauna is restricted to the actual project area and avoid spill over effects on the neighbouring areas. In the same vein, there will be strict control of operation vehicles to ensure that they operate only within the area to be disturbed by access routes and other works. Truck drivers must be ensure they restrict traffic only on designated and most efficient routes to avoid vegetation trampling. Soil contamination by heavy metals from the mine that may in turn affect the vegetation must be avoided by all means.

In addition, the proponent has committed himself to re-vegetation of some of the disturbed areas through implementation of a well-designed landscaping programme. It is recommended that part of the topsoil excavated from the pit site be re-spread in areas to be landscaped to enhance plant health. Mined and backfilled sites should be fenced off to allow for natural regeneration. In instances where natural regeneration may fail or be slow, it is recommended human intervention must come at hand to aid in

post mining vegetation recovery. Should mining activities change the post mining soil PH due to presence of heavy metals, liming of the soil should be considered to normalize the soil Ph and thereby allow vegetation regrowth.

7.1.14 Minimization of run-off and soil erosion

The proponent will put in place some measures aimed at minimizing soil erosion and associated sediment release from the project site during operation. These measures will include terracing and levelling the project site to reduce run-off velocity and increase infiltration of rainwater into the soil. In addition, operational vehicles will be restricted to designated areas to avoid soil compaction within the project site, while any compacted areas will be ripped to reduce run-off. Surface run-off may contain sediment loads that may contain heavy metals. Such sediment load transport to the neighbourhood project areas are likely to cause negative impacts. Infiltration of surface runoff should also be contained to avoid contaminating ground water with heavy metals.

7.1.15 Reduction of energy consumption

The proponent shall ensure proper planning of materials transportation. This will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the proponent shall monitor energy use during operation and set targets for reduction of energy use. The proponent should always ensure that the excavators, tippers, dozers amongst others to be used at the project area are energy efficient. Where applicable, consider use of hand operated tools to save on energy consumption.

7.1.16 Minimization of water use

The proponent shall ensure that water is used efficiently at the site by sensitizing operations staff to avoid irresponsible water use. Water that may collect in mined pits should be used to run machineries as well as sprinkle it on dusty mine surfaces and

extraction routes. Such water should not be used for human, livestock and wildlife consumption.

7.1.17 Controlling oil spills during operation

The proponent will control the dangers of oil, grease and fuel spills during operation by maintaining the machinery in specific areas designed for this purpose. On-site machinery repair will be discouraged and repair work will be restricted to the proponent's approved garages to avoid pollution from oil, grease and fuel. In case of accidental spills, prompt clean up measures will be put in place to contain the spill.

7.1.18 Public Health Safety and Awareness

The proponent will put in place the following:

- Avoid rock blasting by all means
- If blasting is mandatory, then only mild blasting should be done
- Strict adherence to the mining industry specific and general standards
- Strict observation of OSHA industry specific and general standards for projects of this nature and magnitude
- Adherence to principles of best practice for projects of this nature
- Provision of a well-equipped first aid kit as required by OHS and OSHA industry standards for workplaces
- Provision of education and awareness on health and safety issues, complete with health and safety procedures.
- Enforcement and adherence to safety procedures and preparation of contingency plan for accident response.
- Strict adherence to the mining safety measures to avoid collapse of mine pits and consequential injury.
- Provision of adequate drinking water and onsite sanitation facilities to avoid waterborne/water-based diseases.

- Employment of only trained and authorized persons to operate mining and transport equipment and machinery.
- Use of Personal Protective Equipment (PPE) during the construction and operation phases of the project. These shall include working boots, overalls, helmets, dust masks, goggles, earmuffs and gloves depending on the individual workers assignment.
- The proponent should provide a small section of the mining site with a shed and a water stand where food can be served to the mine workers to promote hygiene and health of the employees.
- The proponent must have workmen's compensation cover as required by law (The Workmen's Compensation Act), as well as relevant ordinances, regulation and union's agreements.
- The workers, immediate neighbour and other stakeholders should be sensitized on the dangers and risk associated with mining works for enhanced self-responsibility on personal safety.
- Put in place a respiratory monitoring program for each of the mine workers
- Appropriate sanitation conveniences should be provided at the site as required in the OSHA, 2007 and echoed in the Public Health Act.
- If blasting is mandatory, then observe the following:-

✓ Ensure the proponent has a valid Rock blasting permit from mines and geology department

✓ Ensure that the blaster has a noise permit from the County government of Kitui and comply conditions in the permit

✓ Use controlled Rock blasting technique

✓ Inform neighbours in the proximity of the blast area of the date and time of Rock blasting and the expected effects

✓ Post sentries with red flags at every entry point to the blast area

✓ Prior to Rock blasting use sirens/whistles to warn everybody from approaching the blast site

- ✓ Prior to Rock blasting, evacuate all people including livestock from the vicinity of the blast area

7.1.19 Disruption of normal day-to-day activities

The proponent will put in place the following to minimize the impact:

- Sensitize the local people on the kind of project taking place
- Restrict earthworks on mandatory areas
- Restrict traffic to designated routes
- Drivers to switch off engines and avoid unnecessary revving and engine idling
- Carry out some construction activities at night to avoid disruption
- Secure sensitive areas with a danger tape
- Execute the project as per project schedule to avoid delays

