NAIROBI - NAKURU- MAU SUMMIT HIGHWAY PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY REPORT FOR

THE PROPOSED EXPANSION OF THE EXISTING SACHANGWAN QUARRY AND CONTRACTOR'S CAMP

Prepared By

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ESIA Study Report for the expansion of Sachangwan Quarry

DECLARATION

I, **Mr. Tom Omenda** (NEMA Reg. No. 0011) of E-CUE Associates, submit the following Environmental Impact Assessment (ESIA) Report for the proposed Expansion of the Existing Sachangwan Quarry.

The ESIA study has been carried out according to the Environmental Management and Coordination Act, 1999 and the Environmental Impact Assessment and Audit Regulations (Amendment) Regulations 2019.

To my knowledge, all information contained in this report is accurate and a truthful representation of all findings as relating to the Project.

SIGNATURE: ..... DATE: 31/5/2022

The Environmental Impact Assessment Team

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The Proponent's Declaration:

SOGEA SATOM

The Proponent's Declaration:

As the proponent of the proposed project, we confirm that the information given in this ESIA study report is true to the best of our knowledge.

Name..... PRUVOST THOMAS ..... Signature.....

THOMAS PRUVOST
31 MAY 2022

Designation..... PROJECT MANAGER .....

Date..... 31/05/22 .....

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LIST OF ABBREVIATIONS

ACC	Assistant County Commissioner
AIDS	Acquired Immunodeficiency Syndrome
AQM	Air Quality Monitoring
BAT	Best Available Technology (BAT
BEP	Best Engineering Practice
CDA	Community Development Agreement
CEACP	County Environment Action Plan
CEC	County Environment Council
DHIS	District Health Information Software
DOSHS	Directorate of Safety and Health Services
EA	Environmental Audit
EAC	East African Community
EIA	Environmental Impact Assessment
EMC	Environmental Management Coordination
EMCA	Environmental Management Coordination Act
EMP	Environmental Management Plan
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESO	Environmental and Social Officer
ESS	Environmental and Social Standards
FIs	Financial Intermediaries
FPIC	Free Prior and Informed Consent
GHG	Greenhouse Gases
GoK	Government of Kenya
GPS	Geographical Positioning System
HIV	Human Immunodeficiency Virus
ILO	International Labor Force
IPF	Investment Project Financing

ISO	International Standards Organization
KCM	Kenya Chamber of Mines
KEBS	Kenya Bureau of Standards
KENHA	Kenya National Highways Authority
KFS	Kenya Forest Service
KIHBS	Kenya Integrated Household Budget Survey
KNBS	Kenya National Bureau of Statistics
KPLC	Kenya Power and Lighting Company
MEA	Multilateral Environmental Agreements
NBSAP	National Biodiversity Strategy and Action Plan
NCCAP	National Climate Change Action Plan
NCCRS	National Climate Change Response Strategy
NEAP	National Environment Action Plan
NECC	National Environment Complaints Council
NEMA	National Environmental Management Authority
NEP	National Environment Policy
NET	National Environment Tribunal
NGO	Non-Governmental Organization
NLC	National Land Commission
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Act
PCC	Public Complaints Council
PPE	Personal Protective Equipment
PPP	Public Private Partnership
PWD	Persons with Disability
PWMP	Project Waste Management Plan
QA	Quality Assurance
QC	Quality Control
RE	Resident Engineer
SDGs	Sustainable Development Goals
SERC	Standards and Enforcement Review Committee

SHE	Safety Health and Environmental Standards
TOR	Terms of Reference
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCC	United Nations Framework Convention on Climate Change
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

Project Background

The Government of the Republic of Kenya, through the Ministry of Transport, infrastructure, housing, urban development and Public Works represented by the Kenya National Highways Authority (KENHA), being a state corporation established under the Kenya Roads Act, 2007 identified the need for the rehabilitation, improvement and expansion of the Nairobi – Nakuru – Mau Summit (A8) highway which serves as an access and transportation link for approximately 6 million Kenyans.

This project largely contributes to the realization and implementation of the PPP agenda in Kenya through the delivery of first – class infrastructure projects capable of meeting social and economic requirements of the people of Kenya in a timely, transparent and accountable manner as envisioned in the Vision 2030 blue print and the Big Four Agenda. Construction of the road will require huge quantities of aggregates, stone chippings, sand and gravel. Sachangwan quarry is an existing quarry and has been identified as a potential source of quality aggregates and a suitable location for the other installations namely Crusher, asphalt plant, precast yard, workshops, offices and other support infrastructure.

Project objectives

The main objective of the project is to provide a reliable and efficient supply of aggregates required for construction of the Nairobi Mau Summit (A8) Road and Rironi – Mai Mahiu – Naivasha Road (A8 South). It is also a suitable site for installation of support infrastructure required to undertake quarrying, stone processing and associated activities. Other facilities to be located at the site include crusher, asphalt plant, precast yard, workshops, laboratories offices and associated facilities.

ESIA Objectives

The principal objective of the assessment was to provide a framework for effective management of environmental and social issues during project implementation. It was carried out to enhance the Project's benefits and mitigate any adverse impacts, in line with Government of Kenya and IFC performance standards and guidelines on management of environmental and social impacts in development projects.

Scope of the ESIA

The study was conducted to evaluate the potential and foreseeable impacts of the proposed development. The physical scope was limited to the proposed site and the immediate environment as may be affected or may affect the Quarry expansion and Camp. Any potential impacts (localized or delocalized) were also evaluated as guided by EMCA, 1999 (Amendment 2015) and the Environmental (Impact assessment and Audit) Regulations, 2003 (Amendment 2016).

This report includes an assessment of impacts of the construction, operations and decommissioning of the site and its environs.

Approach and Methodology

The approach to this exercise was structured such as to cover the requirements under the EMCA 1999 (Amendment, 2015), as well as the Environmental Management and Coordination (Impact Assessment and Audit) Regulations 2003 (Amendment 2016). It involved largely an understanding of the project background, the preliminary designs and the implementation plan, as well as decommissioning. Environmental and

social baseline information was obtained through physical investigation of the site and the surrounding areas, desktop studies, public consultations with local communities residing in the project areas, survey, photography, and discussions with key proponent representatives. The steps followed include; Screening, Scoping and detailed study.

Project Description

The site is located in Sachangwan ward, Molo constituency at coordinates 809968.38; 997648.14. The quarry site is an existing quarry located approximately 190m on the RHS of the Mau – Summit Rironi Highway and approximately 680m South West of Sachangwan town. The total project area is estimated at 31.12 ha. The Proponent proposes to expand the current stone quarrying by opencast mining. The quarrying process will involve drilling and blasting. Excavation of stone will basically involve removal of overburden. The proposed quarrying shall be carried out for a target production of 58,000 tonnes per month in 42 months (4 years). The main project components are; crusher plant, concrete plant, asphalt plant, mixing plant, emulsion plant, offices, precast area and workshop. Additional auxiliary facilities include; laboratory, changing rooms and sanitation facilities

Legal, Policy and Institutional Framework

The objective of the review of the policy legal and regulatory framework is to ensure that the development is sustainable and does not compromise the future generations by destruction of the natural resources. It will also ensure that the relevant authorities are consulted to ensure provision of information to ensure that the project development runs smoothly.

The relevant Acts reviewed include EMCA, 1999 (Amendment 2016) and the respective regulations, Mining Act, 2016; Water Act Cap 372 of 2016, Occupational Safety and Health Act, 2007, Work Injury Compensation Benefits Act, 2007, Sexual offenses Act, CAP 62, 2006 , Public Health Act CAP 242, 2012, Physical and Land use planning Act, CAP 286, 2019; Public Health Act, CAP 232, Traffic Act CAP 403, 2014; Employment Act, 2007; Public Roads and roads of Access Act, CAP 399, 2010; Lands Act, CAP 280, 2015; Kenya Roads Act, CAP 408, 2012; National Land Commissions Act, CAP 5D, 2012; Registration of Titles Act Cap 281, 2010; County Government Act, No. 17 Revised 2014 (2012); Forest Act, 2005; Forest Conservation and Management Act, 2016; Energy Act, 2019; Wildlife Conservation and Management Act, 2013; Explosives Act, 2012; Use of poisonous Substances Act, CAP 247; Persons with disability Act No. 14 of 2003

Policies relevant to the project were also reviewed. They include Kenya Vision 2030, Mining and Minerals Policy 2016; National Environmental Policy, 2013; National Environmental Action Plan, 2003 (Revised 2007); National Forest Policy, 2014; National Land Policy 2009; National Land Use Policy, 2017; Wildlife Conservation and Management Policy, 2017; National Biodiversity Strategy and Action Plan, 2000; National Gender and Development Policy, 2019; Occupational Health and Safety Policy, 2012; HIV and AIDS Policy, 2009; Poverty Reduction Strategy 2000; World Bank Environmental and Social Framework.

Multilateral agreements and Conventions relevant to the project area were also reviewed. These include

The institutional framework review included the following institutions: Ministry of Mining and Petroleum; National Environment Management Authority; County Environment Committee; National Environmental Complaints Committee; National Environment Tribunal; Standards and Enforcement Review Committee; Directorate of Occupational Safety and Health Services; County Government of Nakuru; Kenya National Highways Authority; Sogea Satom

Environmental and Socio-Economic Setting

Environmental Setting

The project area is in Nakuru County, Molo constituency. The area experiences an annual average precipitation of 1176 mm and a mean annual temperature of 18.7^{o}C. Rainfall distribution is reliable, and frequent within the area. The main water source in the immediate project area are Sachangwan River located approximately 150m North east of the project site and drains into river Molo. Additional sources of water include boreholes, Nakuru Rural Water supply and rain water harvesting. The site is covered by a thin surficial layer of Quaternary pyroclastics that overlie Tertiary trachytes and quartz trachytes.

The soils are clay loam soils that are grey in colour and are comprised of highly developed textured top soils as well as well drained humic lawns with dark brown sub soils. The site is approximately 150 meters away from the busy Nairobi – Mau Summit Highway. There are scattered residential homes to the West

Air quality measurements undertaken indicate that the ambient concentrations measured are all below the EMC regulatory limits for Rural, Residential, and Other Areas. Main source of noise at all the points assessed is vehicular movement on the busy Nairobi Highway. Due to settlements, agricultural and commercial activities the area has few wildlife.

Socio-Economic Environment

Molo subcounty where the project is located has a total population of 156,732 according to the 2019 KNBS data. The area is mainly inhabited by three ethnic communities namely Kisii, Kikuyu and Kalenjin.

The dominant land use in the project area is rain fed crop agriculture and settlements. Other land uses are tree farming, mining, bee keeping, quarrying and small scale businesses. There are four learning institutions that are within 1km radius of the project site namely; Nguzu River Primary School, Sachangwan Secondary School, Mukinyai Secondary School and Kogo Junior Academy. Waste is predominantly managed by the individual owners through open pits where waste is burned or decomposed for use in the farms. Effluent is mainly managed by pit latrines and septic tanks.

The poverty levels in the area are relatively low which can be attributed to the relatively high rainfall amounts ensuring higher agricultural yields. Other factors include businesses and relatively good road and energy infrastructure. Gender dynamics in the area are such that roles are defined along gender orientations. In the existing quarries, women participate in more secondary roles in comparison to their male counterparts a factor that often contributes to disparity in income levels.

Analysis of Impacts

Prediction of the impacts was conducted by use of the Leopold matrix which quantified the magnitude of the impacts. A logical and systematic approach was adopted for impact identification. The aim was to consider all the important environmental/social project impacts and interactions, making sure that indirect and cumulative effects, which may be potentially significant, are not inadvertently omitted. Individual environmental issues were also viewed in respect to the different facets of the project.

Environmental and Social Impacts

Summary of Positive Impacts

Impact	Description

Employment Creation	The project will create direct and indirect employment opportunities for the local population. The opportunities will comprise both skilled and unskilled labour. Other sources of employment include food vending and supply of items required on site e.g., safety equipment among others.
Growth of the local economy	The project shall employ both skilled and unskilled personnel. This will provide a source of income not just to the locals but other personnel with specialized skills. As a result, more money will be available and shall be injected into the local economy. Consequently, small businesses may begin to thrive.
Skills transfer and training	Through recruitment of labour locally, the workers will have an opportunity to learn an array of skills that relate to quarry operations. This may be difficult to quantify but is still regarded as an important positive impact.
Source of revenue to the government	The personnel employed shall be required to remit taxes to the government thus providing a source of revenue to the government. Additionally, the contract shall pay revenue in the form of cess to the local government thus providing a source of income to the government

Summary of Negative Impacts

Parameter	Magnitude	Impacts	Mitigation measures
Construction phase			
Air pollution	Low	Sources of air pollution will include excavation works and vegetation clearance to pave way for additional infrastructure on site. Other sources of pollution are emissions from construction machinery and vehicles on site	• Emission of dust can be controlled by applying aggregates on the access road and truck parking areas • Proper maintenance of trucks and equipment to minimize emissions • Restrict excavations to the project foot-print to minimize surfaces exposed to wind • Ensure contractor's staff working at high dust generating sites are provided with appropriate PPEs to include dust masks and / or suitable aspirators
Waste generation	Low	Considerable volumes of solid waste will be generated during site preparation. If not properly managed, the waste can pollute the environment besides compromising aesthetics of the sites and the surrounding area.	• The contractor shall develop a comprehensive waste management plan; • Can be easily managed by prudent waste management practices on site
Soil pollution	Low	Accidental spillages of oil and fuel spills from construction machinery may infiltrate the soils and result in soil contamination.	• Ensure proper maintenance of construction vehicles to minimize spills and leaks • Avail a spill kit on site in case any unavoidable spills/leaks that occur • Servicing of vehicles in a bunded area so that any spills are contained

Vegetation Loss	Low	Vegetation clearance to pave for additional infrastructure on site shall cause vegetation loss onsite. However, there are no rare or threatened species	• Restrict clearance to the project footprint • Demarcate areas for clearance beforehand
Operation phase			
Air quality	High	Sources of dust are stone crushing, blasting which would be intermittent and only experienced during blasting operations and vehicles transporting materials in and out of the site. Impacts include respiratory tract infections in addition to being a general nuisance to the public.	• Wet crushing of material should be used to reduce the amount of dust produced • Apply aggregates along the access road and Sprinkle water regularly using rain guns or static sprinklers around the quarry pit to reduce fugitive dust emission • Preparation and implementation of an air quality monitoring plan and ensure compliance to limits set in schedule 1 of EMCA, Air Quality Regulations, 2014 • Provision of safety PPE for workers in dusty areas e.g., crusher plant
Noise and Vibration	High	Sources of noise include stone crushing, and blasting which is relatively intermittent Additional noise sources shall include construction machinery and vehicles on site. Noise and excessive vibrations impact though envisioned to be high due to proximity of the settlements around the project site, are cumulative and short term to the duration of the project. Blasting impacts are anticipated to be high but intermittent throughout the project operation period.	• From the vibration and velocity analysis, the maximum charge weight for blasting plans should be 100 kilograms. Blast-hole design should therefore take this into account • Schedule noisy activities e.g., blasting on weekends or after school hours • Control noise and vibration using Best Practice • Provision of safety PPE for workers noisy areas e.g., crusher plant • Notify residents 1 week prior to impending blasting operations • All construction workers to be supplied with and trained on the proper use of PPE and especially the ear muffs
Land degradation	Medium	Continued mining on the land will increase land degradation making it unsuitable for any agriculturally productive use in the future due to loss of top soil, nutrients and any supportive microflora that are necessary for substantial yields. It will also significantly scar the landscape	• Rehabilitation of the site at project completion in accordance with the Integrated Land Use Guidelines, 2011 and the quarry rehabilitation plan • Revegetation of the site to the native species identified during baseline studies

Landscape scarring	Medium	Excavation of the site scars the landscape resulting into badlands that are visually intrusive. Similarly, stock piles on site often alter the slope of the land and change the topography of the site. Once the extraction stops, the resultant derelict becomes a risk hazard.	• Rehabilitate the site at project completion and site closure • Adherence to slope recommendations in the Integrated Land Use Guidelines, 2011
Solid Waste Management	Medium	Solid waste types will range from vegetation, earth spoil to typical construction waste. Others will be from offices, workshops, clinic and laboratories. Improper waste management may compromise aesthetics and provide sites for disease vectors to breed	• Prepare and implement a waste management plan which as a minimum should include designated waste collection points by type and a waste collection, transportation and disposal protocol. • Engage a registered waste handler for both general and hazardous waste
Liquid Waste Management	Medium	Various liquid wastes including grey and black water and runoff from the workshop areas, batching plant, asphalt plant and various liquid waste streams from washing construction vehicles and equipment washing will be generated. These pose toxicity and quality threats to the soil and ground water, and the existing water sources within the area	• No grey water runoff or uncontrolled discharges from the site/working areas (including washdown areas) to the adjacent stream; • Water containing such pollutants as cement, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site; • Avoid pollution by oil spills by servicing vehicles in a bunded area so that any spills and contained • Ensure a spill kit is availed on site to handle any spills/leaks that may occur
Vegetation Loss	Medium	Additional vegetation clearance on the site for expansion of the quarry and installation of additional infrastructure will lead to overall vegetation loss. Impacts on vegetation are expected to be cumulative and localised to the site due to the narrow species diversity on site	• Areas to be cleared should be demarcated prior to clearance • Areas no longer required should be revegetated as soon as practically possible
Community health and safety	Medium	Injuries to the local population as a direct result of the quarry operations. Impacts anticipated to be moderate due to the close proximity of the settlements	• Have sufficient safety signages on the outside of the site • Institute strict access control and safety induction for all visitors to the site • Strict adherence to blasting schedules and notification / warning systems • Engage a registered and licensed blaster

Occupational safety and health	Medium	The workers engaged in the project are at risk of accidents which could being hit by split and flying rocks, cuts, falls, knocks, machine and vehicle operations.	• Access control and deployment of security personnel to prevent unauthorized entry into the quarry site • Keep workers a minimum 350 m away from the blast spot to avoid scattering stones • Provide the workers with complete PPE as appropriate • Implement standard best industry practices to prevent and manage health and safety risks
Child labour	Medium	The project area is surrounded by a number of schools and settlements hence cases of child labour are highly probable. Associated impacts are children being exposed to hard labour, drug and substance abuse, risks of sexual abuse and contraction of diseases like HIV/AIDs and STIs.	• Recruits should provide evidence of age to ensure that all employees are 18 years and above. • Provision of designated sheds for the food vendors at the project site in order to vet all the vendors • Ban hawking within and around the project site
Substance and drug abuse	Medium	Increased income generated from the project may exacerbate cases of substance and drug abuse within the area. Since the quarry site is a high-risk area measures to ensure that workers are not under the influence of substances at the workplace are necessary to protect the workers themselves and those around them.	• Issuance and signing code of conduct by all workers and sub-contractors • Sensitization and campaigns on substance and drug abuse • Controlling access to the quarry.
HIV/AIDS	Medium	Sexual interactions with the local population may lead to spread of HIV/AIDS and STIs within the area. Considering the low population within the immediate project environment any increase in HIV and AIDS will have a significant bearing on the statistics of the area.	• Conduct regular campaigns to create awareness on HIV / AIDS and STIs prevention and control • Provision of condoms on site strategically locating them to improve access • Highlighting HIV/AIDS prevention as part of the tool box talks
Education	Low	Schools in the vicinity may experience brief interruption during blasting	• Inform the schools 1 week prior of impending blasting operations

Conclusion and Recommendations

The findings of the ESIA study indicate that the project will have general positive impacts on the socio-economic environment. The most important socio – economic benefits are employment creation, skills transfer, source of revenue for the government and growth of the local economy. The most important negative impacts are air pollution, land degradation and noise and vibrations.

Other potential negative impacts include community health and safety risks, occupational health and safety risks, waste management, potential for substance abuse, potential for child labour. Moderate to low impacts anticipated on the bio – physical environment can be mitigated by the measures proposed. In general most

of the environmental and social management measures proposed are generally straight forward but others require creative and innovative ways to implement. Nonetheless, most of the measures relate directly to sound operating practices both during the construction phase and subsequently over the operational life of the quarry. Therefore, it is anticipated that the project will have minimal residual negative impacts on both the socioeconomic and biophysical project environment if the mitigation measures proposed in this report are implemented. It is recommended that a copy of the ESMP should be provided to personnel in charge of implementation for reference throughout the project life cycle.

1 INTRODUCTION

1.1 Background Information

The Government of the Republic of Kenya, through the Ministry of Transport, infrastructure, housing, urban development and Public Works represented by the Kenya National Highways Authority (KENHA), being a state corporation established under the Kenya Roads Act, 2007 identified the need for the rehabilitation, improvement and expansion of the Nairobi – Nakuru – Mau Summit (A8) highway which serves as an access and transportation link for approximately 6 million Kenyans. The project road is part of the Northern Corridor which is one of the busiest and most important transport corridors in East and Central Africa, providing a gateway through Kenya to the landlocked economies of Uganda, Rwanda, Burundi, Southern Sudan and eastern DR Congo. The main objective of the project is to expand the road capacity and improve the road quality between Nairobi and Mau Summit in order to accommodate the incising traffic in a safe and sustainable manner.

The project comprises of the widening of approximately 175 km of the A8 highway between Rironi and Mau Summit into a 4 (four) lane dual carriageway and future augmentation into a 6 (six) lane carriageway in sections depending upon traffic volumes and rehabilitation of approximately 57.8 km of the existing single carriageway of A8 – South Highway between Rironi and Naivasha via Mai Mahiu, construction of a viaduct through Nakuru Town, construction of grade separated interchanges and provision of Highway Information Systems.

This project largely contributes to the realization and implementation of the PPP agenda in Kenya through the delivery of first – class infrastructure projects capable of meeting social and economic requirements of the people of Kenya in a timely, transparent and accountable manner as envisioned in the Vision 2030 blue print and the Big Four Agenda.

Construction of the road will require huge quantities of aggregates, stone chippings, sand and gravel. Sachangwan quarry is an existing quarry and has been identified as a potential source of quality aggregates and a suitable location for the other installations namely Crusher, asphalt plant, precast yard, workshops, offices and other support infrastructure.

1.2 Project objectives

The main objective of the project is to provide a reliable and efficient supply of aggregates required for construction of the Nairobi Mau Summit (A8) Road and Rironi – Mai Mahiu – Naivasha Road (A8 South). It is also a suitable site for installation of support infrastructure required to undertake quarrying, stone processing and associated activities. Other facilities to be located at the site include crusher, asphalt plant, precast yard, workshops, laboratories offices and associated facilities.

1.3 ESIA objectives

The principal objective of the assessment was to provide a framework for effective management of environmental and social issues during project implementation. It was carried out to enhance the Project's benefits and mitigate any adverse impacts, in line with Government of Kenya and World Bank policies and guidelines on management of environmental and social development projects.

1.4 Terms of Reference

The present ESIA study includes several provisions that are outlined in the following ToR:

a) Description of the baseline environment (physical, biological, social and cultural)

b) Detailed description of the Project including - Project objectives, Project design, activities, technology, procedures and processes, materials to be used, products, by-products and waste generated, during the project construction, operation and de-commissioning phases

c) Review Legislative and regulatory framework that relate to the Project

d) Identification of potential environmental impacts that could result from the Project

e) Public involvement, i.e., stakeholder engagement and public consultation on the planning and design of the Project

f) Suggestion of sensible measures for mitigation of identified environmental and social impacts of the Project

g) Development of an ESMP to mitigate negative impacts

h) Preparation and submission of final ESIA report to NEMA, for review and decision making

1.5 Scope of the ESIA

The study was conducted to evaluate the potential and foreseeable impacts of the existing quarry. The physical scope was limited to the proposed site and the immediate environment as may be affected or may affect the proposed Project. Any potential impacts (localized or delocalized) were also evaluated as guided by EMCA, 1999 (Amendment 2015) and the Environmental (Impact assessment and Audit) Regulations, 2003 (Revised 2016).

This report includes an assessment of impacts of the construction, operations and decommissioning of the project site and its environs.