7.2 Mitigation of Decommissioning Phase Impacts

7.2.1 Efficient solid waste management

Solid waste resulting from excavation works will be managed as described in **Section 7.1.6.**

7.2.2 Reduction of Dust Concentration

High levels of dust concentration resulting from excavation works will be minimized as described in **Section 7.1.1.**

7.2.3 Minimization of Noise and Vibration

Significant impacts on the acoustic environment will be mitigated as described in **Section 7.1.5.**

8 ANALYSIS OF PROJECT ALTERNATIVES AND THE PROPOSED ACTION

8.1 Introduction

The ESIA process also involved the examination of the alternatives to the proposed project. This is essential since it allowed the project proponent to make an informed decision regarding not only the location of the project, but also technologies that will be applied during project implementation and operation phases. This process also ensured that the project activities are located in suitable locations and appropriate, cost effective and environmentally friendly technologies are used. The following sections provide the analysis of alternatives that were considered in the case of the proposed small scale copper mining.

8.2 The Proposed Alternative

The ESIA project report has been prepared for submission to NEMA; facts, findings and recommendations/proposals of which are based on the proposed copper mining, materials and proposed technologies. This helps in evaluating and examining the foreseeable effects of the project on the environment and therefore assisting in addressing how the proposed project has to ensure that all environmental measures are complied with during the project preparation and during operational phase.

The alternative consists of the proponent's final proposal with the inclusion of the legal guidelines, regulations and procedures as stipulated in the EMCA, 1999 which aims at reducing environmental impacts to the maximum extent practicable. Appropriate Environmental Management Plans have been prepared as per the requirements of the Act.

8.3 Relocation alternative

Relocation option to a different site is an option for the project implementation. At the moment, the proponent has no alternative site for relocation. The proponent has also obtained land consent from the land owners. Looking for another land to accommodate

the scale, type and size of the project and completing official transaction on it may take a long period. Besides, there is no guarantee that such land with suitable copper ore deposits would be available.

Although monetary costs should not be used to justify a wrong project, this would also mean extra costs in terms of money and time. For example, whatever has been done and paid to date would be a direct loss to the proponent. This may also lead to a No Action Alternative situation. The other consequence is that it would discourage both foreign and local investors. In consideration of the above concerns and assessment of the current proposed site, relocation of the project is not a viable option. The problem is further aggravated by the characteristics of quality copper ore in that the location is fixed, and the situation is not like developing a new factory, where there is much more choice in the location of the premises.

8.4 The No Action Alternative

The No Action Alternative in respect to the proposed project implies that the status quo is maintained. This option is the most suitable alternative from an extreme environmental perspective as it ensures non-interference with the existing conditions. The anticipated environmental impacts resulting from the proposed activity would not occur.

This option will, however, involve several losses to the project proponent and other stakeholders such as the local community and Government. The landowners will continue under-utilizing land by undertaking the non-profitable rain-fed agriculture and livestock keeping. .

On the other hand, the operation phase is expected to create employment opportunities therefore contributing positively to the national economy. The No Project Option is the least preferred option and it becomes apparent that the No Project Alternative is not the appropriate alternative.

8.5 Alternative Mining Method

The proponent is proposing to use surface or open pit mining method since the copper ore is near the surface and the method is widely used today in mining copper. Open pit mining is a technique used to extract copper ore near the earth's surface. It is accomplished by creating and using benches or terraces to gradually reach deeper under the earth's surface. From an environmental perspective, it is the friendliest compared to the Sub-surface/Underground mining technique.

Copper can be mined using two main namely surface (Open pit mining) and sub-surface (Under-ground mining). In each of these mining methods, various earth-moving equipment including shovels, dozers, hauling trucks, and loaders are used to remove and transport the ore. However, the first step is to loosen the rock in the ore body so that it can be moved and processed. Blasting and grinding equipment are used to accomplish this task.

An alternative to the open pit/surface mining method is the underground/sub-surface mining method. It is used when the copper ore is not near the earth's surface. Miners dig a shaft into the ore deposit vertically or a horizontal tunnel (or adit) in order to do this. Mining then follows the vein of ore and the underground mine develops. In both mining techniques, the mined ore must be removed from the mine and transported to a plant for processing and refining. Trucks and trains are used for this purpose.

The proponent has evaluated the two mining methods. The sub-surface technique is not an option here since it is applied when the copper ore is located deep underground. The method is also very expensive and poses major risk of soil and underground water pollution due to acid rock drainage. To this end, the proponent has proposed to use the surface or open pit mining technique since the copper ore is near the surface and the method is widely used today in mining copper.

8.6 Alternative Mining Technology

Copper ore can be mined using three technologies namely manual, mechanical and chemical. From an environmental perspective, manual mining using simple and hand

operated tools is the most appropriate. However, this technology works best when small volume of earth is to be removed and as such may not work for copper mining. The method is also slow and not applicable on hard rock surfaces. Mechanized means by use of excavators, compressors amongst others produces large quantities of copper ore. It is fast and economically appropriate for commercial copper mining. Similarly, chemical method by use of explosive materials produces large quantities of the same. However, chemical method is best suited where mine is located relatively far from residential areas. The Proponent has evaluated the available technologies and has settled for a combination of mechanized, chemical and manual technologies.

8.7 Mining extent/scale

The mining Act 2016 provides for three scales of mineral mining namely: artisanal, small-scale and large scale mining. Artisanal is mainly done by individuals using traditional and simple tools. However, small-scale and large scale can be undertaken by individuals, community and companies by employing appropriate mining methods and technologies. The proponent has evaluated the various mining extent and is proposing to use small scale copper mining since the copper deposits are in selected parcels of land where the proponent has obtained land consent.

8.8 Location of a crusher for mined copper ore

Typically, mined copper ore is supposed to be grind into smaller marbles before final processing into assorted products. The grinding is achieved by a stone crusher which can be on-site or off-site the mining site. The proponent has evaluated the onsite and off-site crusher location and has opted to be transported raw copper ore to processing plants in Nairobi.

8.9 Solid waste management alternatives

The proposed project will generate minimal solid wastes. The following options are available to the proponent in management of the waste.

8.9.1 Re-use /Recycling

Overburden will form the bulk of solid waste during establishment of mining pits. The proponent has an option of discarding such overburden. However, the proponent has opted to safely heap the soil within the mining pits area for re-use during site rehabilitation. Excavated rocks including rejected copper ore will be re-used to backfill the mining pits or alternatively re-used in construction activities.

8.9.2 Integrated solid waste management

Since assorted general waste will be generated by the proposed project and especially at the campsite, an integrated solid waste management system is recommendable. First, the proponent will give priority to Reduction at Source of the waste materials. This option will demand a solid waste management awareness programme in the management and the workers. Notices for proper waste management/handling may be posted at strategic places for the sake of visitors. Secondly, segregation, material recovery, Reuse, composting and Recycling of the waste will be the second alternative in priority. This will call for a source separation programme to be put in place. The recyclables will be sold to waste buyers. The third priority in the hierarchy of options is incineration of the waste that is not recyclable. Finally, sanitary land filling will be the last option for the proponent to consider.

8.10 Liquid waste management alternatives

8.10.1 Use of septic tank at the campsite

Liquid waste is expected to be generated at the campsite that may call use of a septic tank. This involves the construction of underground concrete-made tanks to store the sludge with soak pits. It is expensive to construct and require regular emptying in large discharge points especially with the large projects. This method is the most preferred

for the proposed project but it will require incorporation of soak pit to avoid frequent emptying.

8.10.2 Management of wastewater at the mining pits

Mining pits have a tendency of accumulating wastewater. Such wastewater can be a breeding site for mosquitoes thus compromising the health of the local residents and workers. Further, such wastewater makes mining activities difficult. The proponent has an option of re-using the wastewater for construction activities, irrigation and livestock. Since such mine wastewater is likely to be contaminated with heavy metals, the proponent is proposing to use it for construction activities as well as dust suppression at the mining pits.

8.11 Comparison of alternatives

Under the Relocation alternative, the proponent would have to look for another site and either buy or lease. The amount of money paid to lease would have to be lost among other direct and indirect loss. Beside such a land with suitable copper deposit may not be found. This may discourage investors and may lead to a No action alternative. Under the No Action Alternative, there would be no activities at all. There would be no benefits from the site and neither would there be the insignificant environmental Impacts. The proposed surface/open pit mining method will be more environmentally friendlier compared to subsurface/underground mining method. The proposed combination of manual and mechanized technologies will be relatively fast and create more jobs compared to a purely mechanized or chemical mining technology. Chemical technology is usually the fastest but poses major occupational risks and is most suited for large scale copper mining.

If the proposed alternative goes on, the project would create employment opportunity both directly and indirectly. Copper ore produced would generate additional employment throughout the value chain during crushing, refining and processing. Spill-over effects of the project will generate additional employment opportunities. Revenue

will be generated for both County and national governments and maximum utilization of land will be achieved. The mining will spur growth in the industrial sector. The area would also be opened up and this will promote development. Provided the recommended Environmental Impact mitigation measures are adopted and implemented, negative impacts will be avoided/minimized. However, commitments related to development alternative would ensure that potential impacts are minimized to insignificance levels as envisaged in the EMP.

8.12 Mitigation for the proposed Action

The mitigation measures would be appropriately designed and implemented to protect the environment and especially water, soil, land degradation, flora and fauna of the proposed site. Mitigation measures for the proposed action are detailed in the environmental and social management plan in this report.

8.13 Climate Change and Vulnerability Assessment

Climate change may pose a risk and impact to the proposed project during construction. Climate change impact during construction period may affect infrastructure systems by changing the weather conditions along the project route. For instance, increased precipitation may delay construction work due to; interference with work schedules due to prolonged rains, degradation of roads affecting transportation of construction materials amongst other impacts.

During the operational stage, climate change may affect the proposed copper mining. Extreme storms may also result into flooding which may subsequently result to wastewater accumulating in mining pits. This makes extraction of copper ore difficult as well as expensive in instances where the miner opts to pump the water out of the mining pits. Severe storms can also damage access roads making transportation of excavated copper ore a challenge.

8 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

8.1 Introduction

The proponent of the proposed project acknowledge the fact that the proposed project activities will have some impacts on the biophysical environment, health and safety of its employees and members of the public, and socio economic well being of the local residents. Thus, the main focus will be on reducing the negative impacts and maximizing the positive impacts associated with the project activities through a programme of continuous improvement.