2 APPROACH AND METHODOLOGY

The approach to this exercise was structured such as to cover the requirements under the EMCA 1999 (Amendment, 2015), as well as the Environmental Management and Coordination (Impact Assessment and Audit) Regulations 2003 (Amendment 2016). It involved largely an understanding of the project background, the preliminary designs and the implementation plan, as well as decommissioning. Environmental and social baseline information was obtained through physical investigation of the site and the surrounding areas, desktop studies, public consultations with local communities residing in the project areas, survey, photography, and discussions with key proponent representatives.

The main activities undertaken during the ESIA study included:

a) Consultations with the key project stakeholders including the Project Proponent, community members, local administration, opinion leaders and departmental heads from Nakuru County Governments and the general public.

b) Physical inspections of the Project area which included observation of available landmarks, photography and interviews with the local residents

c) Evaluation of the activities around the Project site and the environmental setting of the wider area through physical observations, georeferencing and literature review

d) Review of available Project documents

e) Documentation of findings, data analysis and reporting

f) Submission of final ESIA report to NEMA, for review and decision making

Below is an outline of the basic ESIA steps that were followed during this assessment:

2.1 Screening

Environmental screening was undertaken to help determine whether or not the proposed Quary expansion and installations fall within a category that requires an ESIA prior to commencement. In addition, other considerations during the screening process included determination of physical location of the project, environmental sensitivity of the areas surrounding the project site, nature of community and social activities in the project area. It was determined that the project is classified as a high-risk project and therefore requires a full study to be undertaken.

2.2 Scoping

This was carried out to determine the key environmental issues to focus on during the study. Further, it was done to determine the anticipated impacts in the project life cycle. During scoping, main environmental and social issues were identified and a Terms of reference drafted and submitted to NEMA for approval. The approved TOR is attached in Annex 3.

The scoping exercise mainly aimed to:

- Identify potential stakeholders with an interest in the project and inform them of the project and the ESIA process

- Determine the spatial and temporal extent of the boundaries for the ESIA as well as the key issues to be addressed in the environmental and social assessment. This was done through a review of relevant background literature on the development in the project area and rapid field assessment in order to focus the environmental and social assessment on key issues requiring assessment and to identify reasonable alternatives
- Focus the study on key and relevant issues for quick decision making
- Identify areas of likely impact and environmental issues that may require further investigation in the subsequent ESIA

2.3 Detailed Study

2.3.1 Desktop study

Available literature on the project area was reviewed in order to get an understanding of the biophysical and social settings within the area. Through the desktop studies, a comprehensive stakeholder engagement plan was also developed. The materials reviewed included published and unpublished literature on the bio-physical conditions, socio-economic setting of the project areas and legislative and policy framework applicable to the project.

2.3.2 Field survey

Detailed fieldwork was conducted from 18th – 25th August 2021, other studies including tests and sampling were also undertaken separately. This was conducted to gather data on the existing environmental and social conditions in the project area. Site visits and assessments were conducted to establish:

a) Land ownership, usage and conflicts

b) Flora, fauna and avifauna found on the site

c) The site landscape and catchment characteristics

d) Surface water bodies within the project area

e) The general environment and sensitive receptors found within the environs of the site

Key environmental and social aspects were identified through the scoping process and consultations.

Field survey techniques

The field survey adopted various techniques of baseline data collection on the existing environmental conditions, namely:

- **Direct observations and recordings**

  These were made on the proposed quarry site and the environs. The project area of influence was defined and evaluated. The findings were recorded and later assessed and documented.

- **Photography**

  Photographs of the project site and the environs were taken on site. The phots were also referenced appropriately for use in the report writing. Key environmental and social features in the project site and its environs were photographed. A few selected photos have been incorporated into the report

- **Checklists**

  Checklists are study instruments that aid in assessing possible environmental impacts during both construction and operational phases of a project. In this study, checklists were utilized to:

  - ✓ Facilitate identification of potential environmental and social impacts
  - ✓ Provide a means of comparing the predicted environmental and social impacts
  - ✓ Indicate the magnitude of both positive and negative environmental and social impacts
  - ✓ Indicate possible adverse environmental and social impacts that are potentially significant but about which sufficient information cannot be obtained to make a reliable prediction
  - ✓ Indicate negative potential environmental and social impacts in the project area, which merit mitigation measures and monitoring during project implementation as well as those that can be mitigated in the design of the project

2.3.3 Public Involvement

2.3.3.1 Key informant Interviews

Key informant interviews were conducted in the project area to obtain information on key environmental and social aspects in the project area. The interviews also helped to obtain rapport with key government officials which would be crucial in the public participation.

2.3.3.2 Public participation meetings

Public consultation meetings were conducted within the project area with the local community as a channel of disseminating information to the local population. These were conducted on the 16/9/2021.

2.3.3.3 Administration of questionnaires

These were used to obtain data on gender aspects of the project and how gender dynamics affect project implementation.

2.3.3.4 Focused group discussions

These were used to obtain data on gender aspects of the project and how gender dynamics affect project implementation.

2.3.4 Air quality Assessments

Measurement of the air quality parameters were achieved using the AQM-09 air quality monitor for Henan Oceanus. The AQM-09 Air Quality Monitoring Station can measure outdoor air pollutants in real-time, measuring data quickly and accurately. It can be customized for different applications demands, the measurement parameters can be chosen from the following: the gas type Ozone(O_3), Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2), Carbon Monoxide (CO), Particulate matter ($PM_{2.5}$ and PM_{10}), and Meteorological parameters (including of Temperature, Humidity, Wind speed, Wind direction, Barometric pressure).

The monitor was set up in an obstruction free area and operated to log in data every 5 minutes for the parameters tested. The Plate 2-1 shows a pictorial presentation of the air quality meter used to undertake the assessment.

The AQM-09

Plate 2-1: Air quality meter

2.3.5 Noise Assessments

The baseline noise measurement methods used were consistent with the requirement of the ISO 1996 protocol Parts 1, 2, 3 standards, entailing the following:

- Inspection of the monitoring locations and the implicated activities
- Compiling photographic reports of the monitoring locations and surroundings.
- Calibration of the sound level meter before and after each measurement.
- At all positions the meter was mounted on a tripod approximately 1.5m above ground level.
- Noise levels expressed in decibels, A-weighted sound pressure level dB (A).

Measurements were conducted for 24 hours at two locations as follow:

- Diurnal schedule -14 hours and
- Nocturnal schedule- 10 hours.

Surveys of this type and duration provide information on daily variability in noise levels especially at peak hours (times with heavy traffic on the Nairobi Highway), as well as provide an expected typical or average daily condition.

A model Larson Davis LxT Type I integrating sound level meter was used to collect the measurements and sound recordings at each site. The meter logs noise levels and records audible sound over a set monitoring period selected by the user. The effective measurement range of the instrument is 20-140 dBA to ±1 dBA accuracy. The logging rate was set for 30 seconds over the monitoring period.

Microphones were placed 1.2 - 1.5m above the ground, and at least 1.5m from any reflective surface. Note that the A-weighted frequency network and Fast (F) time weighting was used for all measurements.

Data parameters logged every half a minute for each survey period included the following:

- integrated average equivalent noise level (Leq) in dBA;
- maximum noise level (Lmax) in dBA;
- minimum noise level (Lmin) in dBA; and
- 1/3 octave band values in dB.

A Calibrator was used for calibrating the meters before and after each monitoring period. The calibrator has an estimated uncertainty for sound pressure level of ±0.12 dB at a 99% confidence level. Calibration was performed before and after each 3-hour monitoring period to ensure the noise meter variance was within 0.5 dB.

Data were downloaded to a computer for analysis with the Larson Davis *SLM software program*. The data were Quality Assurance/Quality Control (QA/QC) reviewed to identify sources of noise and filter out invalid data, such as noise from technician activities. Daily and nightly values were calculated as per EMC guidelines; daytime was defined as 6:00 AM to 8:00 PM and night-time as 8:00 PM to 6:00 AM. Field crew recorded precipitation, cloud cover, wind direction, and observed audible noise sources. Weather conditions were also documented and are discussed in section 4.1.

Instrumentations

The following instruments were used during the measurement:

- Larson Davis Type 1
- Tripod Stand.
- GPS
- Camera
- Acoustic Calibrator
- Open Field Microphone

2.3.6 Vibration tests and analysis

Rock samples were collected from the site between 16th and 18th September 2021 and delivered to Danelli Engineering Laboratories on 20th September. Three samples were collected, representing fresh rock, weathered rock and highly weathered rock for an aggregation of the ground conditions. The unconfined compressive strength (UCS) and density of these samples were analysed at the laboratory.

Tests were conducted in accordance with ASTM D 7012 – 04: Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures.

Currently the most widely accepted propagation equation for ground and air vibration considering the damage to structures is in the form of:

$$V = K\left(R/W^{\beta}\right)^{-\alpha} \qquad \textbf{(3-1)}$$

Where **V** is the peak particle velocity (mm/s) or peak overpressure **(dB), k** and **a** are site constants to be determined by regression analysis; R is the distance of the measuring transducer from the blasting face (m) and W is the maximum charge weight per delay (kg).

This basic regression formula has been developed further in the probabilistic model by Kumar *et. al* to include UCS and density of the rock:

$$v = \frac{f_c{}^c D^b}{\gamma} \qquad \textbf{(3-2)}$$

Where:

v – vibration velocity

D – scaled distance (m/kg$^{1/2}$) which is defined as the ratio of distance from charge point, **R** (m), to the square root of charge mass, **Q** (kg), expressed in TNT net equivalent charge weight; **b** and **c** are site constants

γ – density

$\mathbf{f_c}$ – unconfined compressive strength of the rock

Using this regression analysis, the following table presents the calculated peak particle velocities at various distances from blast source likely to be generated at the site by various charge weights.

2.3.7 Archeological and Cultural Heritage Assessments

As part of this archaeological and cultural heritage impact assessment, the following tasks were conducted: 1) site file search, 2) literature review, 3) completion of a field survey assessment and 4) analysis of the acquired data and finally a report on these was produced.

Literature review

To understand the archaeology of the site, a background study was undertaken, and relevant literature consulted. These studies entailed a review of published archaeological literature and heritage impact assessment reports that have been conducted around the proposed area. These investigations were fundamental in shedding light on the archaeology and cultural heritage of the proposed quarry sites, as well as the compilation of this report.

Physical survey

The field survey was conducted from the 28th of September to October 4th 2021. This survey was conducted by a senior archaeologist with vast experience in ACA. The field assessment of the proposed quarry sites was conducted on foot. The targeted survey indicated the presence of previously erosional outcrops. No excavations or sampling (except for the new quarry), was undertaken since it was not necessary to disturb a heritage resource without a well-defined research plan. The field survey did not include any form of subsurface inspection beyond the inspection of the section of the quarry sites that had been cut, and the quarry walls exposed by previous quarrying activities.

Documentation

Documentation included taking photos using an 18.1 Cannon D700 Digital Camera. All areas with prehistoric materials/features were photographed and recorded using handheld GPS Garmin GPSMAP

62S with the WGS 84 datum point as reference. All finds were described in detail (extent, orientation, shape etc.) through field notes and photographs. In areas where erosion had cut deep gullies, surveys included examining areas for archaeological materials such as stone tools, fossil bones or any other forms of archaeological. Local informants who are residents of the project site were also consulted about possible remains and features of archaeological and cultural heritage significance on the site.

2.4 Identification of project impacts

In this step, the characteristics of potential impacts were identified, evaluated and predicted using the baseline information collected beforehand and the features of the Project (cause-effect relationship). The Leopold matrix was used to predict the magnitude of the impacts.

2.5 Formulation of the ESMP

A clear and concise ESMP was prepared detailing possible preventive and remedial measures for each negative impact. The ESMP may not have captured emergent issues during imoplementation therfore periodic reviews will be necessary.

2.6 Reporting

The ESIA Study report was written in accordance with the Environmental (Impact Assessment and Audit) Regulations, 2003 (Revised 2016).

3 PROJECT DESCRIPTION

3.1 Project location

The quarry is located in Sachangwan ward, Molo constituency at coordinates (809968.38; 997648.14). It is an existing quarry located approximately 190m on the RHS of the Rironi Highway Mau – Summit and approximately 680m South West of Sachangwan town at coordinates (809988.85m E; 9976647.41mS). The total project area is estimated at 31.12ha. The Figure 3-1 below shows a google earth image of the project site.

Figure 3-1: Google Earth Image showing the project site

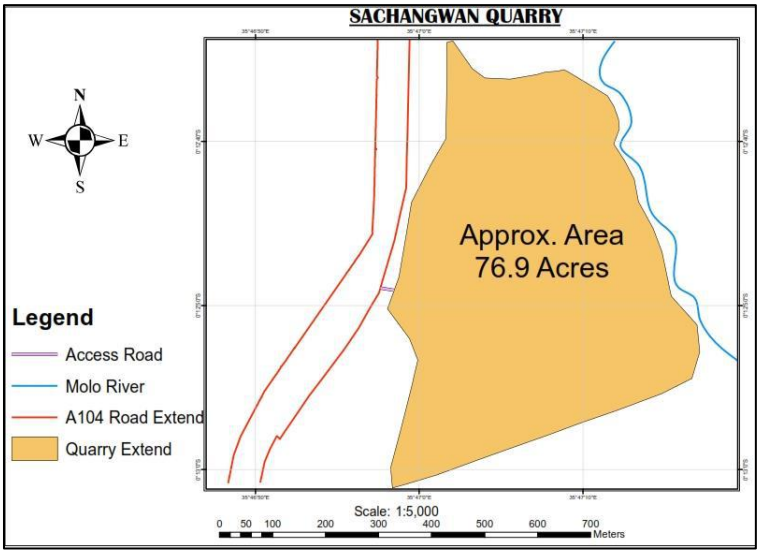


Figure 3-2: Map of Sachangwan project site

3.2 Project proponent

The project proponent is Sogea Satom Company a subsidiary of Vinci Construction domiciled in France and deals in construction and public works. The company specializes in building and engineering works and operates in more than 20 countries.

3.3 Project site layout

The proposed site layout is presented in Figure 3-2 below

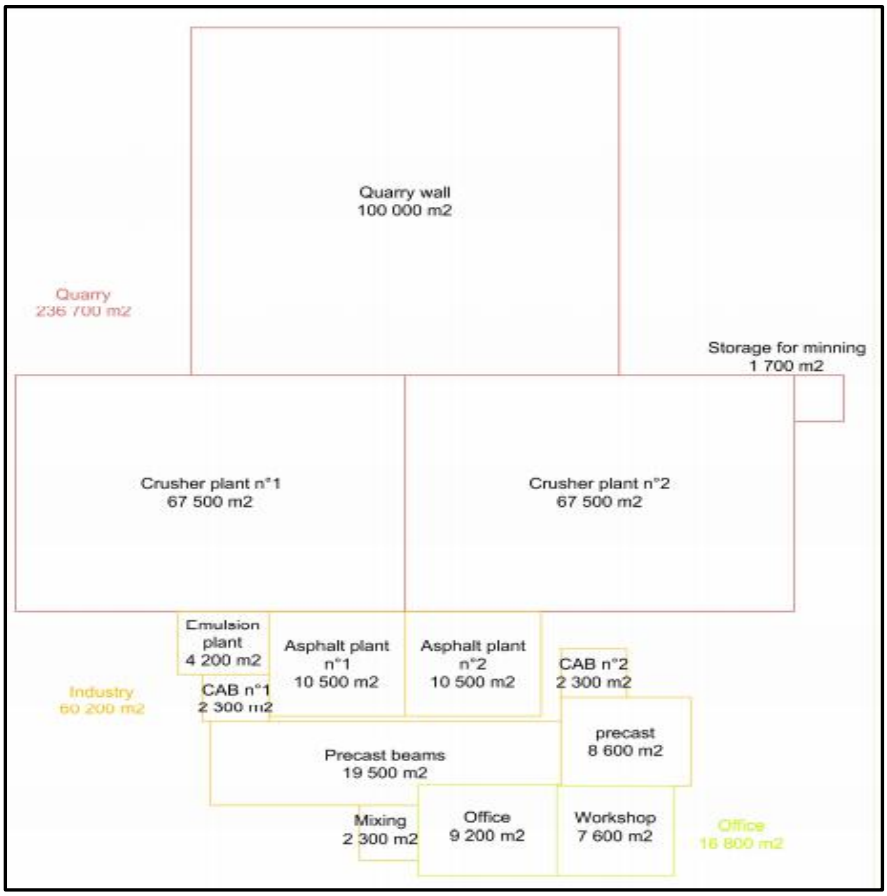


Figure 3-3: Proposed site layout

3.4 Project components

The Proponent proposes to carry out stone quarrying by opencast mining. The quarrying process will involve drilling and blasting. Excavation of stone will basically involve removal of overburden. The proposed quarrying shall be carried out for a target production of 58,000 tonnes per month in 42 months (4 years). The main project components are;

- Crusher plant

- Concrete plant
- Asphalt plant
- Mixing plant
- Emulsion plant
- Offices
- Precast area
- Workshop

3.4.1 Crusher plant

A crusher is a machine designed to reduce large rocks into smaller rocks, gravel, sand or rock dust. They may also be used to reduce the size, or change the form, of waste materials so they can be more easily disposed of or recycled, or to reduce the size of a solid mix of raw materials, so that pieces of different composition can be differentiated. Two crusher plants shall be installed on site. The plant shall be used to crush the hardstone material obtained from the quarry and shall comprise various large equipment namely; a pre-screener, loading conveyor, intake hopper, magnetic separator, crushing unit, such as jaw crushers, cone crusher, impact crusher etc

The plant is envisioned to have a production capacity of 58,000 tons per month, with a storage height of 7m at an angle of 70%. The crusher plant area is estimated at 16.68 acres. It shall comprise the following infrastructure; principal crusher, water tank and drilling area, offices, changing rooms, sanitary facilities, septic tank, machine parking, fuel station, work shop and a laboratory.

Crusher components

- **Vibration Feeder**: These machines feed the jaw and impact crusher with the rocks and stones to be crushed
- **Crushing unit**: These are the machines where the rocks and stones are crushed. There are different types of crushers for different types of rocks and stones and different sizes of the input and output material. The crusher plant shall incorporate one or several crushing machines depending on the final material. (small stones or sand)
- **Vibrating Screen**: These machines are used to separate the different sizes of the material obtained by the crushers
- **Belt Conveyor**: These elements are the belts used for transportation of the material from one machine to another during different phases of process
- **Central electric control system**: Control and monitor the operation of the entire system.

Figure 3-4 **Error! Reference source not found.**below shows the proposed layout of the crusher plant on site

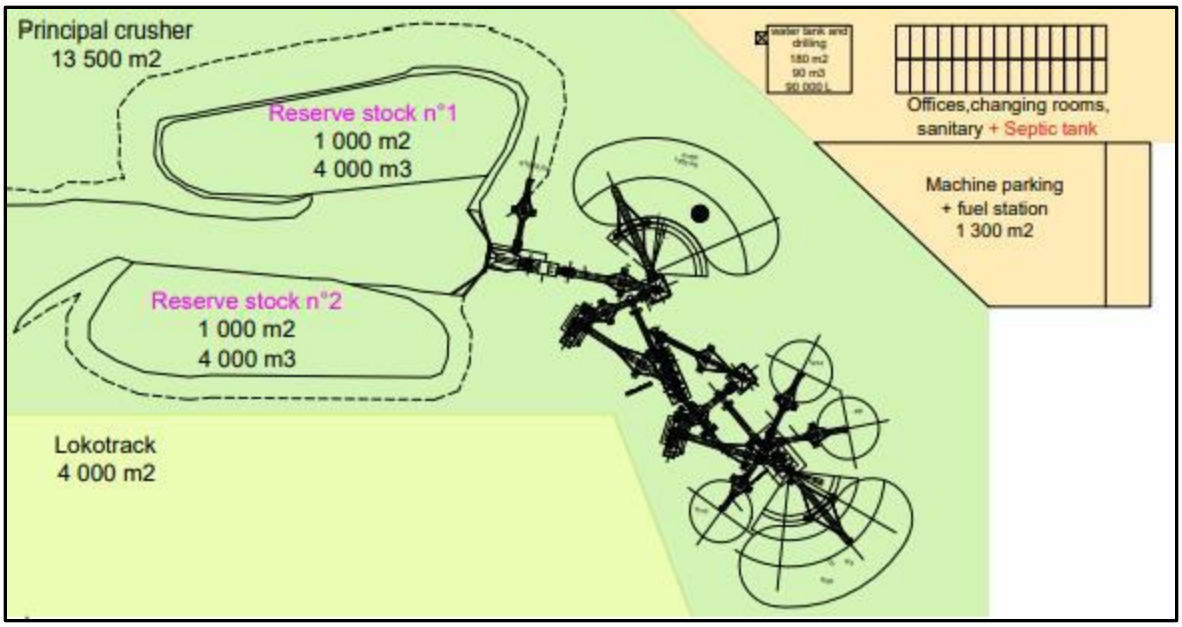


Figure 3-4: Proposed Crusher Plant installation

3.4.2 Asphalt plant

An asphalt plant mixes together aggregates and bitumen to create the hot mix paving material. The aggregates can be a single sized material or it can be a blend of various grades/sizes of materials. The coupling material otherwise called asphalt cement can be cutback asphalt, manufactured folios or emulsion. It consists of the following components

- Cold feed bins
- Primary vibrating screen
- Charging conveyor
- Drying drum with burner
- Hot aggregate bucket elevator
- Pre-separator with bag filter
- Multi-deck vibrating screens
- Hot receptacles
- Mixing unit
- Bitumen storage tanks
- Weighing hoppers
- Filler storage silo/hopper
- Control cabin and panel

The operations of the plant start by supporting the unheated-crude aggregates into various receptacles of the cold aggregate feeder according to their sizes via the cool feeder gates on the individual receptacles which will control the aggregates flow. Once this is done, the aggregates are moved to a drying drum via a

charging conveyor. The drying drum heats-dries the aggregates viably as drying drum comes fitted with a burner. Aggregates are then transferred to the tower unit after they are heated in the drum and this transfer of aggregates is done using a bucket lift. On top of the tower unit, is a multi-layered screening unit through which hot aggregates get treated, separated and put away into various receptacles in view of their sizes. The aggregates are then weighed, released into the mixing unit, and mixed with bitumen and filler material.

The plant is envisioned to have a daily production capacity of 1200 tonnes. The asphalt shall be comprised of 99% pebbles, fines and sand. The plant will have an average granular density 1.5, i.e., approximately 11,500 m^3. It is anticipated that 2-3 weeks of stock shall be available.

Figure 3-5 below shows the proposed asphalt plant conceptual layout

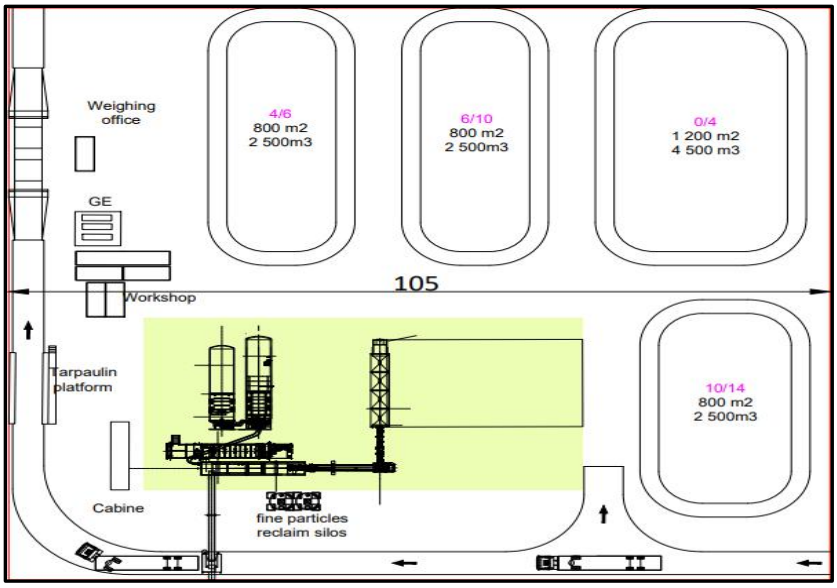


Figure 3-5: Proposed Asphalt plant installation

3.4.3 Emulsion plant

Bitumen emulsion plant is a special equipment used to produce emulsified bitumen. It melts bitumen and disperses it in water with fine particles to form an emulsion. Bitumen emulsion plants is widely used in road construction and maintenance. A plant with a capacity of 125 tons per day shall be installed on site. It shall be installed on approximately 1.04 acres of land. The installation shall comprise 40 bitucontainers of 67m3, storage late for emulsion tanks and an office.