An environmental management/monitoring plan has been developed to assist the proponent in mitigating and managing environmental impacts associated with the life cycle of the project. The EMP has been developed to provide a basis for an Environmental Management System (EMS; ISO 14001 principles) for the project. It is noteworthy that key factors and processes may change through the life of the project and considerable provisions have been made for dynamism and flexibility of the ESMP. As such, the ESMP will be subject to a regular regime of periodic review.

Tables 4, 5 and 6 form the core of this ESMP for the construction, operational and decommissioning phases of the proposed project respectively. In general, the tables outline the potential safety, health and environmental risks associated with the project and detail all the necessary mitigation measures, their financial costs, as well as the persons responsible for their implementation and monitoring. The ESMP will be used as checklist in future environmental audits.

Table 6: Environmental and Social Management Plan for the proposed project

Environmental/ Social Impacts	Proposed Mitigation and Aspects for Monitoring	Responsibility for intervention and monitoring	Estimated costs in K.Shs	Monito means
Public Safety, Traffic, Occupational Safety and Health (OSHA)	❖ Provide all workers with properly fitting personal protective equipment (PPE) and clothing to avoid injuries and illness. ❖ Maintain smooth flow of traffic within the mines and ensure adequate space for trucks to turn ❖ Provide a camp site with basic facilities ❖ Use light tools to do mining and reduce incidences of injury ❖ Minimize use of chemical explosives. ❖ Always keep explosives in a safe and maintain cautionary signage "HATARI" ❖ Provide a pit latrine at the campsite ❖ Consider coming up with workers respiratory program as required by OHS and OSHA guidelines on workers health and safety in workplaces of this nature ❖ Workers must be sensitized on the importance of using the PPE at mining points ❖ Clearly post signage at the mining pits such as "PUT ON PPE BEFORE ENTERING THE MINES" ❖ Provide hand washing point at the pit latrine ❖ Provide adequate and clean drinking water at the camp site and all the active mining pits ❖ Secure mining pits by fencing to avoid accidental fall into the quarrying pits. ❖ Provide a well-equipped first aid kit during mining works as required by OSHA guidelines for worksites ❖ Provide workers with basic trainings on basic first aid administration ❖ Strictly, carry out mining activities during the day ❖ Sensitive/risky mining sites should be clearly secured by a danger tape to warn off intruders.	Management & workers	300,000	inspect routin mainte e

	❖ Consider demarcating the mining site with brightly coloured route markers ❖ Put up a danger/warning signs especially at the main and feeder roads. Signs such as DANGER!, BEWARE OF FALLING ROCKS!, KEEP OFF MINING IN PROGRESS! Could easily warn the members of the public and workers who frequently use the roads. The signage will awaken the civic consciousness of the people with regard to safety ❖ Clearly indicate speed limit within the mining site ❖ Properly design entrance and exit to the mining pits to allow for deceleration and acceleration. ❖ Clearly indicate direction of traffic flow i.e indicate how traffic of transport vehicle should flow within the mining area ❖ Safety awareness may be gained through regular safety meetings, safety training or personal interest in safety and health. This awareness will increase ability to respond if, some day in future, one is a bystander in an emergency. ❖ Workers should always be sensitized on social issues such as drugs, alcohol, diseases etc. There should be training programs to facilitate this.			

Air pollution	❖ Use light tools to do mining where applicable ❖ Avoid hauling of excavated soil and rocks from elevated areas ❖ Ensure mining machinery and vehicles are properly tuned and maintenance regularly done ❖ All miners to be provided with dust masks ❖ Sensitize all workers on the importance of usage of the dust masks ❖ Always sprinkle water on all active and dusty mining pits ❖ If trucks are to be used to carry excavated soil and rocks, then the trucks must be adequately covered to avoid dust emission ❖ Provide dust screens at the campsite to reduce the amount of dust from the mining pits ❖ Sprinkle water on heaps of soil before hauling or loading on trucks ❖ Sensitize drivers to avoid unnecessary revving. ❖ Restrict traffic to designated and most efficient routes ❖ Reduce earthworks to a critical minimum	Management & workers	100,000	inspect observa
Reduction of indigenous vegetation	❖ Plant trees at the campsite to compensate for lost trees due to mining activities ❖ Avoid unnecessary vegetation clearance ❖ Restrict traffic along the designated and most efficient routes ❖ Aid natural regeneration in old and abandoned mining pits ❖ Avoid vegetation clearance under all costs ❖ Promote natural regeneration by securing abandoned mines by fencing to allow humble time for natural regeneration ❖ Carry out enrichment planting using appropriate tree species ❖ Limit vegetation clearance on mandatory areas ❖ Rehabilitate already mined pits using indigenous tree species ❖ Sensitize workers including drivers on importance of vegetation care ❖ Minimize earthworks to a critical minimum by use of light and hand operated tools ❖ Consider back-filling and rehabilitating already mined pits to facilitate natural regeneration	Management & workers	150,000	rvation Routine inspect

Energy consumption	❖ Keep on using light tools and reduce use of heavy machinery where applicable ❖ Consider installation of solar panel to light at the campsite ❖ Consider use of energy efficient stoves to reduce fuel and charcoal consumption ❖ Ensure machines and vehicles are properly and regularly maintained ❖ Discourage truck drivers from unnecessary revving and idling ❖ Limit traffic movement and operations to efficient and necessary activities. ❖ Sensitize drivers to switch off engines when not being used.	Management, Drivers	50,000	Observ Routine sensitiz
Soil Compaction and erosion	❖ Capitalize on use of light tools and reduce usage of heavy machinery ❖ Restrict traffic to authorized, designated and most efficient routes ❖ Avoid vegetation clearance in non-interest areas to reduce soil erosion ❖ Restrict mining activities to only designated areas ❖ Landscape the area with assorted grasses and tree species ❖ Restrict vegetation clearance to key and designated areas ❖ Were possible establish soil and water conservation structures such as terraces or cut-off ditches to reduce surface run-off ❖ Minimize earthworks to a critical minimum	Management, Drivers, Miners	50,000	Inspect
Increased Water Demand	❖ Carry out roof catchment water harvesting at the campsite. ❖ Use wastewater that collects within the mining pits to sprinkle on dusty mine surfaces to reduce dust and other less sensitive uses ❖ Strictly avoid domestic consumption of waste water in mining pits due to presence of acids, heavy metals among other pollutants. ❖ Provide notices and information signs i.e. "*conserve water* etc. This will awaken the civic consciousness of the people with regard to water usage and management ❖ Encourage water reuse/recycling.	Management, Workers	10,000	Observ Sensitiz
Solid Waste	❖ Ensure rejected/remnant rocks are carefully removed from the working zone ❖ Ensure excavated top soil is carefully heaped on designated areas ❖ The management should consider adoption of an effective waste management system to handle solid materials that are generated from various operations (Use of an integrated solid waste management system; through a hierarchy of options:	Management& Workers	50,000	Inspect sensitiz , trainir

	source reduction, recycling, composing and reuse, and sanitary land service) ❖ The proponent should place waste bins strategically at the campsite ❖ Use rejected rocks and heaps of top soil to backfill the mined zones ❖ Use rejected rocks for local construction activities ❖ Use excavated top soil to undertake tree planting and landscaping activities at the quarry and its environs. ❖ Incase of waste in form of plastic bottles, they should be sold or given away to the approved plastic recyclers while paper waste should be sold to waste paper recyclers. ❖ Any unrecyclable waste should be disposed to approved dump site and as per the Waste Regulations ❖ Train or educate the involved stakeholders on the importance and means of waste management and handling. ❖ The proponent should work hand in hand with private refuse handlers, NEMA and the County authorities to facilitate sound waste management as per the prevailing regulatory provisions.			
Emergency Response Plans-ERPs	❖ Workers to be provided with the requisite safety training and annual drills conducted. ❖ Provide an emergency contacts telephone list ❖ Provide emergency response notification instructions ❖ Training on simple instructions on how to administer first aid ❖ Provide simple procedures of evacuating workers from the mining pits in case of emergency	Management, workers	90,000	Observ training
Equipment Maintenance	❖ Always ensure all machines and equipment is well maintained these in accordance with the maintenance schedules indicated in the manufacturer's manuals as well as the Kenya statutory requirements. ❖ Always ensure the machines and equipment are procured from authorized vendors ❖ Procure spare parts from authorized vendors	Management, Plant operators & Drivers	120,000	Observ

Security	❖ Install security light at the campsite ❖ Employ security guards to man the campsite and the mining pits	Management	40,000	Inspect
Fire Preparedness	❖ Provide fire extinguishers at the campsite ❖ Train workers on fire fighting techniques. ❖ Conduct regular fire fighting drills/simulations to sensitize workers. ❖ Adapt an emergency response plan for the entire mining site and camp ❖ Provide fire hazard signs such as 'No Smoking' signs, direction to exit in case of any fire incidence	Management, workers	50,000	Inspect trainin
Noise pollution	❖ Capitalize on use of light and hand operated tools where applicable ❖ Use of heavy machinery and blasting to be done in special circumstances ❖ Strictly use mild/controlled blasting ❖ Strictly use few shot holes per blasting episode ❖ Install portable barriers to shield compressors and other small stationary equipment where necessary. ❖ Use quiet equipment (i.e. equipment designed with noise control elements). ❖ Co-ordinate with relevant agencies regarding all substantial operation activities in neighbourhood mining areas. ❖ Install sound barriers for pile driving activity. ❖ Limit pickup trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible. ❖ Excavation works should be done during the day when people are away and also the outside environment is also noisy. ❖ Adhere to the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 regarding noise limits at the workplace. ❖ Adhere to times stipulated for blasting and settle disputes as stipulated in lease agreements and statutory requirements.	Management, Plant operators & Drivers	100,000	Inspect Trainin