The Figure 3-6 below shows the typical plan for the emulsion plant proposed on site

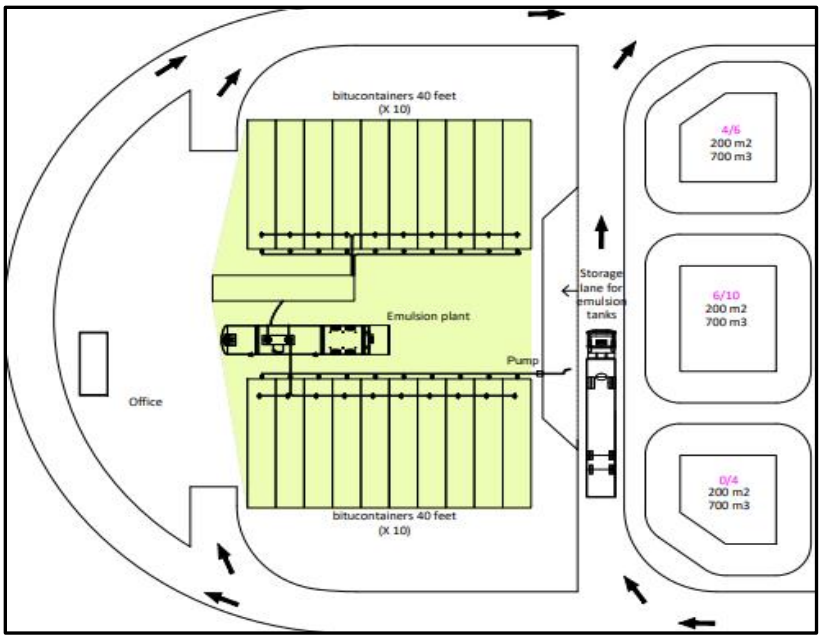


Figure 3-6: Proposed Emulsion Plant Installation

3.4.4 Mixing Plant

The mixing plant is used to mix water, cement and sand to form concrete in predetermined proportions. The plant area shall consist of storage silos, offices, water tanks, and the plant. A storage stock of 1000 tons of cement is envisioned within the site.

The Figure 3-7 below shows a typical layout plan of the concrete and mixing plant area

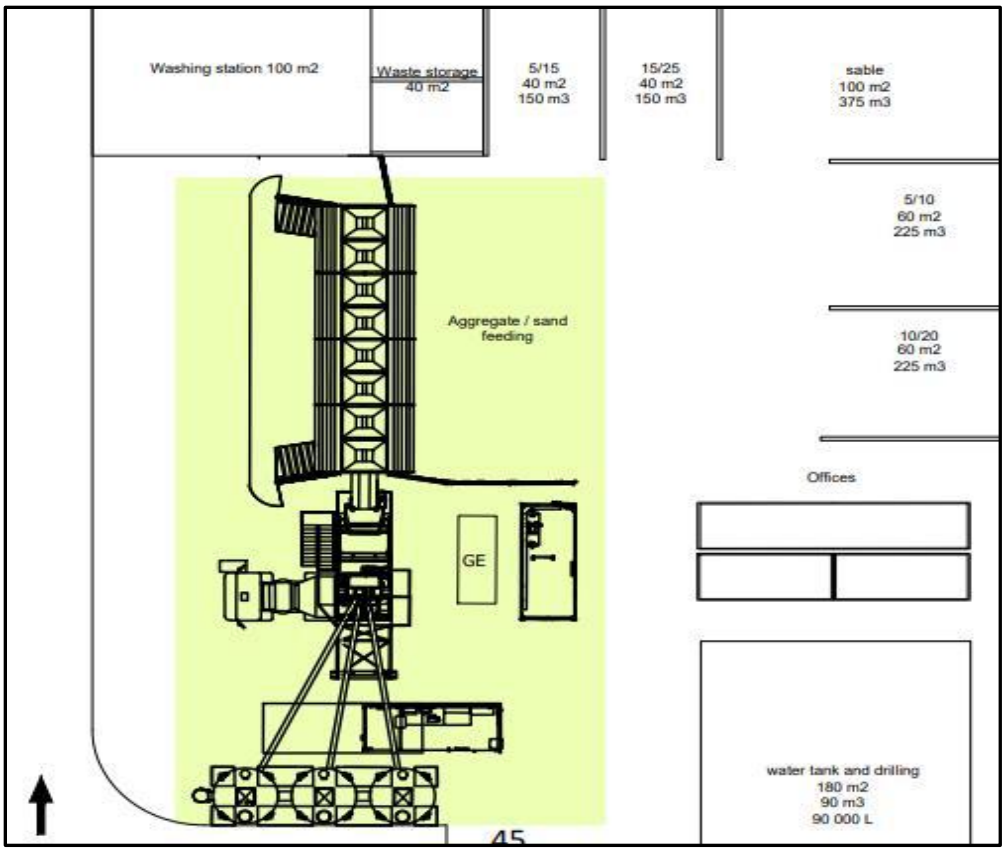


Figure 3-7: Proposed Concrete and Mixing Plant Installation

3.4.5 Precast yard

A precast yard is an area where concrete is casted in a reusable mould or “form” which is then treated in a controlled environment, conveyed to the construction site and lifted to the appropriate place. Precast Construction Technology consists of various precast elements including beams, slabs, columns and some customized elements that are standardized and designed for stability, durability and structural integrity of the infrastructure being developed.

A pre cast yard for production of precast items shall be established on site. The facilities in the precast yard shall include storage area for the precast items, two 60T mobile cranes, Trucks and HIAB parking, steel unloading area, sanitary facilities, changing rooms, offices and the precast area. The Figure 3-8 below shows a typical layout for the proposed precast yard.

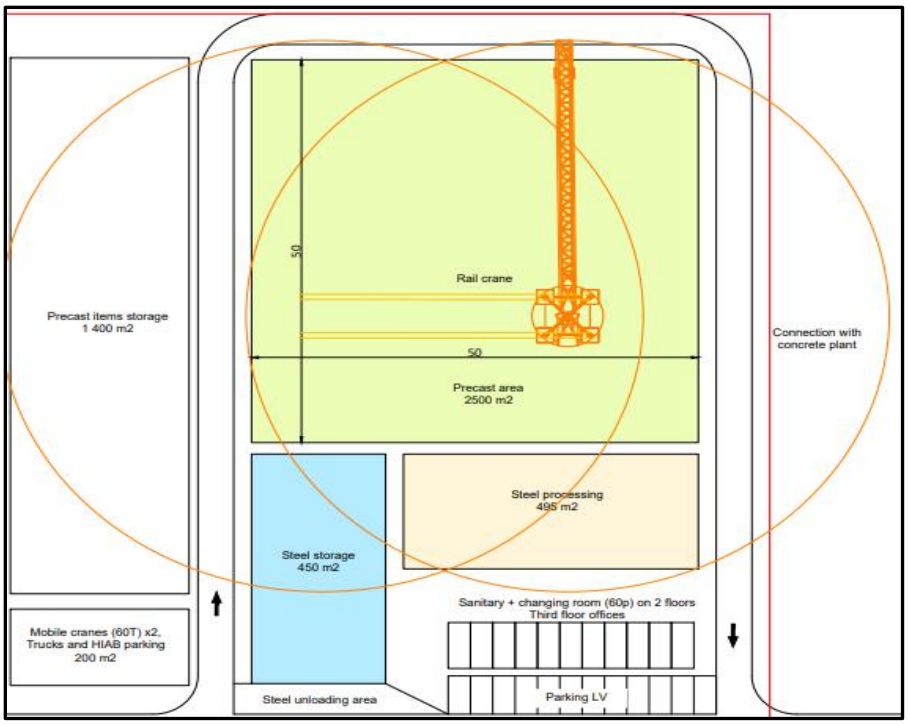


Figure 3-8: Proposed Precast yard (small items) Installation

The workshop area is proposed to occupy 1.89 acres and shall comprise the following elements; a warehouse, a welding workshop, parking for broken down machines, offices, deposit of waste, machinery standby area, fuel station and fuel tank; drainage and washing area. The Figure 3-9 below shows the proposed layout of the workshop area

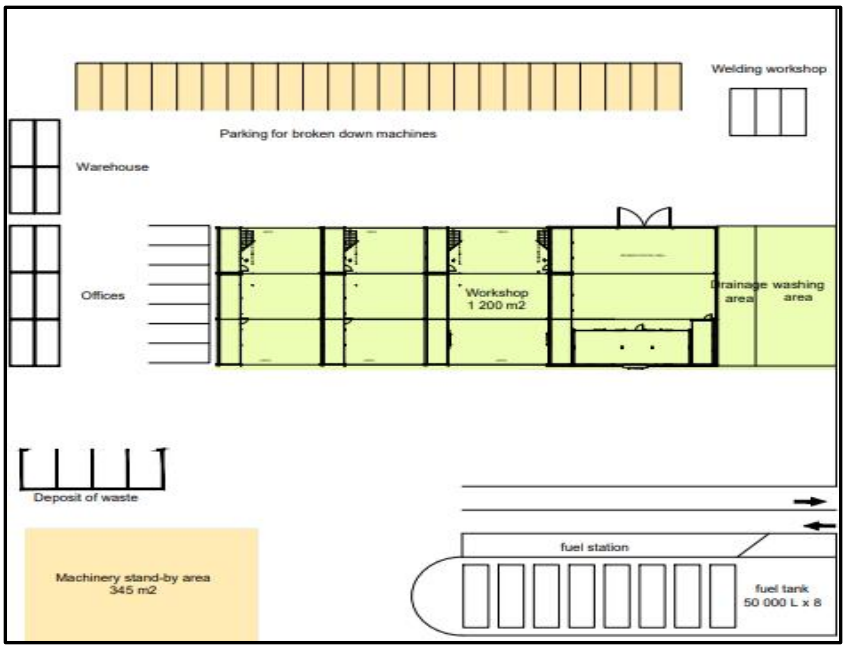


Figure 3-9: Proposed workshop installation

3.5 Construction Equipment, Materials and Utilities

3.5.1 Equipment

Equipment and machinery that will be required for construction in the quarry include. Excavator, mixers, backhoe, bull dozer and borehole drilling machine. The equipment will be assembled at the site after identification of a specific location for them within the site has been done.

3.5.2 Materials

The construction materials to be used for construction of the offices and other supporting infrastructure e.g., sanitary facilities and changing rooms will mainly be sourced locally. They include sand, cement, gravel, ballast, steel, stone, wood, brick and concrete. Explosives will be provided and handled by a licensed blaster.

3.5.3 Utilities

The utilities that will be required for the project include labor, diesel, water and electricity. A borehole will be drilled on site to provide water. Currently, the quarry uses solar energy in buildings; however, because of the expected heavy power demand the expanded operations will need to connect to the main grid and also install stand by power generators.

3.6 Technology procedures and processes

The project construction and operation shall be undertaken by the contractor (proponent). It will largely involve installation of plant machinery and construction of auxiliary facilities e.g., the offices, sanitation facilities, the workshop, materials yard among others. The quarry phase shall also be expanded to pave way for material extraction.

3.6.1 Construction phase

3.6.1.1 Site cordoning and fencing

Owing to the close proximity to the nearby settlements and the Mau Summit – Nairobi Road, the project site shall require enforcement of the existing fence to protect against vandalism and ensure the safety of the public..

3.6.1.2 Site clearance

Although the site has been extensively cleared for installation of the existing infrastructure by the previous user, there shall be additional clearance to expand the quarry face and to for installation of other project infrastructure and construction of offices.

3.6.1.3 Excavation

Excess overburden will be excavated and carted away to expose hardstone material. The excavated overburden will be stockpiled on site and the excess disposed of appropriately in designated dump sites or for rehabilitating the quarry pits. Some of this material can also be reserved for use in landscaping as part of the rehabilitation process once the quarry has been decommissioned.

Excavation works for foundations of supporting infrastructure such as other installations, offices and workshops shall be undertaken. Additionally, the precast yard area shall also be excavated and levelled before works can commence.

3.6.1.4 Installation of machinery

Quarrying of stone is process that is machinery intensive and thus there shall be installation of machinery that shall be used during the operation phase. These shall include the Crusher plant, Concrete plant, Asphalt plant, Mixing plant and the Emulsion plant. Additionally, excavators, crane and loaders shall also be established on site.

3.6.1.5 Expanding of access road

The access roads to the quarry shall be expanded where necessary to allow easy and safe movement of trucks transporting materials to and from the site.

3.6.2 Operation phase

3.6.2.1 Drilling holes and Blasting

A blast hole of suitable diameter shall be drilled either manually or mechanically at a properly selected location on a rock. The hole shall be charged with an explosive. The diameter of the hole is determined by the type of the explosive being used. The diameter, depth, number, and spacing of boreholes require very careful considerations for getting the most beneficial result. The depth of blast-hole depends on the volume of rock to be broken in one shot which is also related to the quantity of the explosive that has to be charged into the hole. The blast holes shall be loaded or charged with predetermined quantities of the selected type of explosive and ignited using a safety fuse or by electric detonators.

3.6.2.2 Material extraction

The quarrying process will utilize a range of equipment such as a pre- screener, loading conveyor, intake hopper, magnetic separator and a crushing unit such as jaw crushers and cone crushers.

3.6.2.3 Stockpiling of material

The material excavated from the quarry will be stockpiled on site and covered during windy conditions to reduce dust pollution from the aggregates stockpiled

3.6.2.4 Stone crushing

The hardstone material that will be extracted will be crushed using the stone crusher that will be installed on site to optimize operations. Powerful hammers or metal jaws within the primary crusher break the rock down. The rock passes through a series of screens that sift it into different sizes. It may also pass through further crushing stages.

3.6.2.5 Material testing

The material testing will be carried out on site in the laboratory by qualified personnel to ascertain the quality of the material that will be used for the construction of the road.

3.6.2.6 Office operations

This will be the hub of administrative functions which shall primarily involve coordination of quarry and road works operations.

3.6.2.7 Routine maintenance

The infrastructure installed within the quarry site and the construction vehicles shall be periodically maintained on site

3.6.3 Decommissioning phase

3.6.3.1 Reinstating vegetation cover

Prior to exit from the site the site shall be reinstated as stipulated in the rehabilitation plan annexed to the ESIA report. Vegetation shall be replanted according to the vegetation profile prior to commencement of works. As far as practically possible the site shall be reinstated to its near original state.

3.6.3.2 Backfilling excavated pits

The top soil stockpiled on site will be used to backfill the excavated areas and level the ground to the extent possible. In the event that the material stockpiled is considered insufficient, additional material shall be obtained from alternative sources including borrow pits around the area.

3.6.3.3 Demolishing structures

The temporary structures including offices, workshop, changing rooms and sanitation facilities shall be demolished and the ground cover reinstated.

3.7 Products, by products and Waste

The construction of the project will generate inert, non-hazardous and hazardous waste over the period of construction. Operation of the roads will result in relatively small volumes of routine waste generation for the life of the Project. Maintenance and repair activities conducted during the operational lifetime of the project may generate limited volume of waste.

3.7.1 Project Waste Management Strategy

A waste management plan shall be prepared at project commencement. The Project Waste Management Plan (PWMP). The PWMP will: -

- Propose a minimization, collection, storage, treatment, re-use and disposal route for each waste stream
- Identify potential third-party re-users
- Propose location of waste storage and duties of site personnel with regard to waste management
- Identify and describe possible locations of disposal sites or long-term storage sites.
- State the methods for properly managing (i.e., training, storing, containerizing, labelling, transporting, disposing) wastes.
- Describe the transition of control from the contractors to the Proponent, including arrangements for wastes associated with commissioning.

3.7.2 Project Waste Management Principles

Standards

The waste management standards to be used for the construction, operation and decommissioning of the quarry should be based on the legal notice 121: Waste Management Regulations 2006. If these regulations do not cover certain aspects of the project, then the Contractor and Proponent shall comply with international regulations on environmentally sound management of waste.

Duty of Care

The principles of 'duty of care' (i.e., the responsibility of a generator or owner of waste to ensure that it is handled, transported and disposed of in an appropriate manner) for waste and waste ownership by the waste generator will be adopted by the proponent throughout the construction, commissioning and operation of the project. During construction and commissioning, the contractor will be responsible for duty of care whereas during operations, the Proponent will be the duty holder.

3.7.3 Waste inventories and Classification

Waste inventories will be created to quantify and characterize waste streams at each stage of the project. Separate inventories will be developed for construction wastes and for commissioning / operational wastes. The

Table 3-1 presents classification of waste by type and provides a description of the standard. Table 3-2 presents the waste disposal options according to type

Table 3-1: Classification of Waste by Type

No.	Waste Type	Waste Standard & Description
1.	Inert	Waste as defined by EMCA Act - Waste Management Regulations.
2.	Hazardous Waste	Waste classified as hazardous according to EMCA Act - Waste Management Regulations

No.	Waste Type	Waste Standard & Description
3.	Non-hazardous Waste	Waste that is neither inert, nor hazardous nor wastewater. It includes 'municipal waste' as defined EMCA Act - Waste Management Regulations
4.	Wastewater	Fresh water that is contaminated as a result of project activity.

Table 3-2: Waste Disposal Options According to Type

No.	Waste Stream	Principal Disposal Option
1.	Inert Waste	Transfer to a third party for recycling or reuse Processed and used for construction and reinstatement purposes Disposal to a recognized disposal site.
2.	Non-Hazardous Waste	Transfer to a third party for recycling or reuse. A special case of this is to spread it on land for agricultural purposes. Disposal to a recognized disposal site.
3.	Hazardous Waste	Disposal as prescribed in the EMCA Waste Management Regulations of 2006.

The volumes of waste requiring ultimate disposal will be minimized both through the control of waste generation and through disposal by a licensed waste handler.

3.7.4 Hierarchy of Waste Management Practices

Each waste stream will be managed according to the following hierarchy of techniques, in which the technique chosen should be the first in the hierarchy that is safe and practicable: -

- Eliminate or minimize the waste stream by choice of procedure or technology
- Re-use as a material
- Re-use as a fuel
- Process and re-use as a material
- Process and re-use as a fuel
- Designated disposal site (Landfill)

3.7.5 Transfer of Waste to Third Parties

It is expected that there will be a variety of potential third parties that may receive wastes generated during the quarry operation. These third parties will include commercial waste disposal contractors and entities (corporate or individual) that have the capacity to reuse or recycle individual waste materials.

In general, transfer to third parties for ultimate disposal will only be permitted if the part of their operation that is used for the project waste is licensed. However, items such as timber wastes and other re-useable wastes may be disposed to local people on the basis of case-by-case review by the contractor.

3.7.6 Construction Waste and Emission Inventories

Construction and Commissioning Waste Management

The Table 3-3 below presents indicative characteristics of wastes that will be generated by operations at the site.

Table 3-3: Characteristics of Potential Project Waste

SOLIDS	**Metals**
Bituminous material	Welding Rods
Cement (Dust)	Isolated Steel Piles Wasted Lengths
Paper and Cards	Copper (Electrical Wires etc)
Plastic bottles, cans, drums & packaging bags (both polythene and biodegradable)	Reinforcement steel
Aggregates	**Sludges**
Vehicle parts	Grease
Glass	Paint
Rags and Oil Adsorbents	Oil
Light bulbs and tubes	**Liquids**
Paint cans and brushes	Wash down water and drum water
Stone and Rocks	Oily water
Tyres	**Domestic**
Cleared Trees & Branches	Food
Cleared undergrowth, shrubs etc	
Waste Timber	
Concrete Shuttering	

It is expected that the special specifications will obligate the contractor to dispose of different categories of waste appropriately. For example, steel wasted lengths may easily be taken by the *Jua Kali* (informal) Industry.

In general, the contractor will be required to develop construction specific Waste Management Plans prior to the start of construction work. At the start of the construction contract, the contractor will undertake a waste minimization/treatment/disposal study, guided by the project waste management strategy. The study will identify and quantify the expected wastes and describe: -

- Proposals for reduction, treatment processing
- Third parties to whom waste will be transferred for re-use
- Liaisons with the local Councils to identify and document suitable council disposal sites ground, landfill and incineration facilities.
- Other locations of landfills or waste storage sites to be adopted if local Council facilities are inadequate.
- On site incineration facilities to be adopted if local Council facilities are inadequate.

The findings of the study will be used in the development of the construction waste management plans which must adhere to the EMCA - Waste Management regulations of 2006. At a minimum, these plans will include: -

- A consolidated summary of the applicable regulations and restrictions governing the generation, and handling of wastes generated during the construction/commissioning phases of the Project.
- Any permitting requirements for waste treatment or disposal.
- Detailed method statement for each element of the waste management handling, treatment and disposal process
- Any third-party agreements for waste handling, transfer or disposal
- After construction of the road, the waste handling/disposal facilities established by the contractor under the construction program will be closed.
- If a waste handling/disposal facility procured by the contractor is closed, the contractors will be required to ensure that it is appropriately de-commissioned (i.e., including capping of any disposal sites) and the surface will be re-instated according to the Project Reinstatement Strategy. If the facility is retained, it will be transferred to the proponent.

Release to the Atmosphere

Atmospheric emissions will be generated by the proposed quarry project activities principally during construction but much more so during operation of the quarry. It is anticipated that the most significant components of such emissions will be particulate matter in the form of dust and combustion gases, specifically: -

- Nitrogen Oxides (NOx)
- Carbon monoxide (CO)
- Sulphur Dioxide (SO2)
- Volatile Organic Compounds
- Aldehydes

General Wastewater Disposal

- Wastewater includes all water flows from the temporary site office, work sites and subsidiary operations such as vehicle and equipment washing.
- Wastewater from temporary site office should be treated in a septic tank and soak pits

- Wastewater from the works will generally be from the concrete batching plant. These wastewaters should be monitored to ensure that they do not pollute the environment.

4 LEGAL, POLICY AND INSTITUTIONAL FRAMEWORK

The Government of Kenya has a policy, legal and administrative framework for environmental management. The Government's policy on road transport is to provide efficient and reliable road network to spur socio-economic development and improve security. The project requires an Environmental and Social Impact Assessment license before implementation, as per the Environmental Management and Coordination Act (EMCA, 1999; Amendment 2019) and EIA / EA Regulations, 2003 (Amendment 2019). The financing institution (World Bank) has also developed Safeguards Policies and Procedures against which development projects are reviewed and monitored, throughout a project's life cycle. Establishment and operations of the quarry and supporting infrastructure will be administered and implemented in accordance with the provisions of the Kenyan policy, administrative and legal framework, and in conformance with World Bank Standards.

Below is a summary of regulations, policies and standards that apply to the project:

4.1 Constitution of Kenya, 2010

The new Constitution of Kenya, which was promulgated on the 27th of August, 2010, is the supreme law of the Republic of Kenya and as such binds all government, persons and state. Environmental provisions are outlined are discussed below:

Rights and Fundamental Freedoms

Article 42 of the new Constitution states that every person has the right to a clean and healthy environment, including the right to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69, and the right to have obligations relating to the environment fulfilled under Article 70.

Obligations in Respect of the Environment

According to Article 69(1), the Government is responsible for the following:

a) ensuring sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;

b) working to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;

c) protecting and enhancing intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;

d) encouraging public participation in the management, protection and conservation of the environment;

e) protecting genetic resources and biological diversity;

f) establishing systems of ESIA, environmental audit and monitoring of the environment;

g) eliminating processes and activities that are likely to endanger the environment; and

h) ensuring that the environment and natural resources are utilized for the benefit of the people of Kenya

Article 69 (2) requires every person to cooperate with State organs and other persons to protect and conserve the environment, and ensure ecologically sustainable development and use of natural resources.

Enforcement of Environmental Rights

Article 70 (1) states that a person can apply to a court for redress if they allege that their right to a clean and healthy environment recognized and protected under Article 42 has been is being or is likely to be, denied, or threatened.

Article 70 (2) states that on application under clause (1), the court may make any order, or give any directions, it considers appropriate –

a) To prevent, stop or discontinue any act or omission that is harmful to the environment;
b) To compel any public officer to take measures to prevent or discontinue any act or omission that is harmful to the environment; or
c) To provide compensation for any victim of a violation of the right to a clean and healthy environment."

In Article 70 (3), the Constitution goes on to elaborate that an applicant does not have to demonstrate that any person has incurred loss or suffered injury.

Environmental and Natural Resources

Article 40 of the constitution binds the state not to enact any legislation that arbitrarily deprives a person of his land, or interest in land. In the event that the government is to compulsorily acquire private or community land, the holders of such interest are entitled to a prompt, full and fair compensation. Article 62 includes in the definition of public land, forests, minerals and water. The Constitution recognizes that natural resources are public resources whose use should be undertaken for the benefit of all Kenyans. This is encapsulated through the inclusion of natural resources within the definition of public land.

The Constitution directs that exploitation of natural resources should be sustainable. It also states that benefits derived from the exploitation of natural resources should be shared in an equitable and fair manner. While Article 69 of the Constitution provides for benefits-sharing in broad terms, indicating that natural resources must be utilized for the benefit of the people of Kenya, Article 67 specifies that local communities have to benefit from such exploitation.

Article 71 subjects the exploitation of natural resources to further scrutiny by Parliament, thereby increasing control on the use of natural resources in the country.

In Article 162, the Constitution mandates Parliament to establish courts with the status of the High Court, which will hear and determine disputes relating to the environment and the use and occupation of, and title to, land. The court as a state agency has an obligation to stop, prevent and discontinue any act of commission or omission that is harmful to the environment. It has the powers to compel a state officer to take action to stop the harmful actions. Where the case can be proven that the victim's rights were indeed violated or denied, the court can order compensation or any redress it sees fit.

Agreements Relating to Natural Resources

Article 2 (6) provides that any treaty or convention ratified by Kenya should form part of the law of Kenya. Kenya is party to 16 international environmental treaties, which are designed to protect various aspects of the environment, including biological diversity, natural resources, marine and coastal environment, the ozone layer, wetlands, culture and natural heritage, pollution, international trade in wild flora and fauna, and combating desertification, among others.

The Fifth Schedule of the Constitution presents legislations to be enacted by the Parliament of Kenya, with Agreements relating to natural resources (Article 71) being provided a time specification of 5 years. The enactment of legislation regarding the environment (Article 72) is provided a time specification of 4 years.

Article 66(2) places an obligation on the State to enact legislation to ensure that investment in property is to benefit local community and their Counties. County Governments have a critical role to play in the exploitation and exploration of natural resources despite the seemingly clear exclusive jurisdiction of the

national government in the management and control of natural resources. Under Article 174 the objects of the devolution and Counties include: -

- To recognize the right of communities to manage their affairs and to further their development;
- To protect and promote the interests and rights of minorities and marginalized communities;
- To promote social and economic development; and
- To enable equitable sharing of national and local resources

Additionally, the Fourth Schedule provides the following as some of the functions of Counties:

a) County planning and development including electricity and gas reticulation and energy regulation;

b) Trade development and regulation;

c) Control of pollution;

d) Agriculture including fisheries;

e) County transport;

f) Implementation of specific national government policies on natural resources and environmental conservation; and,

g) Ensuring and coordinating participation of communities and locations in governance at the local level

The above-listed constitutional provisions warrant active involvement of County Governments in many aspects of the mining sector. Therefore, the National Government should purposefully involve county governments in the formulation and implementation of projects in the extractive industry.

Relevance of the Constitution to the project

- *This ESIA study fulfils the constitutional requirements of promoting sustainable utilization of natural resources and protection of the environment.*
- *The proponent is obligated to work in a clean environment and not to contravene the right of any person within its zone of influence, in accordance with the constitution. They shall ensure the establishment and operations of the quarry is carried out in an ecologically, economically and socially sustainable manner.*
- *The proponent is entitled to a fair administrative decision-making process from NEMA and other State organs.*

4.2 LEGAL FRAMEWORK

4.2.1 Mining Act, 2016

The Mining Act of 2016 was enacted to align the regulation of the mining sector with the new Constitution of Kenya, 2010, as well as international and regional best practices on matters relating to prospecting, mining, processing and any dealings in minerals. Key issues discussed by the Act include mineral rights, institutional architecture for its management, artisanal mining, community engagement and environmental issues in the mining process. Constitutional provisions include:

1. Article 62 (1) {f} & (3): "*Public land includes minerals and mineral oils, which shall vest and be held by the national government in trust for the people of Kenya*";
2. Article 66 (2): "*Parliament shall enact legislation ensuring that investments in property benefit local communities and their economies*";

3. Article 69: "*In respect to the environment, the State shall ensure sustainable exploitation of natural resources and ensure equitable benefit sharing of the accruing benefits; and encourage public participation*";
4. Article 71: Agreements relating to exploitation of natural resources in Kenya (whether it is a right or a concession) are subject to approval by Parliament;
5. Article 232: Requires participation by people in policy making

The Mining Act defines construction minerals to include stones, gravel, sands, soils, clay, volcanic ash, volcanic cinder and any other minerals used for the construction of buildings, roads, dams, aerodromes and landscaping or similar works, and such other minerals as the Cabinet Secretary in charge of the Ministry Mining (MoM) may declare to be construction minerals, through Gazette notice.

Land Use, Water Rights Laws and Pollution Prevention

Section 179 of the Mining Act requires the holder of a permit or mining license to adopt the following sustainable land use practices:

- restoration of abandoned mines and quarries;
- avoidance of seepage of toxic waste into streams, rivers, lakes and wetlands;
- disposal of any toxic waste is done in the approved areas only;
- carrying our proper blasting and all works that cause massive vibration, and muffling to keep such vibrations and blasts to reasonable and permissible levels in conformity with the EMCA 1999 (Amendment 2019); and,
- restoring land to its original status or to an acceptable condition as close as possible to its original state, upon completion of mining operations

The Act provides that anyone applying for a mining license should obtain an ESIA license and an approved Social Heritage Assessment. Equally, prospecting, retention and mining licences cannot be granted unless the applicant submits a site mitigation and rehabilitation or mine-closure plans for approval. In this regard, the applicant is required to provide an Environmental Protection Bond (or financial security) that is sufficient to cover any costs associated with the implementation of the environmental and rehabilitation obligations.

Mining operations may take place on private land, community land or public land, in accordance with the relevant provisions on access to land. Key obligations relating to land and mining provided under the Act include:

1. Free Prior and Informed Consent (FPIC)

Regulation 23(4) of the Mining (License and Permit) Regulations, 2017, provides that County Government and local communities should be adequately informed about potential benefits and impacts of any mineral activity or mining operation, in a timely manner, and be given the opportunity to approve or reject the mineral activity or mining operation, before commencement. Anyone applying for a mineral right should ensure full and prior disclosure of any relevant information to the local communities, as part of the consultation process. The process of consultation should be carried out through negotiation and good faith between the applicant and the landowner, and / or communities.

Consent should be in the form of a written agreement that clearly indicates the boundaries of the land in relation to the license or permit area. The different consents provided for under the Mining Act are outlined in Table 4-1 below.

Table 4-1 : Consents provided under the Mining Act of 2016

Type	Description / Classification	Persons to Provide Consent
Private land	Consent of the landowner cannot be unreasonably withheld; otherwise, the government will compulsorily acquire the land.	Lawful (registered) landowner or occupier
Community land	Community land registered under the Community Land Act, 2016	Community residing where mining operations shall take place
	Unregistered community land	National Land Commission (NLC), relevant County Government and any other person (or community) that may be affected by grant of the mineral right
Public Land	Public land	NLC
	Public land lawfully held, used or occupied by a state agency	Relevant state agency; provided the said land is not occupied by the state agency as lessee (under a private lease)
	Land situated within a forest area	Director, Kenya Forest Service (KFS)
	Wildlife region e,g. national park, marine park or local sanctuary	Cabinet Secretary, Ministry of Tourism and Wildlife
	Protected area under EMCA 1999 (Amendment 2019)	Cabinet Secretary, Ministry of Environment and Forestry
	Land situated in a town, municipality or trading centre	Governor of the County exercising control
	Land dedicated or set aside as a place of burial, religious significance, as a public building, or for any public purpose	Appropriate Cabinet Secretary or other authority (e.g. County Governments are in charge of burial places)
Mining rights	Assignments, transfers, mortgage and trade of mineral rights	Approval of the Cabinet Secretary on recommendation of the Mineral Rights Board. The Cabinet Secretary will grant consent within 30 days as long as the mineral rights holder complied with relevant tax provisions.

2. Surface Rights and Compensation

Part IX of the Mining Act requires mineral rights holders or their agents, or employees, to produce evidence of the mineral right, by way of a valid license or permit, when undertaking mining operations over land that is owned or occupied by some other person or community. The Act provides that the landowner or lawful occupier has the right to continue grazing livestock or cultivate the land, to the extent that doing so will not interfere with prospecting and mining operations, or constitute a hazard to crops and livestock. The lawful occupier, owner or user of land, should be compensated before commencement of mining operations.

3. Resettlement

The Act provides that the Cabinet Secretary should, in consultation with the community and the NLC, ensure that inhabitants or communities displaced by a proposed mineral operation are settled on suitable

alternative land, if they prefer to be compensated by way of resettlement. Such resettlement should be done in accordance with the relevant Physical Planning law, while taking into consideration the community's economic wellbeing, social and cultural values. The Act goes on to elaborate that the cost of resettlement should be borne by the mineral right holder.

Health and Safety

Regarding the safety of workers and mine operations, the Mining Act provides that the holder of a mineral right should comply with the Occupational Health and Safety Act, 2007. The Cabinet Secretary responsible for mining is required to make regulations for the safety and health of persons employed in mines and carrying out prospecting and mining operations in safe, proper, sanitary and effectual manner. Section 217 of the Act requires operators undertaking prospecting or mining operations to maintain insurance cover in respect of the attached risks, especially for health and safety of workers.

Local content (Participation) Requirements

The Act seeks to ensure employment opportunities are created for Kenyans, ensure skills transfer and capacity building for the citizens. When it comes to employment, the mineral right holder should give preference to the local community and Kenyan citizens, and only engage non-citizen technical experts in accordance with such local standards for registration, as may be provided in law. Each mineral right holder is required to submit to the Cabinet Secretary, a program detailing how it shall recruit and train Kenyans. There is also a requirement to submit a program for the procurement of local goods and services. Approval of these programs is a condition for the grant of the mineral right.

Community Development Agreement

The Act makes it mandatory for a holder of a large-scale mining license to enter into an agreement with the community, where the mining operations will be carried out. The purpose of this agreement is to secure socially responsible investment for the affected communities. The structure of the Community Development Agreement (CDA) is governed by the Mining (Community Development Agreement) Regulations, 2017, which provide the guidelines for engagement between mining companies and communities likely to be impacted by their operations. Key defining features of these Regulations include the following:

- The outcome (the agreement) should be arrived at through fair negotiation;
- Communities, or community representatives, should be directly involved in the negotiations;
- The outcome should be formalized in a written document, which is in effect a legal commitment binding on both parties; and
- The agreement should include provisions that address broader development objectives, rather than being focused narrowly on financial compensation

Revenue Sharing

Section 183(5) of the Mining Act provides that the revenues collected by the State should be distributed as follows: 70% to national government; 20% to county government; and 10% to the community where mining operations occur.

Transparency and Accountability

The Mining Act requires a range of mining industry information to be made available to the public, such as mining revenues paid to Government, production volumes of mining operations and copies of signed mineral agreements and their status. The Act also requires the Cabinet Secretary in charge of Mining to ensure that a database of geoscience and information is kept and maintained, and made available to the public on request.

The Act prohibits public officers responsible for the enforcement of this Act from applying for a mineral right, mineral dealers' license, or an export or import permit under the Act. The Act provides that public officers are prohibited from acquiring or retaining a share or interest in any mining company in Kenya, directly or indirectly. This prevents conflict of interest and seals potential corruption and rent seeking loopholes.

Dispute Resolution

Section 154 of the Act provides for dispute resolution. It provides that any dispute arising as a result of a mineral right issued under the Act, may be determined by the Cabinet Secretary, through a mediation or arbitration process as may be agreed upon by the disputing parties or as may be stated in an agreement; or through a court of competent jurisdiction. Section 155 sets out the disputes that may be determined by the Cabinet Secretary.

Relevance to the project

- *The Act requires any mineral right applicant to provide proof of submission and approval of an ESIA report and social heritage and ESMP to NEMA. Other important aspects in the Act include local content plans, an assurance that the operator will involve local communities and Kenyans at large, particularly regarding employment and business opportunities; and resettlement of communities affected by mining operations.*
-

Mining Act Subsidiary Legislations

4.2.1.1 Mining Act (License and Permit) Regulations, 2017

These Regulations were enacted in exercise of the powers conferred by sections 12 (3), 153 (3) and 223 (2), (c), (d), (g), (j), (k) and (1) of the Mining Act, 2016, for the purpose of regulating the issuance of licenses and permits for mineral rights and dealings in minerals.

4.2.1.2 Mining (Local Equity Participation) Regulations, 2012

These Regulations were enacted in exercise of Section 92 of the Mining Act, 2016, and they provide every mining license shall have a component of local equity participation amounting to at least thirty-five per cent (35%) of the mineral right.

4.2.1.3 Mining Act (Use of Local Goods and Services) Regulations, 2017

The purpose of these regulations is to: -

a) promote job creation using local expertise, goods and services, businesses and financing in the mining industry value chain and their retention in the country

b) create mining and mineral related supportive industries that will provide jobs and sustain economic development

c) achieve and maintain a degree of participation for Kenyans or companies incorporated in Kenya for the local supply of goods and the provision of services

d) provide for a robust, transparent monitoring and reporting system

4.2.1.4 Mining Act (Community Development Agreement), 2017

The regulations were formulated to provide a legal basis on which mining operations and mining-related activities are conducted throughout the entire life of the mine, and in order to ensure that:

a) benefits of the mining operations or activities are shared between the holder and affected community;

b) mining operations are consistent with the continuing economic, social and cultural viability of the community; and

c) mining operations contribute to the improved economic, cultural, and social welfare of the community

The regulations aim at promoting accountability and transparency in mining related community development. They elaborate when Community Development Agreements (CDAs) are required, and provide a framework for such agreements.

4.2.1.5 Mining Act (Dealings in Minerals) Regulations, 2017

The purpose of the regulations is to give effect to section 223 (1) of the Mining Act in so far as it relates to dealings in minerals, by providing for the scope and procedures to be followed by a person who requires a mining license or permit including the renewal and revocation of such licenses and permits.

4.2.1.6 Mining Act (Employment and Training) Regulations, 2017

The purpose of the regulations is to: -

a) promote job creation through the use of local expertise in the mining industry and across the entire mining value chain and retain the skills within the country;

b) develop local capacities in the mining industry value chain through education, skills and technology transfer, research and development;

c) achieve the minimum local employment level and in-country across the entire mining industry value chain;

d) provide for the submission of the Employment and Training Plan in the mining industry which should include a recruitment and training programme; and supervision, implementation and monitoring schedule of holders of mineral rights to ensure that Kenyan nationals are employed and properly trained

4.2.1.7 Mining Act (State Participation) Regulations, 2017

The purpose of these regulations is to provide for State participation in prospecting or mining operations carried out by the holder of a mineral right

4.2.1.8 Mining Act (Work Programmes and Exploration Reports) Guidelines, 2017

The purpose of the regulations is to give effect to sections 223(1) and 221(1) of the Mining Act in so far as they relate to guidelines for work programmes and exploration reports. It provides guidance to applicants for, and holders of, reconnaissance, prospecting and retention licenses, on how to prepare and submit compliant work programmes and exploration reports.

4.2.2 Environmental Management and Coordination Act, 1999 (Amendment 2015 & 2019)

The Government enacted the Environmental Management and Coordination Act (EMCA) in 1999 to provide a legal and institutional framework for environmental management in the country. The Act was amended in 2015 to align to the New Constitution (2010). Thereafter, it was amended in 2019 to update the Second Schedule list of projects that require EIA study.

The following are key elements of the EMCA law:

- It stipulates at the outset that "*Every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment*" and that anyone has the right to take a person breaching this law to court;
- It defines illegal activities within a number of areas, including waste management and pollution and degradation of rivers, lakes, wetlands, coastal zones, agricultural areas, forests and biodiversity; and,

- It sets down the principles for EIA, and for the development of 5-year National Environmental Action Plans (NEAPs) and County Environmental Action Plans (CEAPs), to be developed at the National and County levels, respectively.

The law established NEMA to be the principal institution responsible for supervising and coordinating the implementation and enforcement of the act at national and local levels. Section 3A of the Amendment Act (2015) grants any individual right to access information from the Authority (NEMA), lead agencies or any other person that relates to implementation of the Act. Matters relating to the environment are to be addressed in the Environment and Land court that is established under the Environment and Land Court Act (2011).

Section 37 of the Act mandates NEMA to prepare a National Environmental Action Plan (NEAP) and ensure it has undertaken public participation, before the adoption. NEMA is also required to review the adopted NEAP every 3 years. Sections 42 and 43 provide that development near water resources should only be permitted after carrying out EIA, and obtaining written approval from NEMA.

Section 58 of the Act directs that any project of the nature specified under the Second Schedule of the Act should be subjected to an EIA study and a report of the same submitted to NEMA, for the purpose of processing an EIA license. The 2019 Amendment of the Act (Legal Notice No.31) provides an updated list of projects that require EIA, and assigns projects to three categories, depending on the seriousness of their likely effects, namely: low risk, medium risk, and high-risk projects.

Section 68 (1) mandates NEMA, or its designated agents, to carry out environmental audit of all activities that are likely to have significant effects on the environment. In Section 68 (3), the Act requires owner of premises or operator of a project for which an EIA study report was prepared, to take all reasonable measures to mitigate any undesirable effects not contemplated in the EIA report, and also prepare and submit an environmental audit report on those measures to NEMA, annually or as NEMA may require, in writing.

Section 112 (4) mandates NEMA to impose environmental conservation order on burdened land, and in Section 116, the Act provides that persons with legal interest on land subjected to the easement have a right to compensation commensurate with the lost value of the use of the land.

Section 124 of the Act gives NEMA directives on appropriate measures needed to domesticate international environmental agreements ratified by Kenya, subject to the Treaty Making and Ratification Act of 2012.

Vibratory effects on the environment are regulated by the EMCA 2015 Clause 58 (101) and the Noise and Excessive Vibration Pollution (Control) Regulations, 2009. The regulations are gazetted as Legal Notice No. 61 and are hereinafter referred to as the Regulations. In the Regulations, NEMA defines vibration as “an oscillatory motion of solid bodies of deterministic or random nature described by displacement, velocity or acceleration with respect to a given reference point”. EMCA 2015 Part II Clause 4 states about excessive vibrations that:

4. (1). Except as otherwise provided in these Regulations, no person shall:

(a) make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or

(b) cause to be made excessive vibrations which exceed 0.5 centimeters per second beyond any source property boundary or 30 meters from any moving source.

Frequency-dependent limits have the capacity to precisely deal with the hazards presented by ground vibration and are seen as the basis for best practice blasting. The particular frequency-dependent criteria should be reported with the measurements.

Relevance to the project

- *Mining and other related activities, including quarrying of stone and slate, harvesting of aggregate, sand, gravel, soil and clay, are classified as 'high risk projects' under the Second Schedule of EMCA, 1999 (Amendment 2019), and hence the need for a full ESIA study.*
- *This ESIA study report includes an ESMP that outlines measures to be taken to mitigate potential negative impacts, as well as measures to be applied to enhance potential positive impacts.*
- *Should NEMA approve the project, the proponent will be required to promote strict adherence to the ESMP throughout the project's life-cycle.*

E**MCA Subsidiary Legislations**

The section below presents subsidiary legislation that were enacted to support EMCA:

4.2.2.1 Environmental (Impact Assessment and Audit) Regulations, 2003 (Revised 2019)

These regulations are made under section 147 of the EMCA, 1999 (Amendment 2019), and provide the general guidelines for undertaking EIA, environmental auditing (EA) and monitoring in Kenya. Regulation 3 provides that the EIA/EA Regulations should apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the EMCA, 1999 (Amendment 2019).

Regulation 4(1) states that no proponent should implement a project that is likely to have a negative environmental impact; or for which an EIA is required under the Act or these Regulations, unless an EIA has been concluded and approved in accordance with these Regulations.

Regulations 11 and 12 provide that EIA should be conducted in accordance with terms of reference (ToR) developed during the scoping exercise by the proponent and approved by NEMA. The assessment should be conducted in accordance with the general EIA guidelines and sector EIA guidelines set out in the Third Schedule to these Regulations. Sector EIA guidelines should be developed by the lead agency in consultation with the Authority (NEMA).

According to Regulation 17 (1), the proponent shall in consultation with the Authority, seek the views of persons who may be affected by the project. In seeking the views of the public, after the approval of the project report by the Authority, Regulation 17(2) states direct the proponent to:

(a) Publicize the project and its anticipated effects and benefits by:

- posting posters in strategic public places in the vicinity of the site informing the affected parties and communities of the project;
- publishing a notice on the project for two successive weeks in a newspaper that has a nation-wide circulation; and

(b) hold at least 3 public meetings with the affected parties and communities, to explain the project and its effects, and to receive their oral or written comments;

(c) ensure that appropriate notices are sent out at least one week prior to the meetings and that the venue and times of the meetings are convenient for the affected communities and the other concerned parties; and

(d) ensure, in consultation with the Authority, that a suitably qualified coordinator is appointed to receive and record both oral and written comments and any translations thereof received during all public meetings for onward transmission to the Authority

Regulations 18 and 19 outlined the content to be included in an EIA study report and the procedure for submission to the Authority, respectively. Regulation 20 describes the process of reviewing the EIA report by NEMA and lead agencies. In Regulation 21, NEMA is mandated to invite the public to make oral or

written comments on the report, within 14 days of receiving the EIA study report. Thereafter, Regulation 23 (1) provides that NEMA should give its decision on the EIA license application, within 3 months of receiving the EIA report. NEMA should communicate their decision to the proponent within 14 days from the date of making the decision, and a copy should be made available for inspection at the Authority's offices.

Regulation 31 (1) provides that an environmental audit study should be undertaken on any development activities that are likely to have adverse environmental impacts, including - (a) ongoing projects commenced prior to the coming into force of the EIA /EA Regulations; or (b) new projects undertaken after completion of an EIA study report. Regulation 31 (4) {b} provides that a Proponent of a project that has undergone an EIA study should undertake an environmental audit of the project within a period of 12 months of commencement of the operations, and not more than 24 months after the completion of a project, whichever is earlier. Additionally, Regulation 31 (5) provides that the environmental audit study should be conducted in accordance with the TOR developed by the Proponent, in consultation with the Authority. Content to be included in the environmental audit report is provided in Regulation 31 (7).

Relevance to the project

- *This ESIA study complies with the guidelines and procedures provided under the Environmental (Impact Assessment and Audit) Regulations.*

4.2.2.2 Environmental Management and Co-ordination (Waste Management) Regulations, 2006

The Waste Management Regulations of 2006 were established under sections 92 and 147 of the EMCA, 1999 (Amendment 2019). They apply to all categories of waste including solid waste, industrial waste, hazardous, pesticides and toxics, biomedical waste and radioactive substances. Some of the stakeholders that are regulated include: waste generators, transporters, recyclers, composters, incinerator operators and landfill/dumpsite operators. Licensing procedure, fees, offences and penalties as well as operational guidelines are also provided in these Regulations.