Fly rock, Air overpressure and ground Vibration	❖ Limit use of heavy machines and blasting to special cases ❖ Blasting to be done during day time only ❖ Provide workers with earmuffs ❖ Capitalize on use of light and hand operated tools where applicable ❖ The mining hours to be strictly limited to daytime i.e. between 8.00 am to 5.00 pm. ❖ Screening using baffle moulds material such as already excavated materials i.e. soils and other solid wastes. ❖ Conduct awareness and training to the staff on the risks of noisy environment ❖ Fly rock should be avoided altogether outside the site. ❖ If the assessment of the danger zone suggests it may extend beyond the site boundary, then a controlled space should be created, where people/animals are either excluded or protected, and not endangered by the blast and the subsequent fly rock. ❖ Avoid rock blasting unless it is mandatory ❖ Strictly practice controlled blasting and use a registered blaster ❖ Supervision of the site by a person with knowledge of dangerous blasting activities, process design, controlled drilling and careful observation of mine pit faces, and adherence to accepted blasting practices. ❖ Appropriate blasting design must be adopted by ensuring the setting-out and drilling of blasts is as accurate as possible and the drilled holes should be surveyed for deviation along their lengths ❖ Correct stemming will help control overpressure and fly rock and will also aid the control of ground vibration. ❖ Monitoring of blasting and re-optimizing the blasting design in the light of results, changing conditions and experience should be carried out as standard. ❖ Avoid blasting in adverse weather conditions i.e. during significant temperature inversions; moderate to strong winds towards sensitive areas; foggy, hazy or smoky conditions with little or no wind; a still cloudy days with a low cloud ceiling; periods when the surface temperature is falling in the middle of the day; periods when strong winds accompany the passage of a cold front; and before mid-	Management, Plant operators & Drivers	100,000	Inspect Trainin

	morning or after sunset on clear calm days. ❖ Ensure there is a valid Rock blasting permit from mines and geological department ❖ Ensure that the blaster has a noise permit from the County government of Kitui and comply conditions in the permit ❖ Inform neighbours in the proximity of the blast area of the date and time of Rock blasting and the expected effects ❖ Post sentries with red flags at every entry point to the blast area ❖ Prior to Rock blasting use sirens/whistles to warn everybody from approaching the blast site ❖ Prior to Rock blasting, evacuate all people including livestock from the vicinity of the blast area			

Disruption of wildlife habitat	❖ Maintain existing small scale mining and give wildlife humble time to migrate ❖ Minimize vegetation disturbances ❖ Plant trees at the campsite to provide additional niches for wildlife ❖ Limit use of heavy machines and blasting to special cases ❖ Strictly use mild/controlled blasting ❖ Capitalize on use of light and hand operated tools where applicable ❖ Restrict consumption of waste water in mine pits by wild game since the water is mostly contaminated with acids and heavy metals ❖ Avoid pumping of mine waste water into vegetated sites to avoid absorption of heavy metals by plants and thereafter bioaccumulation in wild game ❖ Backfill open pits to reduce waste water accumulation ❖ Strictly avoid subsurface mining which may result to acid rock drainage ❖ Strictly maintain noise levels to a critical minimum to avoid disturbance to wildlife ❖ The mining hours should be strictly limited to daytime i.e. between 8.00 am to 5.00 pm when the rest of the environment is noisy ❖ Screening using baffle moulds material such as already excavated materials i.e. soils and other solid wastes. These should be located on the site boundary to reduce noise for noise-sensitive wild animals. ❖ Always check the presence/absence of indicators of a healthy environment such as ants to establish whether pollution is taking place.	Management, Miners	150,000	Inspect Monitc
Risk of Acid rock drainage and heavy metals	❖ Capitalize use of surface mining with isolated and minor cases of subsurface mining ❖ Strictly use waste water accumulating in the mine pits to sprinkle on dusty mine surfaces ❖ Strictly, pump out wastewater from mine pits under special conditions especially during heavy rains ❖ Never use wastewater in the mine pits for domestic purposes at the campsite ❖ Strictly avoid underground mining that may proceed below the water table and result to acid drainage ❖ Avoid pumping of wastewater from mine pits in vegetated areas	Management, workers	100,000	Inspect Monitc Testing

	❖ Restrict consumption of waste water in mining pits by wild game since the water is mostly contaminated with acids and heavy metals ❖ Backfill open pits to reduce waste water accumulation ❖ Carry out periodic analysis of waste water in the mine pits to ascertain the levels of heavy metals concentrations such as lead, cadmium amongst others ❖ Carry out corrective measures of incidences of water pollution beyond acceptable limits ❖ Always check the presence/absence of indicators of a healthy environment such as ants to establish whether pollution is taking place.			

Effects of mine pollution on humans	❖ All mine workers must be provided with PPE such as gas masks ❖ Reduce dust particulates that may contain heavy metals by sprinkling water on active and dusty mine surfaces ❖ Never use water from the mine pits for human consumption to avoid ingesting traces of heavy metals ❖ Always provide miners with clean drinking water ❖ Capitalize on use of surface mining with isolated and minor cases of subsurface mining ❖ Entry into the mine must be subject to wearing of gas masks and adequate cautionary signage posted at entry points of the mine ❖ Backfill open pits to reduce waste water accumulation ❖ Carry out periodic analysis of waste water in the mine pits to ascertain the levels of heavy metals concentrations such as lead, cadmium amongst others ❖ Carry out corrective measures of incidences of water pollution beyond acceptable limits ❖ Always check the presence/absence of indicators of a healthy environment such as ants to establish whether pollution is taking place. ❖ Consider coming up with a respiratory program for mine workers ❖ Monitor exposure level for each employees ❖ Keep data sheets for each employees on exposure level ❖ Take preventive and corrective measures in case of employee exposure level beyond acceptable limits ❖ Use engineering and administrative strategies such as increased ventilation, duty controls amongst others to reduce exposure level ❖ Sensitize mine workers on dangers of exposure to harmful substances from the mine	Management, workers	200,000	Inspect Monito