Waste generation

The Regulations prohibit waste generators from disposing any waste on a public highway, street, road, recreational area or in any public place, except in a designated waste receptacle and is required to collect, segregate and dispose such waste in the manner specified under these Regulations. Any person whose activities generates waste has an obligation to ensure that such waste is transferred to a person who is licensed to transport and dispose such waste in a designated waste disposal facility.

In addition, the regulations support the application of cleaner production technologies in relevant facilities, in order to minimize waste generation and maximize use of raw materials. These includes improvement of production processes; monitoring the product cycle from beginning to end; and incorporating environmental concerns in the design, process and disposal of a product.

Waste transportation

The regulations require any person intending to transport, own and operate an incinerator or own and operate a waste disposal site to apply for a license from NEMA. Transportation of waste should safeguard against scattering, escaping and/or flowing out of the waste from the vehicle. In addition, the transporter must comply with the scheduled routes approved by the Authority from the point of collection to the disposal site or plant.

Licensing and monitoring of waste transporters is intended to address environmental and health impacts of waste management activities through prevention of illegal dumping, prevention of land contamination, secure containment of wastes storage and transit, appropriate storage, handling and disposal of wastes, and data collection with regard to quantities of waste.

The regulations require waste transporters to use designated geographical areas of operation and scheduled routes approved by the Authority. The waste transporter should ensure all their vehicles and equipment for the transportation of waste conforms to set standards and the collection and transportation of waste should not cause scattering, flowing out and emissions or noxious smell. In addition, they should carry with them a duly filled tracking document, at all times during transportation, to facilitate monitoring by law enforcement agents them of the waste. All waste should be delivered to the designated disposal site or plant.

Waste disposal

These regulations require that waste disposal sites should be operated in environmentally sound manner to ensure proper and modern management of solid waste. Waste should be treated in accordance with all the relevant legislations, to ensure that such waste does not present any imminent and substantial danger to public health, the environment and natural resources.

Operators / owners of waste disposal sites or plants are required to carry out annual environmental audit while those intending to set up new disposal sites or plants shall carry out EIA. The regulations recognize the important role of incineration in disposing of hazardous and other types of waste. As such, operators / owners of incinerators are required to carry out annual environmental audit, while those intending to set up new ones shall carry out EIA.

Waste recycling and composting

Recycling provides an opportunity for material recovery for re-use. It leads to reduction of waste quantities and provides opportunities for employment and income generation. The principle of recycling allows for prior segregation of waste, proper disposal and reduced production cost due to material recovery. Some of the common recyclable waste include waste paper, cardboard, glass, scrap metal, rubber sludge/used oil and plastics.

Composting also presents an alternative measure for managing organic biodegradable waste. Key products of composting include manure and biogas which boosts agricultural productivity and alternative clean energy respectively.

The regulations require waste recyclers and composters to obtain the relevant licenses for their operations.

Hazardous waste

The Fourth Schedule to the Regulations lists wastes considered as hazardous and these include explosives, flammable solid and liquids, corrosives, radioactive and carcinogenic substances among others. These wastes require specialized handling, treatment and disposal due high damaging effect to the environment and human health. The regulations prohibit activities likely to generate any hazardous waste without a valid EIA license issued by the Authority. The generator of hazardous waste should ensure that containers or packages for storing such waste are secure and labeled in easily legible characters, written in English and Kiswahili.

Offences

EMCA 1999 (Amendment 2019) identifies various environmental offences and states that any person who contravenes any part of the regulations commits an offence. Any person who contravenes the provisions of the waste management regulations is liable upon conviction to imprisonment or a fine not exceeding five hundred thousand Kenyan Shillings (KSH 500,000) as per the Act. In addition, the court may give such other orders as provided for by the Act.

Relevance to the project

The proponent shall ensure the project complies with the requirements of these regulations by adopting the following practices:

- *Encourage segregation of wastes and grouping them according to their categories*
- *Ensure all wastes are deposited in designated dumping sites*
- *Ensure all waste handlers engaged by the proponent are licensed by NEMA and possess all relevant waste handling equipment and documentation, such as waste transport license, tracking documents, license to operate a waste yard, insurance cover, and vehicle inspection documents, amongst others*
- *Implement cleaner production principles of waste management namely reduce, reuse and recycle*
- *Label all hazardous wastes as specified in Section 24 (1-3) of the Regulation.*

4.2.2.3 Environmental Management and Coordination (Water Quality) Regulations, 2006

These Regulations apply to drinking water, water used for industrial purposes, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife, and water used for any other purposes. They provide rules relative to the use and discharge of water for domestic, agricultural and industrial purposes, make provision for the protection of water resources from pollution, and define water quality standards.

Regulation 4 prohibits anyone from engaging in an activity or activities that are likely to cause immediate or subsequent water pollution, directly or indirectly, regardless of whether the water resource was polluted before the enactment of EMCA. The regulations also prohibit anyone from causing pollution of a water resource by throwing or causing to flow into or near, any liquid, solid or gaseous substance or deposit any such substance, in or near it.

Regulation 6 prohibits anyone from:

(a) discharging effluent from sewage treatment works, industry or other point sources into the aquatic environment without a valid effluent discharge license issued in accordance with the provisions of EMCA

(b) abstracting ground water or carrying out any activity that is likely to have any adverse impact on the quantity and quality water, near any lakes, rivers, streams, springs and wells, before obtaining an EIA license from NEMA

(c) cultivating or undertaking any development activity within a minimum of 6 m and a maximum of 30 m from the highest ever recorded flood level, on either side of a river or stream, and as may be determined by the NEMA, from time to time

Regulations 11 and 24 prohibit anyone from discharging or applying any poison, toxic, noxious or obstructing matter, radioactive waste or other pollutants into the aquatic environment unless such discharge, poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards set out in the Third Schedule of these Regulations.

Regulation 14 states that persons with an effluent discharge issued under EMCA should carry out effluent discharge quality and quantity monitoring, in accordance with methods and procedures of sampling and analysis prescribed by NEMA, and shall submit quarterly records of such monitoring to the NEMA or its designated representative. The discharge monitoring record should be in the prescribed form as set out in Sixth Schedule to these Regulations.

Regulation 27 provides that any person who contravenes any of these Regulations commits an offence and shall be liable on conviction to a fine not exceeding five hundred thousand Kenyan shillings (KSH 500,000). In addition to the above, the court may give such other orders as provided for by the EMCA.

The Environmental Management and Co-ordination (Water Quality) (Amendment) Regulations, 2012 (L.N. No. 85 of 2012), amended Schedule 11 on fees chargeable for the application for a license to discharge of effluent into the environment.

Relevance to the project

The proponent and the design consultants' team shall be advised on the requirements of this regulation and appropriately incorporate the regulations in the project design document.

4.2.2.4 Environmental Management and Coordination (Noise and Excessive Vibration Pollution) Control Regulations, 2009

These regulations define noise as any undesirable sound that is intrinsically objectionable and can cause adverse effects on human health or the environment. The regulations therefore prohibit anyone from making or causing to be made any loud, unreasonable, unnecessary or unusual noise that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

Article 13 2(d) of the regulations allows for construction work at night for public utility construction, construction of public works, projects exclusively relating to roads, bridges, airports, public schools and sidewalks, provided noise generated is not caused within a residential building or across a residential real property boundary where such noise interferes with the comfort, repose, or safety of the members of the public.

The Second Schedule of the Regulations provides for the maximum permissible level of noise at construction sites, as follows:

Table 4-2: Maximum Permissible Noise Levels for Construction Sites (measured within the facility)

Facility		**Maximum Noise Level Permitted (Leq) in dB(A)**	
		Day 6.01 am - 6.00 pm (Leq 14h)	Night 6.01 pm - 6.00 am (Leq 14h)
1	Health Facilities, educational facilities, homes for the disabled etc.	60	35
2	Residential	60	35
3	Areas other than those listed in (1) and (2)	75	65

Leq: equivalent continuous sound level

Relevance to the project

The project proponent will undertake the necessary engineering and administrative control measures to ensure noise and vibration levels due to quarrying operations are within the limits specified under the Regulations.

3.2.1.1 Environmental Management and Coordination (Air Quality) Regulations, 2014

These Regulations provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The regulations provide for the establishment of emission standards for various sources such as mobile sources (e.g., motor vehicles) and stationary sources (e.g., industries) and establish the

procedures for the issuance of emissions licenses, measurement of emissions, inspection and monitoring programs, and reporting requirements.

Relevance to the project

The proposed quarry project is expected to generate dust during drilling, blasting and crushing operations, and also during handling and transportation of the construction material. The suggested control measures include:

- *Proper blasting pattern for effective rock fragmentation and generation of minimal fine dust to open atmosphere*
- *Regular sprinkling of water sprinkling at dust emanating sources - drilling, blasting and transportation through haulage roads, etc.*
- *Periodic maintenance of transport vehicles and equipment to check emission levels*
- *Proper maintenance of project vehicles to comply with exhaust emission requirements*
- *Regular ambient air quality monitoring to ensure air pollutants are within permissible limits*

4.2.3 The Lands Act, 2012

The Land Act was enacted by Parliament to give effect to Article 68 of the Constitution of Kenya (2010), 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. The Act applies to all land declared as (a) public land under Article 62 of the Constitution; (b) private land under Article 64 of the Constitution; and (c) community land under Article 63 of the Constitution and any other written law relating to community land.

The Act guarantees security of tenure for land under (a) freehold; (b) leasehold; (c) such forms of partial interest as may be defined under the Act and other law, including but not limited to easements; and (d) customary land rights, where consistent with the Constitution and guarantees equal recognition and enforcement of land rights arising under all tenure systems and non-discrimination in ownership of, and access to land under all tenure systems.

The Act revoked 'the Way leaves Act' and 'the Land Acquisition Act', and allows for Compulsory Acquisition as an option in acquiring land for public utility in Sections 8 and 9. Specifically, Section 9, (1) states that any land may be converted from one category to another in accordance with the provision of this article or any other written law. In section 11, (1) it states that the commission (National land commission) shall take action to maintain public land that has endangered or endemic species of flora and fauna, critical habitats or protected areas.

Relevance to the Project

The proponent will comply with the Act by verifying the land ownership status before acquiring private land for the project and ancillary developments. They are also required to safeguard sensitive flora and fauna existing on the land.

4.2.4 National Land Commissions Act, 2012

Under the National Land Commission Act, section 5 (1) provides that the commission shall be responsible for, among others duties, monitoring the registration of all rights and interests in land and ensuring that public land and land under the management of designated state agencies are sustainably managed for their intended purpose, and for future generations. The commission is required to manage and administer all unregistered trust land and unregistered community land on behalf of the county government and develop and encourage alternative dispute resolution mechanisms in land dispute handling and management. The Commission is also required in consultation and cooperation with the national and county governments, to establish county land management boards for the purposes of managing public land

Relevance to the project

In case of compensation of any kind by the government due to accusation of land for the project activities, the National Land Commission shall be responsible for adjudicating the compensation rates.

4.2.5 Physical and Land Use Planning Act, 2019

This The Act provides for the planning, use, regulation and development of land and for connected purposes. It was enacted to ensure that every person engaged in physical and land use planning shall promote sustainable use of land and livable communities which integrates human needs in any locality. The Act allows the County Government to prepare a local physical and land use development plan in respect of a County, Sub-County, or unclassified urban area.

Section 55 (1) the objective of the development control are to ensure optimal land use, to protect and conserve the environment and to promote public safety and health. Section 58 states that a person shall obtain development permission from the respective county executive committee members by applying for development permission from the county executive committee member in a prescribed form. Where an applicant is not the registered owner of the land for which development permission is being sought, the Act provides that the applicant should obtain the written consent to the respective county executive committee member at the time of applying for development permission.

Relevance to the project

The proponent will have to apply for the necessary permits for the land use as per the requirements by the County Government of Nakuru.

4.2.6 The Occupational Safety and Health Act, 2007

This Act was signed into law in October 2007 to repeal and replace the Factories and Other Places of Work Act Cap 514. It came into force on December 20, 2007. The Act makes provision for safety and health of workers in all workplaces in Kenya. All rules made under the previous Act remain in force under the new Act. The Act requires developers to notify the Director of Occupational Health and Safety of their intended development before commencement. The act also sets minimum standards that are to be maintained in such workplaces to safeguard health, safety and welfare of workers. These are all aimed at elimination of hazards from workplaces. The act further requires all workplaces to display the abstract of the act for all workers to read and remind themselves on how to protect themselves from hazards.

The Act also makes it mandatory for occupiers or employers to provide personal protective equipment and all practicable means to prevent injury to health of workers who are exposed to any potentially harmful substances or conditions. Section 9(1) demands that every occupier shall establish a safety and health committee at the workplace in accordance with regulations prescribed by the Minister, if there are twenty or more persons employed at the workplace.

The Act further requires all workplaces to have stocked first aid boxes under the charge of trained first aid attendants. The Factories (Building Operations and Works of Engineering Construction) Rules of 1984 are more specific on standards and requirements for the construction works. The said Act requires that before any premises are occupied or used a certificate of registration should be obtained from the chief inspector. The occupier must keep a general register with provision for health, safety and welfare of workers on site. For safety, fencing of the premises and dangerous areas must be done. There should be provision for clean and sanitary working conditions. Moreover, there must be also provision of portable drinking water.

The Act requires proponents to keep a general register at the workplace to record accidents or occupational diseases. Despite being repealed, the regulations under the Factories and Other Places of Work Act (Cap 514) are still operational under the Occupational Safety and Health Act, 2007 and shall apply, where appropriate.

Relevance to the project

- *The proponent shall comply with all sections of the Act related to this project, including the provision of PPE, fire safety, First Aid, clean drinking water, use of explosives, and insurance cover for staff are observed, so as to protect all involved from work related injuries or other health hazards.*

In addition to the Occupational Safety and Health (OSHA, 2007), the following legislations apply to the proposed quarry project:

4.2.6.1 The Factories (First Aid) Rules, L.N. No. 160/1977

These Rules apply to workplaces, and require the occupier to put in place appropriate measures for ensuring persons injured at the workplace receive necessary medical attention. The Rules specify contents to be included in a First Aid Box in accordance with the number of workers, as well training requirements for the First Aid team.

4.2.6.2 The Factories and Other Places of Work (Protection of eyes) Rules, 1977

These rules apply to all factories, all premises, places, processes operations and works and building construction works and works of engineering constructions. The occupier is required to provide eye protectors and shields for the protection of persons employed in specific processes. In addition, the Rules require all persons that are provided with eye protectors or shield to take care of them, avoid misuse and report any loss or destruction/ defect of the eye protector or shield.

4.2.6.3 The Factories and Other Places of Work (Electric Power) Rules 1979

These rules may apply to the generation, transformation, conversion, switching, control, regulation, distribution and use of electrical energy in workplaces. They require the occupier to put appropriate measures in place to eliminate electrical hazards within their premises by the insulation of conductors, and by the provision of circuit breakers and personal protection.

4.2.6.4 The Factories (Building Operations and Works of Engineering Construction) Rules, 1984

These Rules cover the construction, structural alteration, repair and maintenance of buildings, including repainting, redecoration and external clearance of the structure; the demolition of a building; and preparing and laying the foundation of an intended building or work of engineering construction for the purpose of any industrial or commercial use. The Rules require the contractors and occupiers to observe good safety standards while performing building operations mentioned above.

4.2.6.5 The Factories and Other Places of Work (Safety and Health Committees) Rules, 2004

These rules apply to apply to workplaces with 20 or more regular employees. They require the occupier to set up safety and health committees with equal representation of management and workers. The functions of the committee include conducting safety and health inspections, investigating accidents, and making recommendations to the occupier on improvements for the promotion of a safe and healthy working environment.

4.2.6.6 The Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005

These Rules apply to workplaces where activities result in noise levels that could impair or damage employees' hearing ability. They specify the permissible levels of noise, and require the occupier to carry out noise measurements, develop a noise prevention programme to reduce noise levels, and provide hearing protection.

4.2.6.7 The Factories and Other Places of Work (Medical Examination) Rules, 2005

These Rules apply to workplaces where employees are engaged in occupations that expose them to hazards that might harm their health. They specify occupations requiring medical examinations, and the types of examination of employees at the employer's cost.

4.2.6.8 The Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007

These Rules apply to workplaces, and require the occupier to put appropriate measures in place to prevent the occurrence of fires within their premises. They address the safe handling, storage and transportation of flammable substances. They also require the occupier to provide means of evacuation, fire detection systems, firefighting equipment, and firefighting teams.

The Rules prescribe annual fire safety audits, the formulation of a fire safety policy, and training of workers on fire safety issues.

4.2.6.9 Factories and Other Places of Work (Hazardous Substances) Rules, 2007

These Rules apply to workplaces where workers are likely to be exposed to hazardous substances. They require the occupier to prevent employees from exposure to such substances by putting sensible control measures in place, or, where these are not reasonably practical, to ensure that personal protective equipment (PPE) is provided. In addition, they also prescribe occupational exposure limits (OEL) for hazardous chemical substances, safe handling, use and disposal of hazardous substances.

4.2.7 County Government Act, 2012

This Act was enacted to give effect to Chapter 11 of the Constitution of Kenya, 2010; to provide for county governments' powers, functions and responsibilities to deliver services and for connected purposes law also requires public participation in the planning and development of a county. Section 105 (1) states that a county planning unit shall be responsible for coordinating integrated development planning within the county.

Section 115 (1) states that public participation in the county planning processes should be mandatory and be facilitated through provision to the public of clear and unambiguous information on any matter under consideration in the planning process, including clear EIA reports.

Relevance to the project

This ESIA report complies with the Act.

4.2.8 Water Act 2016

Part II, section 18, of the Water Act, provides for national monitoring and information systems on water resources. Section 73 of the Act allows a person with license (licensee) to supply water to make regulations for purposes of protecting against degradation of water sources. Section 75(1) allows the licensee to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water sources within his/her jurisdiction.

Relevance to the project

- *The proponent shall take reasonable measures to ensure the quarry operations do not to pollute any surface water resources.*
- *The proponent shall put in place adequate wastewater management strategies as per the EMCA (Waste management) Regulations of 2006. In addition, maintenance of fuel powered equipment and/or vehicles should be done off-site and at designated garages within Gilgil town.*

4.2.9 The Explosive Act, 2012

The act regulates the purchase, assemblage, manufacture and use of explosive materials. It also stipulates conditions for use, precautionary measures and storage requirements. The Act requires one to seek authority to acquire, transport and use blasting materials. It furthers makes it an offence liable for penalties to any person causing an explosion where life or property is endangered.

Section 9 (1) No person shall purchase or otherwise acquire blasting materials except under the authority of, and to the extent authorized in, a written permit issued by an inspector.

Section11 (1) No person shall use, or cause to be used, any blasting materials, (a) at a depth of ten meters or more, measured from the surface along or down a shaft, well or tunnel, unless he is in possession of a valid miner's blasting certificate issued to him under the Mining Act (Cap. 306), or is under the immediate supervision of the holder of such a certificate; or (b) in all other cases, unless he is in possession of a valid miner's blasting certificate issued to him under the Mining Act (Cap. 306) or of a valid permit issued to him for such purpose by an inspector, who is hereby authorized so to do, or unless he is under the immediate supervision of a person in possession of either such a certificate or permit

The Explosives Act (Cap 115, 2012) lists in the Schedule the explosives used at material quarries and stone quarry sites in Kenya. These include gelatinous explosives (such as blasting gelatine, gelignite, gelatine dynamite, etc.). Others are non-gelatinous explosives (such as dynamite, ligdyn, farmers' dynamite, etc.) and Nitro-cotton. Other accessories outlined are detonators, including Danolite and instantaneous detonating fuse; gunpowder; sporting powder; percussion caps and fireworks of various kinds.

All imported explosives, whether contained in the above list or not, are deemed to be authorized explosives, if included in and conforming to the "authorized list" in forces in the United Kingdom.

Relevance to the project

The proponent shall comply with the provisions of the Act and ensure they obtain relevant permits and approvals before proceeding with the project.

4.2.10 The Work Injury Benefits Act, 2007

This is an Act of Parliament that provides for compensation payment to employees for work related injuries and diseases contracted in the course of employment and for connected purposes. The Act includes the provision of compulsory insurance for employees. The Act also defines an employee as any worker on contract of service with an employer.

Relevance to the project

It is recommended that all workers contracted during the project implementation phase obtain the required insurance covers so that they can be compensated in case of injuries at work.

4.2.11 The Employment Act, 2007

The Employment Act declares and defines the fundamental rights of employees in Kenya, including basic conditions of employment of employees and regulation of employment of children.

Relevance to the project

The project proponent will be advised to ensure that appointed contractors comply with the Act.

4.2.12 HIV AND AIDS Prevention and Control Act. 2006

This Act law prohibits various forms of sexual violence offences committed against men and women. These include sexual assault, indecent acts, sexual harassment, child pornography, and child prostitution, exploitation of prostitution and deliberate transmission of HIV and AIDS among others. It provides that, no person shall be denied access to employment for which he is qualified; transferred, denied promotion or have his employment terminated, on the ground of his HIV status.

Section 3 of The Act highlights that the purpose of the legislation including public awareness and rights to people living with HIV/AIDS. Public awareness shall be achieved through education, public campaigns even at workplaces.

Relevance to the project

The proponent shall comply with the law by putting in place regular HIV and AIDS sensitization program at the workplace. No person should be discriminated against in matters employment due to his HIV status.

4.2.13 Public Health Act Cap 232

Part IX Section 115 of the Act states that no person or institution shall cause nuisance or conditions liable to be injurious or dangerous to human health. Any noxious matter or waste water flowing or discharged into a watercourse is deemed as a nuisance. Section 116 requires local Authorities to take all lawful necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or conditions liable to cause injuries or just are dangerous to human health. Part XII Section 136 states that all collections of water, sewage, rubbish, refuse and other substance which permit or facilitate the breeding or multiplication of pests shall be deemed a nuisance. The Act addresses matters of sanitation, hygiene and general environmental health and safety which is directly related to road project and associated activities.

Part XII Section 136 is complemented by the Malaria Prevention Act (Cap246) which provides measures to curb the breeding of mosquitoes at development sites. Measures proposed in the Act to control the breeding of the vector include: maintenance of free drainage channels, removal of stagnant water from any land to prevent larvae breeding, removal of wastes and broken bottles, amongst others.

Relevance to the project

The proponent shall be advised on measures to apply in order to comply with the provisions of the Act, which shall ensure the health of the workers and the public at large is safeguarded, during project implementation and after commissioning.

4.2.14 Use of Poisonous Substances Act, Cap 247

This Act provides for the protection of persons against risks of poisoning by certain substances that may be used. The purpose of this Act is to protect persons against risks of poisoning by toxic substances arising from the use, storage, importation, sale, disposal and/or transport.

Relevance to the project

The proponent shall ensure any machinery / equipment imported by the contractor is free from poisonous substances. The equipment and substances must be approved by the Kenya Bureau of Standards (KEBS).

4.2.15 Sexual Offences Act, 2006

This Act provides for sexual offences, their definition, prevention and the protection of all persons from harm from unlawful sexual acts, and for connected purposes. Section 23 states that anyone in a position of authority or holding a public office, who persistently makes any sexual advances or requests which are unwelcome, is guilty of the offence of sexual harassment and shall be liable to imprisonment for a term of not less than three years, or to a fine of not less than one hundred thousand shillings (KSH 100,000) or both. In addition, the Act prohibits a wide range of sexual offences including rape of all kinds, indecent acts, incest, pornography, child trafficking, etc.

Relevance to the project

- *This Act gives the public and the workers of the project the right to report any indecent behavior to a court of law, and protects children and young girls from defilement and other adult persons from all forms of harassment and discrimination.*
- *The proponent and his agents will be advised on the requirements of the Act, not discriminate on the basis sex during hiring of workers, on sexual harassment, and awareness creation among the workers.*

4.2.16 Persons with Disability Act, 2003

This Act was enacted to give effect to Article 54 of the Constitution of Kenya, 2010, which provides for the rights and rehabilitation of persons with disabilities. Section 21 of the Act provides that persons with disabilities are entitled to a barrier-free and disability friendly environment. They should have access to buildings, roads and other social amenities, and assistive devices and other equipment to promote their mobility.

Relevance to the project

The proponent will make such provisions on site.

4.2.17 The National Museums and Heritage Act, 2006

The National Museums and Heritage Act, 2006 protects all archaeological and cultural heritage of historical interest and other protected objects. These objects and features include:

- Antiquities - any moveable object other than a book or document made in or imported into Kenya before the year 1895, or any human, faunal or floral remains of similar minimum age.
- Objects of archaeological or paleontological interest in existence before the year 1800.
- Objects of historical, cultural or scientific interest which came into existence in or after the year 1800.
- Architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of universal value from the point of view of history, art or science.
- Works of humanity or the combined works of nature and humanity, and areas including archaeological sites which are of outstanding value from the historical, aesthetic, ethnological or anthropological point of view.
- Areas which are and have been of religious significance, use or veneration and which include but are not limited to Kayas;
- A door or door frame carved in an African of Oriental style before the year 1946;
- Any object or type of object, whether or not part of an immovable structure, which being of historical or cultural interest has been and remains declared by the Minister under section 25 (1) (d) to be a protected object;
- Protected areas and sites which have been declared under sections 25(1) (a), (c) or (f) by the Minister to be protected areas.

Relevance to the project

An archeological and Cultural Assessment was done

4.3 POLICY FRAMEWORK

4.3.1 Kenya Vision 2030

This policy aims at transforming Kenya into a newly industrializing, middle-income country providing a high quality of life to all its citizens in a clean and secure environment. The Vision is anchored on three key pillars: Economic; Social; and Political Governance. The political governance pillar envisages public participation during project development; while social pillar envisages development through equitable social development.

4.3.2 Mining and Minerals Policy 2016

The Mining and Minerals Policy, 2016, comprehensively addresses the gaps that have existed in the mining sector and aligns them with the aspirations of Kenya Vision 2030, the provisions of the new Constitution of Kenya (2010) and the African Union Mining Vision (2009). The African Union Mining Vision policy aims at positioning mining as a key driver of Africa's socio-economic development.

The guiding principles of the Mining and Minerals Policy, 2016, are outlined in Section 3.2. They include; -

1) inter-generational equity and sustainable utilization of mineral resources;
2) integrating sound environmental protection, safety and health considerations in mineral resources development;
3) equitable access to mineral resources and benefit sharing; transparency, accountability, and public participation;
4) respect of socio-cultural values, access to justice, gender equality and inclusiveness; and,
5) value addition and development of horizontal and vertical linkages to the local economy

The Mining and Minerals Policy objectives aim at providing a framework for: harmonizing mining, health and occupational safety and environmental legislations; gender mainstreaming and eradication of child labour in mining industry; mainstreaming activities of artisanal and small-scale miners; local participation in the mining investment ventures; as well as equitable sharing of mineral benefits between the National Government, County Governments and local community

Policy strategies that focus on environmental management include:

- Strategy 4: Develop legislative mechanisms for accessing land for mineral development
- Strategy 5: Achieve an acceptable balance between mining and environmental conservation and ensure that the sector operates within the approved (national and where necessary international) standards of health, safety, human rights and environmental protection
- Strategy 8: Pursue a responsive regulatory framework that ensures that benefits accruing from the mining sector are maximized for greater socio-economic development
- Strategy 9: Design mechanisms for sharing benefits accruing from exploitation of minerals between the National Government, the County Governments and Local Communities
- Strategy 10: Develop and implement mechanisms to enhance participation of Government (National & County), affected communities and other stakeholders in mining investments
- Strategy 11: Develop a framework for mainstreaming and formalizing artisanal and small scale mining operations in order to support livelihoods and entrepreneurship
- Strategy 12: Develop and implement frameworks, structures and mechanisms that ensure equitable participation, ownership and decision-making in mining value chains by women, youth, and disadvantaged groups

Chapter 4 of the Policy document covers the establishment of directorates and specifies their mandates, as follows:-

a) Directorate of Mines
- Arbitration of mining disputes
- Mine health, safety and environment

b) Directorate of Geological Surveys
- Evaluating and monitoring hazards associated with earthquakes, landslides, toxic minerals, subsidence and other ground failures

c) Directorate of Mineral Promotion and Value Addition
- Promoting mineral value addition
- Providing extension services to small scale and artisanal miners on mineral processing and value addition

d) Directorate of Resource Surveys and Remote Sensing
- Land use land cover mapping
- Data generation for sustainable conservation; and
- Mapping of land degradation

This policy requires that the proponent should obtain relevant permits and licenses, including land-owner consent, before operating the quarry. The proponent shall ensure that environmental and social health mitigation measures are in put in place to minimize adverse effects of quarrying. This policy will also be used as an emphasis for stakeholder involvement throughout the project phases.

4.3.3 National Environmental Policy, 2013

The policy provides a framework for an integrated approach to planning and sustainable management of Kenya's environment and natural resources, which in turn strengthens the legal and institutional framework for effective coordination and management of the environment and natural resources. The guidelines in the policy are aimed at achieving socio-economic wellbeing and survival of citizens and humans through proactive measures in protection of the environment.

The salient features of the policy include:

- Under paragraph 3.2(n) one of the principles to be applied in implementing the policy is that communities should be involved in decision-making and empowerment in implementation of decisions flowing out of the policy.
- Under paragraph 5.12.1 the policy advocates for gender equity in ownership of natural resources. It also advocates for equality in dealing with natural resources as it relates to people living with disabilities, the marginalized and minority groups.
- The policy takes cognizance of high population growth (which leads to higher human activity), shrinking productive land and technological changes as some of the factors that dictate a change in strategy and planning in order to safeguard the environment.
- It also provides for the need for rehabilitation and restoration of environmentally degraded areas such as disused quarries and mines, deforested areas, riverbanks, wetland hilltops and eroded shorelines

The policy promotes the adoption of ESIA as an environmental management tool.

4.3.4 National Environmental Action Plan, 2003 (Revised 2007)

National Environmental Action Plan was a deliberate policy effort to integrate environmental concerns into the country's development initiatives/plans. The policy provides a series of measures to address climate change including sustainable land management incorporation into national planning, policy and legal frameworks. It also seeks to increase the country's forest cover and adopt economic incentives for the management of forest products and community participation in conservation strategy.

4.3.5 National Forest Policy, 2014

Among other objectives the National Forest Policy aims at:

- Preparation of a national strategy to increase and maintain forest and tree cover to at least 10% of the total land area and rehabilitation/restoration of degraded forest ecosystems, and the establishment of a national forest resource monitoring system.
- Adoption of an ecosystem approach for the management of forests, and recognition of customary rights and user rights to support sustainable forest management and conservation.

This policy will act as a guideline in ensuring that compensatory planting is adopted and vegetation is cleared only within the expected area of use, without interfering with the other ecosystem outside project area.

4.3.6 National Land Policy 2009

The National Land Policy covers all aspects of land as regards to holding, classification, adjudication, registration, ownership and management. It also deals with historical injustices on land, and covers issues on natural resources and environment. The rationale for a policy on land was informed by the inadequate policy, legal and institutional frameworks on land coupled with the complex land management and administration system that was in place then. The policy also addresses the issues related to environment, natural resources, rights of women, youth and the vulnerable, and community interests.

Overall, the policy aims at ensuring land is put into productive use on a sustainable basis by facilitating the implementation of key principles on land-use and conservation. This is to be achieved by among other measures, putting in place an enabling environment for investment and exploitation of natural resources, at the same time as ensuring a sound and sustainable management of land-based resources.

The policy underscores the interests of the local community where natural resources are discovered. It notes that whereas there is need to exploit natural resources in order to secure national interests, the exploration should likewise confer benefits to the local community. In order to achieve a sustainable management and governance of natural resources, and to regulate the relationship between the people and the natural resource, the policy proposes that all policies, regulations and laws on environment and natural resources be harmonized with the legal framework established under EMCA, 1999. It also provides for public participation in auditing of environmental land management.

4.3.7 National Land Use Policy, 2017

This policy provides goals and direction for the current and future management of land in Kenya. It outlines the measures and guidelines which the government shall implement to achieve optimal utilization and management of land, and from which laws governing land administration and management shall be drawn.

Section 51(d) of the policy states that government to establish development control standards, processes and procedures that are efficient, transparent and accountable taking into account International Conventions and national policies relating to the sustainable use of land and the preservation of environmental values.

Section 3.4.3.4 promotes Environmental Management and Audit as land management tools and encourages public participation in the process.

4.3.8 Wildlife Conservation and Management Policy, 2017

It is aimed at promoting protection and conservation of wildlife in Kenya, through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes in

order to provide for the social, economic, ecological, cultural and spiritual needs of present and future generations; contribute to the sustainable development of the country; and enhance the quality of human life.

The undertaking of the project may lead to wildlife habitat destruction and in extreme cases human-wildlife conflict. The proponent shall apply sensible mitigation measures to minimize disturbance to wildlife during the project's implementation.

4.3.9 National Biodiversity Strategy and Action Plan, 2000

It is a national framework of action that ensures the present rate of biodiversity loss is reversed and the present levels of biological resources are maintained at sustainable levels for posterity.

The project may fall within a forest and there is a possibility that wildlife will be encountered. Therefore, should the project encounter endangered flora and fauna then their conservation is of primary importance.

4.3.10 National Gender and Development Policy, 2019

This policy aims at achieving equality of opportunity and outcomes with respect to access and control of national and county resources and services. It also seeks to ensure equality of treatment that meets the specific and distinct needs of different categories of men and women.

The implementation of the project will create job opportunities; through gender mainstreaming the problem of marginalizing women during employment may be addressed.

4.3.11 Occupational Health and Safety Policy, 2012

This policy aims at advancing workers safety and health at the workplace. Section 18 requires the employer (in this case the proponent) to ensure the health and safety of persons other than his/her workers. The policy also establishes the role of the employer in ensuring the health and safety of the surrounding communities during the implementation of the project.

The proponent will be expected to comply with the requirements of this policy when engaging workers in mining activities.

4.3.12 HIV and AIDS Policy, 2009

The policy provides a mechanism for establishing and promoting programs to ensure non-discrimination and non- stigmatization of the infected, and, contributing to national efforts to minimize the spread and militate against the impact of HIV and AIDS.

This policy shall provide a framework to both the project proponent and contractor to address issues related to HIV and Aids.

4.3.13 Poverty Reduction Strategy 2000

This policy aims at reducing poverty and promoting economic growth. It articulates Kenya's commitment and approach to tackling endemic poverty through involvement of the poor communities in both rural and urban areas in various socio-economic development activities.

The proposed project will offer various employment opportunities to Kenyans and therefore contribute directly towards the realization of this policy.

4.4 INSTITUTIONAL FRAMEWORK

4.4.1 Ministry of Mining and Petroleum

The Ministry of Petroleum and Mining was established to provide leadership in the management of the extractive sector in the country, as guided by the executive order No. 1 of 2018. The Ministry has two State Departments, namely, the State Department of Petroleum and the State Department of Mining.

The mandate of the State Department of Mining is to: develop policy on Extractive Industry; conduct mineral exploration; develop mining policy management; prepare inventory and mapping of mineral resources; coordinate mining and minerals development policy; develop policies on the management of quarrying of rocks and industrial minerals; ensure management of health conditions and health and safety in mines; conduct mining capacity development and value addition and maintain geological data (research, collection, collation, analysis).

Overall management of the mining sector of Kenya is through Directorates and specialized agencies, whose mandates are outlined in Table 7.

Table 4-3: Directorates and agencies governing the mining operations in Kenya

Directorates / Agency	Function
1. Directorate of Mines	The Directorate has 4 technical divisions, namely: (a) Licensing Division, which is in-charge of managing mineral rights and dealings through the online Cadastre Mining system; (b) Mineral Audit Division, which deals with the verification of mineral exports, management of mineral royalties and levies; (c) Inspectorate Division, which is responsible for compliance and enforcement of Mining Act 2016, Mining Regulations in regard to work programmes, mine plans, health and safety, license conditions; (d) Explosives Division, which deals with safety and use of commercial explosives (import, manufacture, sale, storage, handling and transportation) under the Explosives Act No 115 of 1933 (Cap 115). The Directorate has representation in four regional offices: Mombasa, Embu, Eldoret and Migori.
2. Directorate of geological surveys	The Directorate is responsible for: • Undertaking systematic geological mapping and structural mapping of the whole country to describe the onshore and off shore geological conditions; • Assessment and provision of information on mineral wealth of the country following detailed investigation; • Performing evaluation and monitoring of hazards associated with earthquakes, landslides, toxic minerals, subsidence and other ground failures; • Undertaking research related to geological processes and tectonic activities;

	• Compiling geoscience data and database management; • Preparation and publishing geological reports and maps as a framework for mineral, energy and water resource assessment, research, planning, decision making and other related undertakings; • Undertaking quantitative and qualitative laboratory analyses of rocks, mineral ores, precious and semi-precious minerals, metals and assay for gold, etc; and • Formulation of policy on geology and mineral exploration
3. Directorate of Mineral Promotion and Value Addition	The Directorate is responsible for: • implementation of policies on mineral promotion and value addition; • promotion of mineral value addition within the country; • providing extension services to small scale and artisanal miners on mineral processing and value addition; and • marketing mineral investment opportunities in the country
4. Directorate of Resource Surveys and Remote Sensing	Key functions of the Directorate include: • Land use land cover mapping; • Develop early warning-system for crop forecasting; • Data generation for sustainable conservation of Livestock/wildlife; and • Mapping of water towers, land degradation, etc.
5. Mineral Rights Board	This is an independent Board with membership from the Government and Private Sector. Its role is to advice and give recommendations, in writing, to the Cabinet Secretary on: - grant, rejection, retention, renewal, suspension, revocation, variation, assignment, trading, tendering, or transfer of Mineral Rights Agreements; - areas suitable for small-scale and artisanal mining; - areas where mining operations may be excluded and restricted; - declaration of certain minerals as strategic minerals; - termination, suspension or curtailment of production in respect of mining licenses; - fees, charges and royalties payable for a mineral right or mineral; and - any matters which under the Mining Act are required to be referred to the Mineral Rights Board

	The power to grant, deny or revoke a mineral right is vested on the Cabinet Secretary. However, such powers can only be exercised after recommendation of the Mineral Rights Board.
6. County Office for Mining	This Office serves as the representative of the Directorate of Mines in the Counties, with responsibility for granting, renewing and revoking artisanal mining permits; maintaining a register of artisanal miners; maintaining fair trade; and facilitating the formation of artisanal association groups or cooperatives for the miners.
7. County Artisanal Mining Committee	This was established under section 94 of the Mining Act, 2016, to assist the Directorate of Mines in managing artisanal mining activities in Counties. It advises the County Office of Mining on issues relating to granting, renewal or revocation of artisanal permits.
8. Kenya Chamber of Mines (KCM)	It was formed in year 2000 to represent the interests of Kenya's miners, exploration companies, mineral traders, suppliers and professionals in the mining industry. It seeks to create and maintain a business environment that is conducive for the successful development and benefit of its member's businesses and of the mineral industry in Kenya as whole.

4.4.2 National Environment Management Authority

The object and purpose for which NEMA was established is twofold: (a) to ensure sustainable management of the environment through exercising general supervision and coordination over matters relating to the environment and; (b) to be the principal instrument of government in the implementation of all policies relating to the environment. Key functions of the Authority include:

a) coordinating environmental management activities being undertaken by the lead agencies;

b) taking stock of the natural resources;

c) advising on land use planning;

d) undertaking research, investigation and surveys in the field of environment and disseminating information on the findings;

e) mobilizing and monitoring the use of financial and human resources for environmental management;

f) regulating, monitoring and assessing activities to ensure that the environment is not degraded;

g) enforcing environmental standards, undertaking environmental education, public awareness and public participation programmes;

h) developing, publishing and disseminating manuals, codes or guidelines relating to environmental management;

i) preparing the state of the environment report and; development and implementation of the national environment action plans (NEAPs)

Section 17 of the Climate Change Act (2016) empowers NEMA to monitor, investigate and report on whether public and private entities are in compliance with the assigned climate change duties and to regulate, enforce and monitor compliance on levels of GHG emissions, as set by the National Climate

Change Council.

4.4.3 County Environment Committee

The County Environment Committee (CEC) is responsible for management of the environmental affairs at the county level by developing county environment strategic action plan every 5 years, and any additional functions prescribed under the Act, or as assigned by Governor by notice in the gazette. It was established in the 2015 Amendment of EMCA (1999), to replace the District and Provincial Environment Committees.

4.4.4 National Environmental Complaints Committee

The National Environmental Complaints Committee (NECC) is responsible for the investigation of allegations or complains related to the environment; preparation of annual reports on the state of the environment; and undertaking public interest litigation on behalf of the citizens, in environmental matters. It was established to replace the Public Complaints Committee (PCC).

4.4.5 National Environment Tribunal

The National Environment Tribunal (NET) was established whose mandate is to decide on grievances and appeals against decisions made by NEMA with respect to issues such as environmental licensing among others. Those who are aggrieved by NEMA's decisions also have the option of going to the High Court but are typically encouraged to lodge their complaints with the National Environment Tribunal.

4.4.6 Standards and Enforcement Review Committee

The Standards and Enforcement Review Committee (SERC) is responsible for formulation of environmental standards, methods of analysis, inspection, monitoring and technical advice on necessary mitigation measures. The Committee, in consultation with relevant lead agencies, recommends water quality, noise, sewerage, air quality, radiation, and general pollution standards.

4.4.7 Directorate of Occupational Safety and Health Services

The mandate of the Directorate of Occupational Safety and Health Services (DOSHS) is to ensure compliance with the provisions of the OSHA (2007) and subsidiary legislations, and promote safety and health of workers. Key functions include:

- Inspecting workplaces to ensure compliance with safety and health law
- Examination and testing of steam boilers, air & steam receivers, gas cylinders, lifts, cranes chains and other lifting equipment
- Measurements of workplace pollutants for purposes of their control
- Investigation of occupational accidents and diseases with a view to preventing recurrence
- Medical examinations of workers
- Training on Occupational safety and health, first aid and fire safety
- Approving architectural plans of building intended for use as workplaces
- Disseminating information on occupational safety and health to customers

4.4.8 County Government of Nakuru

The proposed quarry project is found within the County Government of Nakuru. The County is considered to be the fastest growing town in East and Central Africa, and this means building and construction industry proportionately expands at the same rate. This rapid growth rate in construction projects has increased

currency velocity in the county resulting in the establishment of numerous construction related industries over and above employment opportunities to thousands of people.

4.4.9 Kenya National Highways Authority

This is an autonomous road agency, responsible for the management, development, rehabilitation and maintenance of international trunk roads linking centres of international importance and crossing international boundaries or terminating at international ports (Class A road), national trunk roads linking internationally important centres (Class B roads), and primarily roads linking provincially important centres to each other or two higher-class roads (Class C roads).

The authority shall be charged with the responsibility of ensuring that the contractor implements the laid out environmental procedures to prevent deterioration of the environment

4.4.10 Sogea Satom

The company is the contractor and the proponent for the quarry and camp. He shall be responsible for implementing the laid out environmental procedures aimed at preventing pollution and degradation of the environment.

4.5 NATIONAL ENVIRONMENTAL GUIDELINES AND STANDARDS

The Government of Kenya has developed a wide range of guidelines and standards to be used in various sectors, to ensure compliance with national environmental laws and regulations and enhance environmental sustainability. Table 8 provides a summary of guidelines and standards that apply to the mining sector.

Table 4-4: Environmental Guidelines and Standards

Guidelines / Standards	Environmental Role
1. Guidelines for Work Programmes and Exploration Reports, 2017	These guidelines provide guidance to applicants for, and holders of, reconnaissance and prospecting licences, on how to prepare compliant work programmes and exploration reports. Basically, work programmes are used to evaluate new applications and to ensure year-on-year progression, whilst exploration reports document the work completed and provide the basis for assessing compliance with the license/permit conditions and commitments. Non-compliant work programmes and technical reports may lead to rejection of an application or suspension or revocation of a mineral right.
2. County Public Participation Guidelines, 2016	The purpose of these guidelines is to strengthen democracy and participatory governance, by increasing accountability, inclusivity and ownership in various devolution activities. They are intended for use by all stakeholders including National and County Government officers, civil society and all government institutions that are engaged in public service delivery.

3. Eviction and Resettlement Guidelines, 2009	These guidelines lay a firm basis for preventing forced evictions and they apply in respect of all land and all occupiers of land in Kenya.
4. E-waste management guidelines	The objective of these guidelines is to streamline procedures for handling and disposal of e-waste generated by various sectors to avoid environmental pollution.

4.6 NATIONAL STRATEGIES AND ACTION PLANS

Table 4-5 outlines national strategies and action plans for environmental sustainability in Kenya.

Table 4-5: Environmental Strategies and Action Plan Kenya

Strategy / Action plan	Environmental role
1. Kenya Vision 2030	Vision 2030 prescribes the flagship programmes to be undertaken by the year 2030 in order to ensure a clean and healthy environment for the current and future generations
2. National Spatial Plan, 2015 - 2045	The Plan details the national spatial vision that will guide the long-term spatial development of the country for a period of 30 years (from 2015 to 2045). It aims at achieving an organized, integrated, sustainable and balanced development of the country, hence informing the future use and distribution of activities by providing a framework for better organization and linkages between different activities within the national space.
3. National Climate Change Response Strategy (NCCRS), 2010	The purpose of this strategy is to provide robust measures needed to address the challenges posed by climate variability and change in all sectors.
4. National Climate Change Action Plan (NCCAP), 2018 - 2022	This Plan derives from the Climate Change Act of 2016, which requires the Government of Kenya to develop Action Plans to guide the mainstreaming of climate change into sector functions. It provides mechanisms for realizing low carbon climate resilient development. It also emphasizes on sustainability, while prioritizing adaptation and enhanced climate resilience for vulnerable groups, including women, youth, persons with disability (PWD), and marginalized / minority communities.
5. National Environment Action Plan (NEAP), 2009 - 2013	This Plan was a deliberate policy effort to integrate environmental concerns into the country's development initiatives and plans. It provides a framework for the implementation of the National Environment Policy (NEP), as well as the realization of the Sustainable Development Goals (SDGs) and Vision 2030.

6. National Biodiversity Strategy and Action Plan (NBSAP), 2000	The Plan serves as a guide to integrate biodiversity concerns into relevant sectoral or cross-sectoral plans, programmes and policies, especially those that can have a bearing on national biodiversity. The NBSAP should be mainstreamed into the planning and activities of all those sectors that can have an impact (positive and negative) on biodiversity.

4.7 INTERNATIONAL FINANCE CORPORATION PERFORMANCE STANDARDS

4.7.1 Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts

The standard underscores the importance of managing environmental and social performance throughout the life of a project. Further the standard recognizes that an effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management, and involves engagement between the client, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders. The objectives of the standard include;

- To identify and evaluate environmental and social risks and impacts of the project.
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.
- To promote improved environmental and social performance of clients through the effective use of management systems.
- To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately.
- To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.
- Monitoring and review - establish procedures to monitor and measure the effectiveness of the management program, as well as compliance with any related legal and/or contractual obligations and regulatory requirements

4.7.2 Performance Standard 2: Labour and working conditions

The standard recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. The objectives include to:

- Promote fair treatment, non-discrimination, and equal opportunity of workers.
- Establish, maintain, and improve the worker-management relationship.
- Promote compliance with national employment and labor laws.
- Protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.

- Promote safe and healthy working conditions, and the health of workers.
- Avoid the use of forced labor.