Table 7: Environmental Monitoring Plan for the proposed project

Element/ environmental and socioeconomic component	Sources or key areas	Key issues/Impacts	Parameter	Frequency of monitoring	Responsibility	Costs(Ksh)	Relevant legislation/guidelines
Water	Surrounding streams Boreholes	Water Quality and Quantity as a public health concern Aquatic life ecosystem support Domestic water standards Industrial water standards	Water Quality(physical and biochemical composition) and Quantity Abstraction rates and drawdown for boreholes	Monthly or at least two times a year to cover seasonal variations	Proponent	200,000	EMCA (Water Quality) Regulations ,2006
Effluent and storm water discharge	Runoff from buildings Road and other infrastructure	Water Quality and Quantity as a public health concern Aquatic life ecosystem support Waterborne diseases prevalence Riparian rights issues Effluent discharge license	Effluent Quality(physical and biochemical composition) and Quantity	Monthly	Proponent	220,000	EMCA(Water Quality) Regulations ,2006

Solid Waste Management	Infrastructure developments Construction areas	Key sources Amounts produced Nature or type of waste Storage means Transportation means Waste Treatment Disposal methods Disposal areas/siting and conveniences Hazardous waste	Quantities Per day/month Composition Equipment used Waste reduction and recovery at source	Monthly	Proponent	230,000	EMCA(Waste Management) Regulations,2006
Biodiversity loss	Forests(natural and artificial)in and around the project area Streams around the project sites	Loss of habitats & local biodiversity – rare and endangered flora & fauna Loss of medicinal plants Loss of critical isolated habitats and bird species Disappearance of potential eco-tourism sites	BPI Indices For (E.G. Wetlands In Form Of Streams Bordering The pits Individual species count(capture recapture) Biomass Index	Quarterly	Proponent	210,000	EMCA, various Laws of Kenya and International Treaties

Soil System Monitoring	Forests(natural and artificial)in and around the project area Streams around the site	Soil erosion rates, Slope stability, Water, sediments load, Types and effectiveness of soil conservation measures	Changes in soil structure Soil texture, bulk density, organic carbon,pH,aggregate stability, hydraulic conductivity,electrical conductivity,SAR Soil fertility through regular sampling and determination of pH, P, N, OC, Mn, Zn, Cu, Mg, EC, Na and Ca; Heavy metals Pesticide residues	Quarterly in the particular project areas defined	Proponent	180,000	EMCA Water Act,2002 Public Health Act Waste Management Regulations (2006) Water Quality Regulations (2006)
Occupational Health and Safety for any development:	Workers and machinery on site	Compliance to the OSHA, 2007	Audit of safety and health conditions in all premises and work places	Continuous and upon completion annually	Proponent	300,000 p.a	EMCA OSHA 2007
Air Quality and Noise	Machinery and moving vehicles	Compliance to Occupational Safety and Health Act 2007	Noise levels	Continuous during construction and certain areas(generators	Proponent	280,000 p.a	EMCA OSHA 2007

				and noisy machines)			
Vibrations	Machinery and moving vehicles	Compliance to OSHA,2007	Vibration levels	during construction and certain areas(generators and noisy machines) semiannually	Proponent	260,000	EMCA OSHA, 2007
TOTAL						**1,780,000**	

8.2 Decommissioning Phase

The main purpose of decommissioning is to restore/rehabilitate the site to acceptable standards and all efforts which should be geared to making the site as close as possible to its original state before the existence of the proposed project. The decommissioning will in brief involve:

- Filling the mined pits, removal of debris and landscaping to have aesthetic value.
- Planting of fast growing indigenous trees which exist within and around the project site to compensate for the lost fauna and flora during site preparation.
- Applying the most appropriate controls and procedures in place throughout to control environmental degradation by dividing the site into a number of portions and excavating in turn. The debris from one pit will be used to fill the pit previously excavated.

Moreover, to rehabilitate the site as close as possible to its original state, the following rehabilitation measures as discussed in the table below should be practiced by the proponent;

Table 8: Environmental Management Plan for the Decommissioning and Closure

Objective: To make the place after operation equivalent or better than its original condition

Action required	Responsible party	Time frame
▪ All stone wastes should be used in landscaping and covered with soil which can support vegetation.	Proponent	Once
▪ All pits and depressions should be filled as much as possible and landscaping involving covering the surface with suitable soils for plant growth ▪ Improve soil fertility and PH where needed.	Proponent	Once
▪ Once operations cease, areas under modification /rehabilitation must be demarcated with danger tapes or barbed wire to prevent access by animals and human beings as rehabilitation continues.	Proponent	Continuous
▪ A security fence should be constructed to completely limit access from other areas.	Proponent	once
▪ Transport all equipment and dispose wastes appropriately.	Proponent	Once

Table 9: The Restoration Plan

Environmental Social Impact Aspect	Mitigation Action	Responsibility	Time frame	Cost Estimate
Mining Pits	-Exhaust and rehabilitate on material site before opening another section. -Exhausted excavations and mine pits be backfilled -Hold top soils by planting vegetation on the pit backfilled. -Ensure reduced stagnation of water in mined pits -Develop appropriate agreement with land owner on conditions and terms of operations	Proponent	Throughout the project cycle	**1,250,000**
Destruction of physical environment, soil erosion and loss of biodiversity	-Protective structures should be used to avoid small scale landslides -Topsoil should be stockpiled , backfilled and compacted separately from subsurface and after completion works be restored in order to facilitate natural regeneration around the area of operations -Planting of trees	Proponent	Throughout and once after completion work	**360,000**
Sediment run-off	-Avoid sediment (which may contain heavy metals) transport from the mine -Install sedimentation traps -Silt fence should be established where erosion is predetermined -Design drainage ditches to avoid affecting nearby land -Divert run-off around working area -Treat water from the mine to remove heavy metals before discharge to the environment	Proponent	Throughout the project cycle	**200,000**
Storm water run off	Create of diversion channel to ensure no water flows across rehabilitated areas until it is stable	Proponent	Once off	**100,000**
Flora and Fauna	-Minimize area of clearance -Sensitize natural habitats	Proponent	Throughout the project	**570,000**