4.7.3 Performance Standard 3: Resource Efficiency and Pollution Prevention

Recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. This Performance Standard outlines a project-level approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices. In addition, this Performance Standard promotes the ability of private sector companies to adopt such technologies and practices as far as their use is feasible in the context of a project that relies on commercially available skills and resources.

Objectives include to;

- Avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.
- Promote more sustainable use of resources, including energy and water.
- Reduce project-related GHG emissions

4.7.4 Performance Standard 4: Community Health Safety and Security

Recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration and/or intensification of impacts due to project activities. While acknowledging the public authorities' role in promoting the health, safety, and security of the public, this Performance Standard addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups.

Objectives include to;

- Anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances.
- Ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

4.7.5 Performance Standard 5: Land Acquisition and Involuntary Resettlement

The standard recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. It therefore aims to;

- Avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs.
- Avoid forced eviction.
- Anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by providing compensation for loss of assets at replacement cost and ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.
- Improve, or restore, the livelihoods and standards of living of displaced persons.

- Improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

4.7.6 Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements of this Performance Standard have been guided by the Convention on Biological Diversity, which defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems." It addresses how clients can sustainably manage and mitigate impacts on biodiversity and ecosystem services throughout the project's lifecycle. Objectives include;

- To protect and conserve biodiversity.
- To maintain the benefits from ecosystem services.
- To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

4.7.7 Performance Standard 7: Indigenous Peoples

recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. Objectives include;

- To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples.
- To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts.
- To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner.
- To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle.
- To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present.

4.7.8 Performance Standard 8: Cultural Heritage

recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. Objectives include

- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To promote the equitable sharing of benefits from the use of cultural heritage.

4.8 MULTILATERAL ENVIRONMENTAL AGREEMENTS

Kenya is a signatory to various international and regional treaties and conventions relevant to the conservation and governance of globally threatened and endemic species and fragile ecosystems. Table 4-6 presents some of the Multilateral Environmental Agreements (MEAs) ratified by Kenya, and which are relevant for the mining sector operations.

Table 4-6: Multilateral Environmental Agreements Relevant to the Mining Sector

MEA	Environmental Role
1. United Nations Convention on Biological Diversity (UNCBD)	The CBD is also known as the "Omnibus Convention" or the "Convention for all life on the Earth", and is regarded as the over-arching biodiversity convention which deals with many critical issues including access and benefit sharing. It was signed on June 11, 1992 and ratified on July 26, 1994.
2. World Heritage Convention (UN, 1972)	The objective of the convention is to establish an effective system of collective protection of the cultural, historical and natural heritage of outstanding universal value. It was signed on June 5, 1991.
3. United Nations Framework Convention on Climate Change (UNFCC 1992)	The convention sets an ultimate objective of stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system. It was ratified in August, 1994

5 DESCRIPTION OF THE ENVIRONMENTAL AND SOCIAL SETTING OF THE PROJECT

5.1 Physical Environment

5.1.1 Climate

Climate of the area is equable with few extremes of temperature and ample precipitation in all months. Precipitation varies somewhat throughout the year in response to the changing location and intensity of storm systems with an annual average precipitation of 1176mm. The highest precipitation is experienced in April and October with an average of 299mm while the least precipitation is experienced in February with an average of 48mm. There is an average of 202.2 days of precipitation, with the most precipitation occurring in April with 22.5 days and the least precipitation occurring in January with 10.4 days. The mean annual temperature is 18.7ºC. The maximum temperature is 25.5ºC while the minimum temperature is 12.4ºC. Rainfall distribution is plentiful, reliable, and frequent within the area. The average annual humidity is 61%. The highest humidity is experienced in May while January is the least humid month.

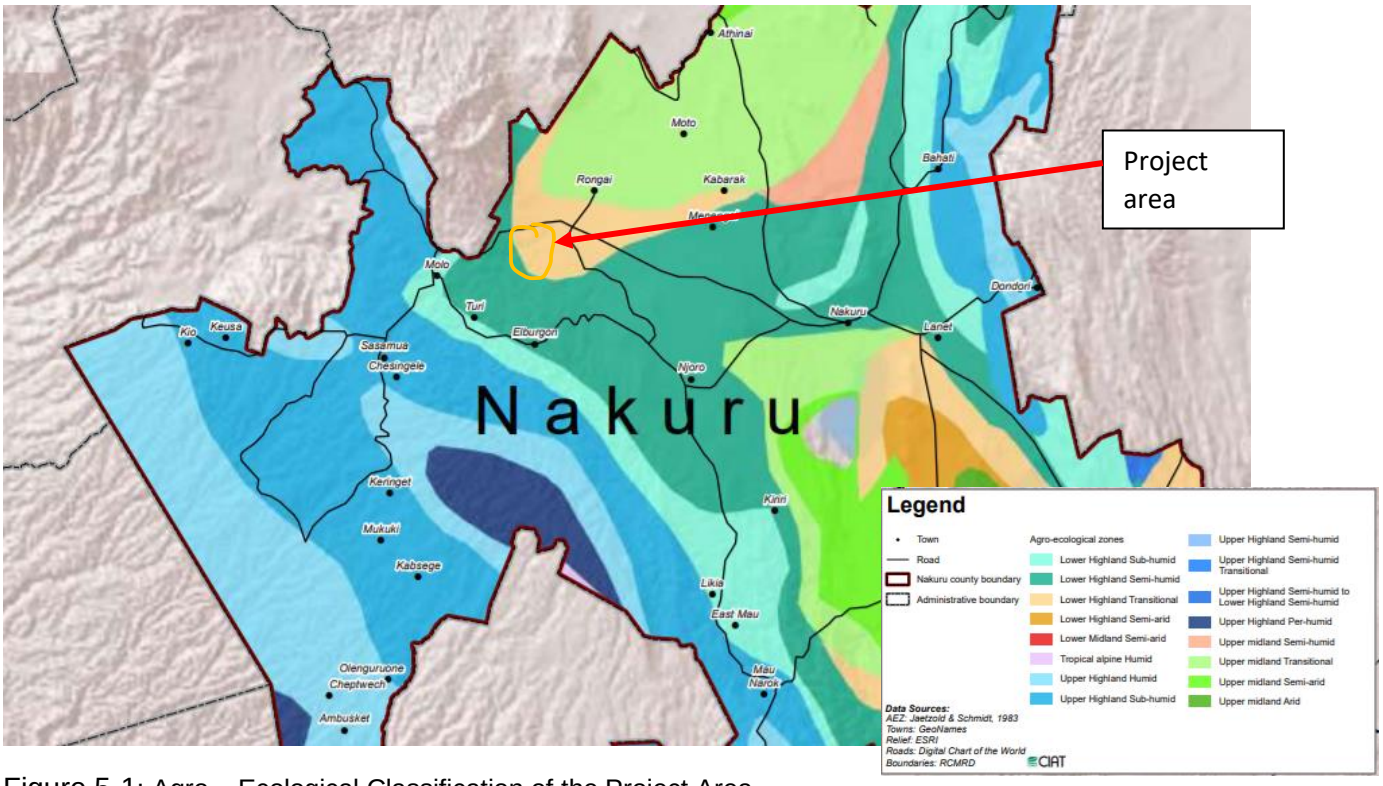


Figure 5-1: Agro – Ecological Classification of the Project Area

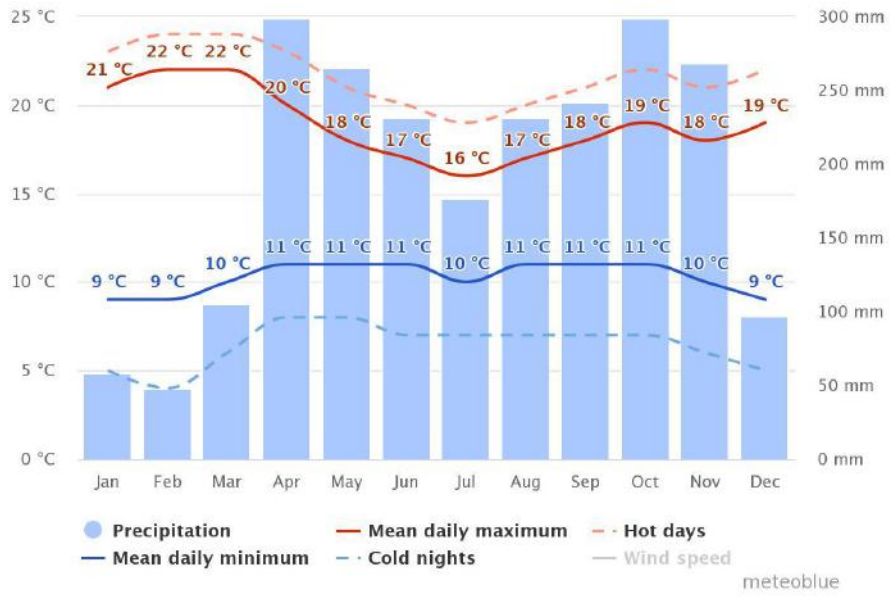


Figure 5-2: Average temperatures and precipitation in Molo

Source: https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/molo_kenya_186315

The area also receives adequate sunshine amounts per day. January has the highest number of sunny days, 12.3, while July has the least, 0.6. The table below shows the average days of sunshine throughout the year coupled in relation to the precipitation days.

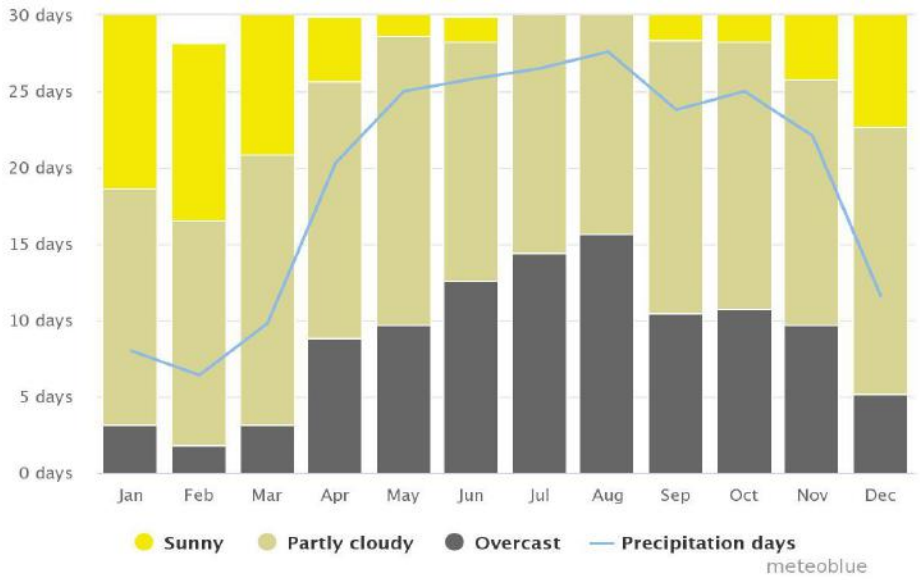


Figure 5-3: Cloudy, sunny and precipitation days in a year

Source: https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/molo_kenya_186315

The strongest wind speed recorded is a maximum of 19km/h and it is mainly experienced in the month of March, with an average of 6.8 days. However wind speeds from 1km/h to 12km/h most parts of the year. The figure below shows the number of days per month during which the wind reaches a certain speed.

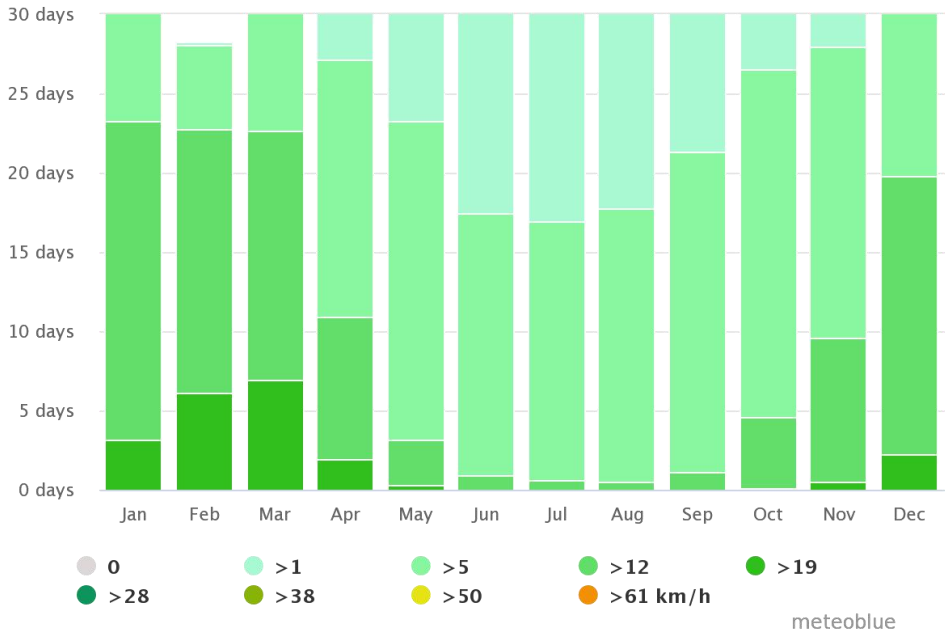


Figure 5-4: Predominant wind speeds during the year

Source: https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/molo_kenya_186315

The predominant wind direction is from South West (SW) to North East (NE) 1897 hours in a year. This is approximately 21.65% of the time in the year. The figure below shows the most dominant wind direction in the area.

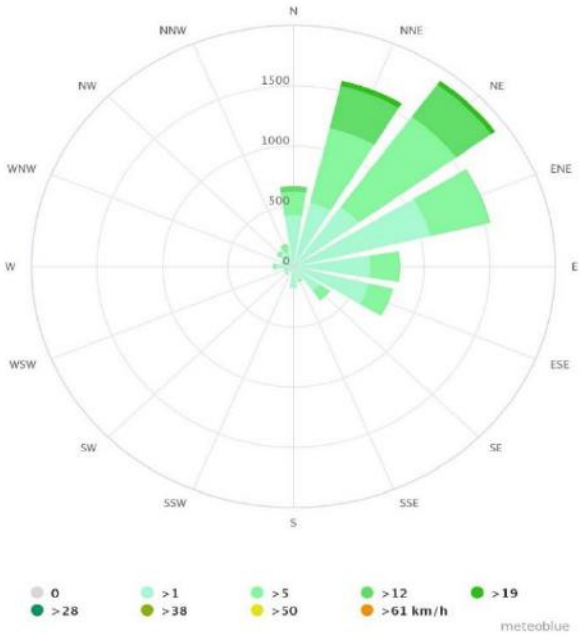


Figure 5-5: Windrose diagram for Molo

Source: https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/molo_kenya_186315

5.1.2 Geology

The project area is in the western part of the rift valley which is characterized by forested highlands and farmland on the shoulders. The rocks encountered are limited to the Tertiary and Quaternary volcanic suite of central Kenya and are largely pyroclastic in origin. A wide range of lava types have been recognized, ranging from melilite and perovskite, melaphelenites and basanites, phonolite and trachyte. The structure of the area is largely obscured by late-stage pyroclastic activity.

Some of the geological features that are in close proximity to the project area include the Rongai Plain, which gently slopes from the north east to the south and covers an area of approximately 647.45km^2; The Molo Plateau, which covers most of the south western part of the region and carries an almost complete margin of forest.

Geology of the project site

The site is covered by a thin surficial layer of Quaternary pyroclastics that overlie Tertiary trachytes and quartz trachytes. The latter are in turn underlain by Tertiary volcanic ashes, agglomerates and sediments. These units are described in more detail in the following subsections.

a) Pyroclastics and sediments of Rongai and Mau slope

These sediments comprise pumice, yellow ashy sediments and bleached tuffs. Exposures in river sections show that the sediments consist of medium and fine – grained, yellow and buff, banded tuffaceous deposits showing coarse- or fine-grained bedding and unconformable cross-cutting of earlier by later beds. These sediments grade upwards into layered clays, iron-rich soils and ochre-pigmented sandstones. A dip of 10° east-north east is typical in the unit.

b) Trachytes and quartz trachytes

Typically, these rocks appear on freshly broken surfaces as granular blue grey lavas, with glassy felspar phenocrysts showing rectangular sections. Weathered surfaces usually display a typical satin-like, silver-grey trachytic sheen, but occasionally weathering produces a finely mottled appearance with minute flecks of dark brown, khaki and green.

In some rocks the fine-grained base appears to be composed of a quartz-felspar inter-growth, and in others quartz occurs in optical continuity infilling minute, widely spaced irregular interstices. In others ophitic plates in the groundmass are accompanied by small clear pools of quartz.

c) Black ashes of Elburgon

They are a homogeneous, massive rock with columnar jointing that probably originated from ash-flow deposits. They are generally soft, readily weathered with porous texture; the 'black' connotation is because they often outcrop in riverbeds and appear sooty-black when waterlogged. When dry they are dark grey or purple.

d) Grey and bleached agglomerates and tuffs

These outcrop 1 kilometre southeast of the quarry site. They appear bleached yellow, buff and pale grey and compose the majority of the Mau succession. They are usually soft and readily eroded, due to the ash-fall nature of the rocks in the upper part of the succession, but ash-flow types also occur. Extensive pyroclastic deposition, and removal, reworking and redeposition by water, occurred contemporaneously.

The agglomerates consist of a fine-grained ashy base with included rock fragments and generally uncompressed pumice, varying in size and proportion, close-packed or dispersed. They occur first in the succession beneath the lowest ash-flow tuff and persistently recur.

5.1.3 Topography and Soils

Nakuru county is broadly divided into three topographical zones namely the upper highland, lower highland, upper midland and the lower midland. The project area falls in the lower highland zone. The soils on the project site are clay loam soils that are grey in colour and are comprised of highly developed textured top soils as well as well drained humic soils with dark brown sub soils. There are patches of reddish-brown sandy loam soils that dot the project site. The soils in the area are fertile and support agricultural productivity which is one of the main sources of livelihood in the area. Within the quarry site are red loam soils which are prone to erosion especially rill and gully erosion.

Plate 5-1: Section of the site showing rill erosion

Plate 5-2: Excess overburden stockpiled on site thus exposure to erosion

5.1.1 Drainage

The project area is largely drained by Njoro, Rongai, Molo, Narasura and Maji Mazuri rivers. The Njoro River which flows east drains into the saline Lake Nakuru, while the Molo and Rongai Rivers which originate on the northern slopes of the Mau traverse the Rongai plains and joins the Pekerra River to drain into Lake Baringo.

Figure 5-6 below shows the drainage of the larger project area.

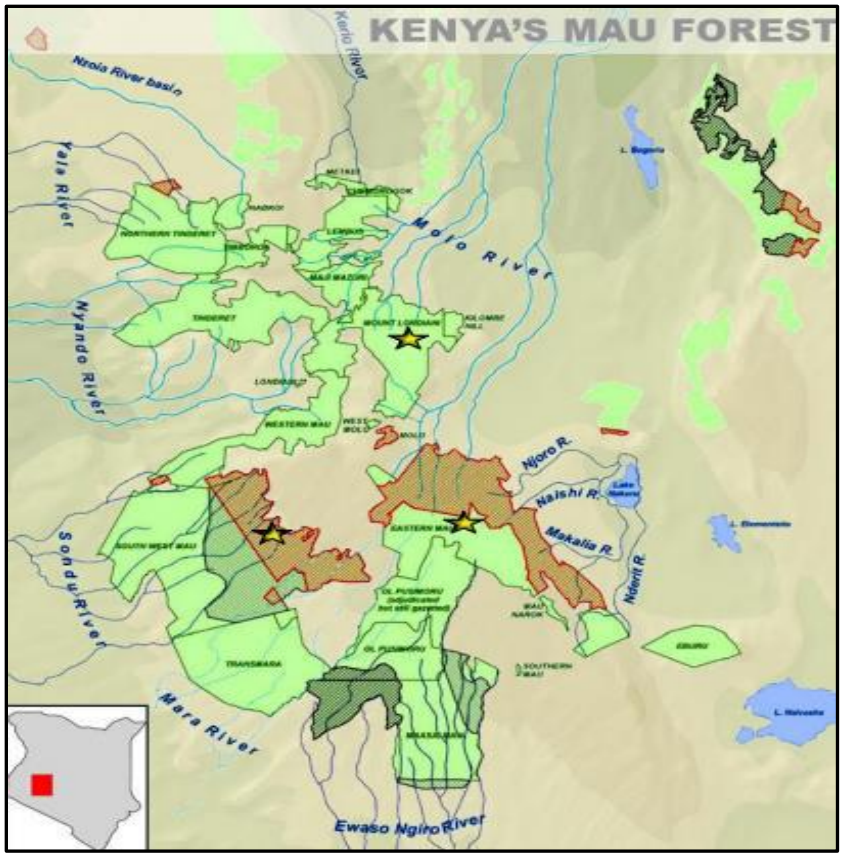


Figure 5-6: A map showing the drainage of the Project area

The main water source in the project area is Sachangwan river located approximately 150m North east of the project site and rain water. Additional sources of water include boreholes and rain water. The locals harvest rain water during the rainy seasons to help supplement the river water during dry months. Sachangwan River is a tributary of Molo River and originates from Koibatek forest.

Plate 5-3: River Sachangwan within the project area

5.1.2 Air quality

Air quality tests were done at the site and at the nearest sensitive receptor. The main source of air pollutants in the area is vehicular emissions from the adjacent busy highway. Other activities along the project area that have implications on air quality, though not dominant, is outdoor burning of firewood at the residential homes and along the highway (used in making of wooden chairs).

According to the USEPA (2016), sensitive receptors encompass but are not limited to "*hospitals, schools, day-care facilities, elderly housing and convalescent facilities. These are areas where the occupants are more susceptible to the adverse effects of exposure to toxic chemicals, pesticides, and other pollutants"*. In addition to the aforementioned, the definition covers human settlements where involuntary exposures are likely to occur. Residential homesteads are the main receptors in the vicinity of the ESIA Study Area. Figure 5-7 shows the land use within the immediate project environs.

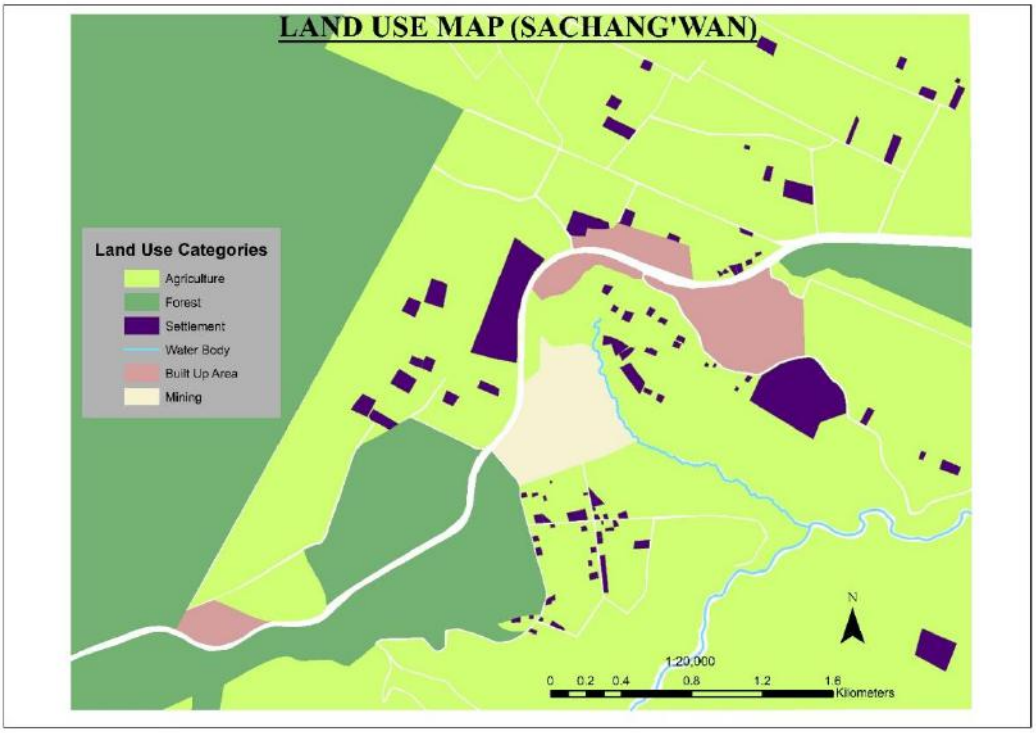


Figure 5-7: Land use around the project area

Plate 5-4: PEFA Sachangwan church located close to the project site (810132.46E; 9977160.87S)

Plate 5-5: Settlements in close proximity to the project site (809826.96E; 997663.99)

Ambient Air Quality Scenario

The Project area is approximately 150 meters away from the busy Highway to the Northwest of the project area and mainly surrounded by forests on either side. The site also borders scattered residential homes to

the West. All these have potential impacts on the surrounding air quality. The ambient levels of pollutants such as VOCs, PM_{10} and $PM_{2.5}$, NO_2, O_3, and SO_2 were assessed along the Project site and at surrounding receptors. The concentrations measured in this baseline data collection survey are discussed in detail below.