	-Re-vegetate disturbed area within the site with fast growing plant that are existing within and around the mined pit site		cycle	
Surface and ground water drainage obstruction	-Preserve vegetation along drainage channel -create runoff barriers	Proponent	Throughout the project cycle	**220,000**
Loss of land	-Soiling and grassing of all the mined pits -Compensation	Proponent	Once –off	**1,260,000**
Total Cost				**Kshs.3,960,000.00**

10 CONCLUSION AND RECOMMENDATIONS

The proposal by the proponent to undertake copper mining in accordance with the provisions of the Mining Act 2016 has been evaluated critically. The assessment has ascertained has obtained land mining consent from the local land owners and the County Government of Kitui. Further, by law, the proponent qualifies to hold a mining license as per the provisions of the Mining act 2016. The Act reads in part "The following types of mineral rights may be granted in respect of authorizing mining operations: a reconnaissance permit, a prospecting permit and a mining permit to a citizen of Kenya or a body corporate, where no less than sixty percent of the shareholding is held by citizens of Kenya". However, mining cannot start before acquisition of a Nema license and a mining license. It is against this background that this Comprehensive ESIA was undertaken to assist the client to obtain Nema EIA license and subsequently apply for a mining license.

Based on a feasibility study undertaken by the proponent, the proposed project site has commercially viable copper ore deposits. Household surveys, public and key stakeholders' meetings done during public participation and consultation process indicate that the local people fully support the proposed copper mining.

Critical examination of the project area has established that it is predominantly agropastoral mainly characterized by rain-fed agriculture and livestock keeping. The area is sparsely populated with very few households within the vicinity of the proposed mining sites. The assessment has also ascertained that the proponent will use surface (open pit copper mining) method since the copper ore is near the surface. Mechanized and manual technologies will be combined with isolated cases of chemical technology to extract the copper ore. The ESIA experts are convinced that the selected mining method and technologies are the best from environmental and economic perspectives.

The assessment has further ascertained that the proposed copper mining project will bring about various benefits as indicated in this report, notably the utilization of natural resources, employment creation, optimum land use, corporate social responsibility, payment of taxes, promotion of the industrial sector amongst others. These benefits notwithstanding, the proposed project will bring forth some negative impacts such as increased dust (air pollution), fly-rocks and overpressure, noise and ground vibration, health and safety risks, pressure on existing infrastructure, potential pollution to water and soil, visual intrusion and landscape effects, removal of vegetation and increased waste (solid and liquid) generation amongst others. It should, however, be noted that the identified negative impacts can be adequately mitigated by implementing the provided ESMP.

The proposed project design has integrated mitigation measures with a view to ensuring compliance with the applicable laws and procedures in the operations. All activities should be conducted as per the laid down legal framework and regulations particularly EMCA 1999(2015, Amended Act), Mining Act, 2016, Mining and Minerals Act (Cap 306) and the Explosives Act (Cap 115). Throughout the proposed project cycle, sustainable environmental management should be ensured; avoiding inappropriate use of natural resources, conserving nature and guaranteeing health and safety of all people, working on the project, general public and inhabitants of the project. The integrity of the natural and social environment must be protected while ensuring wise and sustainable utilization of the mineral resource.

Conservation of resources such as energy and water within the project should be encouraged. Sound operational practices aimed at environmental conservation should also be adopted and special attention should be paid to conservation of the environment. Finally, restoration of the project site should be implemented throughout the project cycle as provided in the report restoration plan. ESMP precisely presents the identified negative impacts, their mitigation measures, the responsible party and the

timelines upon which practical actions are expected. The proponent is expected to strictly follow the proposed project methods, technologies and general and specific industry standards. The proponent is hereby advised to exercise caution and execute his mining activities within the confines of the existing statutory provisions and the principles of best practices for project of this nature and magnitude. Mining works engender a certain level of risks. As such, the proponent is strongly advised to familiarize himself with OHS and OSHA guidelines on workers' safety, health and welfare in mine workplaces in order to remain compliant and avoid possible injuries and subsequent liability issues arising. The developed ESMP precisely presents all likely occupational risks and hazards. The proponent is strongly advised that it is his full mandate to translate the ESMP into practical actions for full compliance.

The environmental expert has ascertained that the proposed project is appropriate and the likely negative impacts can be mitigated adequately by implementing the developed ESMP. Further, copper mining will be restricted in selected farmlands where the proponent has obtained land consent. Additionally, the project will generate assorted benefits to the land owners, local community, proponent and the government. On the basis of these findings, it is recommended that NEMA licenses the proposed project provided that the ESMP is fully implemented and the NEMA licensing conditions are fully adhered to.

11 REFERENCES

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12 APPENDICES

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