The monitoring points are labeled SP1 and SP2 as shown in Figure 5-8

Figure 5-8: Sampling locations

Description of the assessment points

Two locations were monitored including the project area and the nearest residential home. The points are described in Table 5-1 below

Table 5-1: Description of monitoring points

Site ID	Sampling Location	Site category	Description (main source of air pollutants)	Parameters monitored
1	SP1	Inside the project area	Vehicular emissions,	PM, SO_2, NO_2, VOCs & O_3
2	SP2-	Residential home	Vehicular emissions, Homestead activities	PM, SO_2, NO_2, VOCs & O_3

Particulate Matter- Results

The PM measurements results are presented in Table 5-2 and discussed in the next section.

Table 5-2: Particulate Matter Results

Sampling Location	Dates	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	TSP ($\mu g/m^3$)	Comments
SP1	20^{th}- 21^{st} Aug 2021	25	18	31	Heavy traffic along the Nairobi Highway

					the main source of pollutants
SP2	21st – 22nd Aug 2021	16	10	25	Heavy traffic along the Nairobi Highway the main source of pollutants.
Limits		*100 -EMC limits*	*75 & 50 (WHO interim targets 1 & 2 respectively*	*180 -EMC limits*	*All values are within the respective limits*

Particulates (PM_{10} and TSP) levels are all within the respective EMC regulatory limits for Residential, Rural and Other areas of 100 µg/m^3 and 180 µg/m^3 respectively. The main source of these pollutants being the busy Nairobi Highway. SP2 reported relatively lower levels mainly because the homestead is covered under a set of trees.

In the absence of a local regulatory limit for $PM_{2.5}$ under the Residential, Rural and Other areas category, WHO guidelines were used to compare the obtained results. All the measurement points reported values are within the WHO guideline (25 µg/m^3).

Table 5-3: Gaseous pollutants results

Sampling Location	**Dates**	**NO_2 (ppm)**	**SO_2 (ppm)**	**O_3 (ppm)**	**TVOCs (ppm)**	**Comments**
SP1	20th- 21st Aug 2021	0.085	0.02	0.04	10	The main source of pollutants is the heavy traffic along the adjacent Highway
SP2	21st – 22nd Aug 2021	0.069	0.012	0.03	15	The main source of pollutants is the heavy traffic along the adjacent Highway
Limits -EMC		*0.1*	*0.048*	*1.25*	*na*	*All values are within the respective EMC limits*

The ambient concentrations measured are all below the EMC regulatory limits for Rural, Residential, and Other Areas, as presented in Table 5-4. The values will serve as baseline to which future measurements can be compared with to assess impacts and compliance.

Although the activities at each sampling day at every sampling point cannot be verified, it is strongly believed that the high traffic volume along the Nairobi Highway is the main source of the pollutant levels reported.

5.1.3 Noise and Vibration

Main source of noise at all the points assessed is vehicular movement along the adjacent. Others are residential and commercial activities.

Description of the assessment points

The area monitored are all within the vicinity the project area. The two monitoring points are described in Table 5-4 one being inside the site while the other point is in a resident homestead.

Table 5-4: Measurement points

Site ID	GPS location	Description
SP1	0°12'39.43"S 35°47'4.78"E	Within the project area - mainly affected by vehicular movement on the Nairobi Highway, approximately 200 meters away
SP2	0°12'37.04"S 35°46'59.79"E	Residential home - mainly affected by vehicular movement on the Nairobi Highway, approximately 50 meters away. Homestead activities and barking dogs also another source of reported noise levels.

Measurement Results

The obtained data for each measurement location compared against the respective EMC set maximum limits are summarized in Table 5-5 and Table 5-6 below.

Table 5-5: Measurement Results- Nocturnal schedule

Site ID	Sampling Location	Date of measurement	Lmin	Lmax	Leq	EMC limits
SP1	Inside quarry site	20th to 21st - Aug-21	35.2	60.1	**41.0**	*25*
SP2	Residential home	21st to 22nd Aug-21	34.1	79.6	**51.9**	*25*

Table 5-6: Measurement Results- Diurnal schedule

Site ID	Sampling Location	Date of measurement	Lmin	Lmax	Leq	EMC limits
SP1	Inside quarry site	20th to 21st - Aug-21	35.9	68.4	**43.9**	*50*
SP2	Residential home	21st to 22nd Aug-21	41.6	90.1	**50.0**	*40*

The obtained noise levels were compared against the EMC maximum permissible limits for construction sites. Noise levels obtained during the nocturnal schedule were all above the respective regulatory limits. Noise on the diurnal schedule at the residential home were also above the set limit for SP2- residential home. The busy Highway was noted to be the main source of these reported levels. Dogs barking and occasional alarms and ambulances form the highway were also noted to contribute to intermittent elevated noise levels.

The baseline data obtained is representative of the noise levels at all the measurement locations and can be used to compare subsequent levels when the project is under construction and operational phases of the project.

5.2 Biological Environment

5.2.1 Vegetation

The unquarried areas are dominated by bushes, grasses and short shrubs. To the south west of the site are mature trees of *Acacia nilotica* which are endemic to the area and dominate the landscape. Other species include *Senna siamea, Senna spectabilis, Podocarpus spp*. Although vegetation has been cleared extensively, secondary vegetation of *Siamea spp* have emerged on the site. To the north eastern part of the site, mature cedar and podocarpus species were observed. Generally, the vegetation cover on site is estimated at 60%. There are no species that are rare, endangered, threatened or are of conservation value.

Plate 5-6: Grassland and *Acacia spp*. on site

Plate 5-7: *Senna siamea* spp on site

5.2.2 Fauna

The project area has low wildlife density and diversity owing to activities within Sachangwan shopping centre, settlements and land use. The most commonly spotted wildlife are rabbits, birds and frogs. Most of the wildlife are in Koibatek forest, a protected and environmentally sensitive area which is about 4 km away from the site. Adjacent to the site is a ranch where a few Colobus monkeys reside. The larger part of Koibatek Forest is dominated by planted forests that cover an approximate area of 21 km^2, while the remaining section of approximately 20 km^2 is covered by indigenous forest. The forest is also the source of the Molo River which flows down and drains its waters into Lake Baringo.

Some of the species include antelopes, rabbits, monkeys, bush bucks, antelopes, monkeys, baboons, bushpigs, snakes, rats, frogs and crane birds.

5.3 Socio – Economic Environment

5.3.1 Project Administrative Location

The project area is located in Sachangwan division, Molo Ward, Molo sub-county, Nakuru County. It is accessed from the Nakuru– Mau Summit Highway at coordinates 0o12'48.73''; 35o46'56.85'' the site is situated 680m south west of Sachangwan centre and 1.28km south east of Koibatek forest,

5.3.2 Population and Demography

The population of Molo Sub-county is 156,732 according to the 2019 KNBS data. The male population totals 78,129 while females are 75,598. Further the project is located in Sachangwan location which predominantly inhabited by the Kalenjin community. Other tribes inhabiting the area in smaller numbers are

kikuyu and Kisii communities. The Table 5-7 below shows the population projections for Sachangwan ward.

Table 5-7: Population projections in the project area

Sublocation	2019	2020	2021	2022	2023	2024	2025
Sachangwan Location	7877	8057	8240	8428	8621	8817	9019

The area is mainly inhabited by three ethnic communities namely Kisii, Kikuyu and Kalenjin. The larger Sachangwan location is predominantly inhabited by the Kalenjin and Kisii, Mukinyai by the Kikuyu community while Kabianga is largely cosmopolitan.

5.3.3 Land use

The project site is an existing quarry. The predominant land use in the project area is rain fed crop cultivation and settlements. Other land uses are tree farming, mining, bee keeping, quarrying and small business activities within Sachangwan centre.

5.3.4 Education and Literacy

Nakuru County has seen a steady increase in the number of schools. As of 2018, the county had 1089 primary schools and 408 secondary schools. The introduction of Free Primary Education has also led to pressure on the existing facilities in these institutions. Currently, according to Kenya Integrated Household Budget Survey (KIHBS, 2005/06), the literacy levels in the county stand at 79.7% with the high literacy levels attributable to Free Primary Education and promotion of adult continuous education. The county's Teacher to Pupil Ratio is 1: 49 for public primary schools and 1:36 for public secondary schools. The area has four learning institutions that are in located within 1km radius of the project site namely; Nguzu River Primary School, Sachangwan Secondary School, Mukinyai Secondary School and Kogo Junior Academy.

5.3.5 Poverty

Nationally, poverty is defined as the inability to meet basic needs associated with features such as lack of land, unemployment, inability to feed oneself and one's family, lack of proper housing, poor health and inability to educate children and pay medical bills. The project is located in Sachangwan ward, Molo sub county, Nakuru county Kenya where economic growth and development is mainly driven by agriculture. The percentage of people living below the poverty line is 18.1% compared to the national percentage of 36.1%. it contributes 0.009% to the national poverty. The area receives good annual amount of rainfall that facilitates good yields.

According to KNBS data 2019, Molo sub county is one of the places in Nakuru county with high land potential in terms of agricultural productivity and is at the top in terms of licensed businesses especially whole sale and retail trade in Nakuru county. The poverty level of the area is therefore average as evidenced by farming practiced by the locals who grow maize, beans, bananas and vegetables. Additionally, there are small businesses carried out by the locals in Sachangwan center. The area is well served with KPLC and has good infrastructure. However, there is a reasonable proportion of youths in the area who are unemployed. The poverty level in the county can be attributed to unemployment, an increasing dependency ratio, poor marketing linkages for agricultural products, lack of affordable credit facilities for farmers and high costs of farm inputs.

5.3.6 Gender

According to the 2019 Census by KNBS the total population of Molo sub-county was 156,732. The male population is 78,129 while the female population is 75,598. In a study conducted by Lahiri – Dutt (2007) women often joined the informal mining sector as an alternative source of livelihood to subsistence agriculture to improve their income levels. Despite consistent efforts to ensure that gender disparities are alleviated, discrimination and gender disparity are still experienced in the mining and especially within stone quarrying sites.

A policy document by the ministry of mining (GoK, 2016) states that gender disparity is often escalated in the extractive sector and women who are increasingly taking part in the sector are often disadvantaged when it comes to decision making, control over resources and limited practical knowledge.

5.3.7 Infrastructure

The quarry has some basic infrastructural facilities to support the operations. These include electricity by the Kenya Power and Lighting company, health facilities namely Oasis medical centre, Highway hospital and Sachangwan dispensary. Sewer is managed by use of septic tanks, and pit latrines. Other infrastructural facilities include Mau – Summit Road and mobile network infrastructure. The mobile networks available are Safaricom and Airtel.

5.3.8 Waste management

The project area is a typical rural area. Waste is predominantly managed by the individual owners through open pits where waste is burned or decomposed for use in the farms. Effluent is mainly managed by pit latrines and septic tanks. Within the project site solid waste is managed by open pits where waste is dumped and burned while fecal waste is managed by pit latrines

Plate 5-8: Pit latrines on site for managing fecal waste

Plate 5-9: Solid waste receptacles on site

5.3.9 Economic Activities

The main economic activities are small scale crop cultivation, livestock keeping and small scale businesses along the Mau Summit Road and Sachangwan centre. The main crops cultivated include maize, bananas and vegetables. The main livestock kept are cows, goats and sheep. Poultry farming is also carried out in small scale. Mining is also a major economic activity in the area. Several stone quarries are in the area and employ a large number of residents. The mines are both privately owned and aare commercial. These contribute significantly to the economy of the area. Despite several unfortunate events including drowning

and collapse of the mines, the sector continues to thrive employing more and more locals within the area especially in Mukinyai location.

Plate 5-10: Banana crop farming within the project area

Plate 5-11: Livestock keeping – an economic activity in the area

5.3.10 Health

Molo Sub County has a total of 25 health facilities with 13 public hospitals, 5 Faith Based Organizations and 7 private hospitals. There are 3 health facilities that are in close proximity to the site namely; Sachangwan dispensary which is a government facility, Oasis and Highway Health centers which are privately owned. The most common illnesses in the area are Upper Respiratory Tract Infections, Malaria, Typhoid and Flu.

The climatic conditions of the area have had a big impact on the rising cases of malaria infections. Over the past five years, Nakuru county has reported 46,012 cases of malaria infections. The number of Upper Respiratory Tract Infections cases reported in the county is also at an all-time high. There have been 216,944 cases of URTI reported all over Nakuru County according to the DHIS report published in 2016. This numbers are as a result of the ever-increasing investment in quarry and mining industry in the county.

5.3.11 Income and Employment

Majority of the people living in Sachangwan location are living below the poverty line. The main source of income in the area is from agriculture and quarrying. A big percentage of the area locals earn a living off selling their farm produce and livestock. A notable amount of the youth in the area are also investing in their artisanry skills. Nakuru county has a 31% youth unemployment rate according to the KIBHS report 2015-16.

5.3.12 Water supply and Sanitation

The project area is served by Nakuru Rural Water and Sanitation Company. The residents dispose human waste through pit latrines which are covered. however, the number of households with hand washing facilities near the toilet facilities are very few hence there is risk for outbreak of diseases. The project area is one of those that have been declared Open Defecation Free by the county although due to population increase there are still cases of poor human waste disposal.

5.3.13 HIV/ AIDS

The HIV prevalence in Nakuru County is lower than the national prevalence at 4.1%. Nakuru county is ranked ninth nationally based on the prevalence rate. Molo sub county has the second highest prevalence rate in the county, which currently stands at 4.8% according to the DHIS report. The high prevalence rate

can be attributed to the high number of population and the growth of town centers within the sub county. Salgaa is one of the HIV/AIDS hotspots due to the high number of truck drivers who pass through this center.

5.3.14 Tourism and recreation

Approximately 4km from the project site is Koibatek forest that harbors a variety of bird species and wildlife that attract tourists. However, today the forest is exposed to threats such conversion to agriculture, illegal logging and poaching. Examples of birds found in the forest are Red-chested Owlet (*Glaucidium tephronotum*) and Mountain Buzzard (*Buteo oreophilus*). However, their occurrence is low due to increased human activities within the forest.

5.3.15 Settlement patterns

The quarry is located in a rural area where agriculture is the primary rconomic activity. Settlements are scattered but predominantly clustered around the shopping centres namely Sachangwan, Kibunja and Salgaa. The majority of households in the area have durable roofing materials with majorly corrugated iron sheet while wall materials are mainly earth, stones and wood.

5.3.16 Archeology and Cultural Heritage

An archaeological and cultural heritage assessment has evaluated the quarry taking into consideration the state of the site and possible archaeological materials. The site is an existing quarry site that is still active. The site is within the western shoulder of the rift and is entirely covered by volcanic rocks together with lacustrine and fluviatile sediments derived from them (Jennings 1971). A survey of possible heritage materials within the quarried area and the back slope was done and it was established that the site has no archeological bearing rocks or materials.

Plate 3: Erosional outcrops at the back slopes of the Sachangwan quarry,

Caution should, however, be taken to ensure that any archaeological chance finds are well handled. The complete Archaeological and Cultural Heritage Assessment Report is attached in Annex 9.

5.3.17 Similar Developments

There are many other quarries within the project area namely Mukinyai quarries in Mukinyai location and Koibatek forest quarry. The Mukinyai quarries are located 2.96km from the Sachangwan quarry, 300m from the banks of Molo River and 0.88km from Mukinyai Primary School while the Koibatek forest quarry is located 7km from the site. The table below shows the location of the Mukinyai quarries.

Figure 5-9: Google Earth image showing the location of quarries in Mukinyai

Plate 5-12: Abandoned quarry in Mukinyai

6 ANALYSIS OF ALTERNATIVES

6.1 No project Alternative

This alternative maintains the status quo and ensures that the site conditions are maintained as they are. It is the most preferred option from an extreme environmental perspective. It ensures that there is no interference with the environment although it foregoes all the socio-economic benefits anticipated from the project. This alternative does not meet the objective of the project and therefore the project's objective shall not be achieved.

6.2 Alternative Methods of extraction

The proposed method of mining is open cast mining using blasting. Blasting involves drilling of holes that are charged using explosives and ignited to break the stones into required aggregates. This technology allows aggregates of different sizes to be obtained during the blast. It is efficient and less time consuming and more effective and efficient for largescale material extraction. The alternative is to use wedging or heating methods for material extraction. Wedging process involves drilling a row of holes, either by hand or by pneumatic drill, close to each other to create a longitudinal crevice. This process is time consuming and unsuitable for large scale mining. Heating however involves application of a thermal effect to induce rock fracturing and is also less efficient in large scale mining. Considering the large volume of aggregates required by the proponent for construction of the Mau Summit Rironi highway this method will be less effective, too expensive and time consuming.

6.3 Alternative Waste Management Technology

The three primary objectives of wastewater treatment are: (i) to prevent the spreading of diseases, (ii) to reduce discharge of nutrients and other pollutants to the environment and, (iii) to facilitate the recirculation of nutrients.

The principle of Best Available Technology (BAT) means that an adjustment should be made between environmental protection and management of natural resources on one hand, and economical and practical considerations on the other hand. BAT principles include reliability, economy, user aspects, flexibility and responsibility and control.

Alternative 1: Use of Biodigester

Biodigester septic tank (anaerobic digester or mechanization) can be defined as the process of fermentation to break down organic matter from animals, plants or sewage to produce biogas. It can also be defined as the breakdown of organic waste matter into carbon dioxide, methane and water. The bacteria in the tank feed on the organic wastewater and the dark water as they come in. As a result, they become water and gas. The effluent takes about 2 weeks to decompose. The process normally takes place within a centralized system in a unit called an anaerobic digester, also known as a biogas reactor or a biodigester. The advantage is that it is renewable source of energy– biogas produced by digesters can be used to produce vehicle fuels generate electricity, provide on-site natural gas replacement, or be injected into the utility pipeline. It also helps in reduction of Greenhouse Gas (GHG) through employing manure digesters, the methane is captured to produce renewable energy instead of venting into the atmosphere.

The biodigester option may not be feasible since the consistent quantity of organic materials needed to continually run the biodigester from feacal matter and food waste may not be available. Each day, the bio-digester effluent needs to be removed from the effluent tank which can be time consuming as well as being

labour intensive. Additionally, the cost of installing the biodigester may be a limiting factor for the short project life cycle of 3 years.

Alternative 2: Use of a Septic Tank

The proponent intends to use septic tank to dispose the feacal waste. A septic tank is an underground sedimentation tank used for wastewater treatment through the process of biological decomposition and drainage. The tank is watertight container (mostly rectangular or round) made of fibre glass, plastic or concrete. It makes use of natural processes and proven technology to treat wastewater from household plumbing produced by bathrooms, kitchen drains, and laundry.

The tank works by letting waste to separate into three layers namely scum, solids and effluent. The scum, composed of waste that is lighter than water, floats on top while the solids settle to the bottom, where microorganisms decompose them. The middle layer of effluent exits the tank and travels through underground perforated pipes into the drainage field. Finally, gravel and soil act as biological filters to purify the wastewater as it sinks into the ground.

Based on how the septic tank operates, the use of the tank is the most ideal option for the client mostly because of its affordability and the life span of the project. Additionally, the ease of installation outweighs its disadvantages.

Alternative 3: Connecting to the Municipal Sewer System

The proposed quarry is located within Sachangwan area, a typical rural area which is not served by a sewer line. Most households in the neighborhood of the proposed site use *in-situ* methods to manage their liquid wastes. The most common method of effluent management is use of pit latrines and in a few cases septic tanks and soak pits which has been proposed by the proponent.

6.4 Alternative design

The proponent proposes install all the facilities required for stone processing and asphalt plant on one site which is considered more efficient and cost effective. It will also save the time taken to transport material between different sites. The alternative involves installation of the facilities including the stone crushing unit, the asphalt plant the mixing plant in different locations. This will be less efficient and expensive since several trips will be made between the different locations. It will also be time consuming and may increase the implementation time of the project.

6.5 Alternative sites

Several sites have been considered within Sachangwan. The alternative sites in Mukinyai location have been extensively exploited and are mainly used as commercial quarry. The other site considered is located in Koibatek Forest which is an environmentally sensitive area. The sites were also evaluated for the quality of material present, and the Sachangwan Quarry had the most ideal quality of aggregates. The proximity of the site to the Mau Summit – Nairobi (A8) makes it easy to access the site and reduces the overall cost of transportation of material to the construction sites on the road.

7 CONSULTATIVE PUBLIC PARTICIPATION

Stakeholder consultations were done to capture public views on the expansion of the quarry. This was done in two phases, the first phase involved interviews with the key informants within the project area which included officials from government agencies and the county government. The second phase of the consultations comprised consultation with the general public. These included public consultative meetings, focused group discussions, individual interviews and administration of questionnaires.

7.1 Objectives of Stakeholder Engagement

The objectives of engaging stakeholders and the community during the ESIA process include:

- Disseminate and inform the stakeholders about the project while ensuring understanding
- Gather comments, suggestions and concerns of stakeholders on considerations during both construction and operation phases of the project
- Building Relationships: through supporting open dialogue, engagements help establish and/ or maintain a productive relationship between the Project and stakeholders.
- Engaging Vulnerable People
- Managing Expectations
- Ensuring Compliance: the process is designed to support compliance with Kenyan regulatory requirements and international best practice.

7.2 Approach to stakeholder Engagement

7.2.1 Initial contacts

This was the first phase of the project and largely involved establishing contacts for subsequent stakeholder engagements. It also involved identification and mapping of the stakeholders for the project.

7.2.2 Key informant Interviews

This involved interactions, in depth interviews and discussions with the regional administration (Assistant County Commissioner, Deputy County commissioner and the chiefs), County government and Government departmental heads representatives. Interactions during this phase were used to share information on the quarry project, solicit opinions, provide recommendations, identify other stakeholders and mobilize them for detailed participation meetings during the second phase of consultations.

7.2.3 Public consultation meetings

This phase involved mobilization and consultative meetings with persons, agencies and organizations operating and/or residing around the quarry site. Due to covid protocol one meeting was held at the Assistant County Commissioner office premises and participants included:

- The regional administration e.g., the District County Commissioner and the Assistant County commissioner and the chiefs and other government representatives
- The County Government
- Representatives of various institutions
- Members of the community residing or operating around the project area and its environs including opinion leaders, farmers, transporters and business persons.

These consultative participatory meetings were avenues for sensitization of the public on environmental guidelines stipulated under the EMCA 1999, the proposed quarrying activities as well as anticipated impacts during establishment and operation. At the meetings, comments and concerns from the grassroot stakeholders notably communities living around the project site, were solicited and where possible addressed.

In general, the consultative participatory meetings provided views, opinions and suggestions on the most appropriate considerations on the establishment and use of the quarry. The sessions also generated fears and concerns to be addressed during operation.

7.3 Outcome of the Interviews

7.3.1 Local Administration

The project is a necessary auxiliary infrastructure of the project. However, impacts of the project should be mitigated appropriately. The most important impacts are noise and vibration impacts and air pollution in the form of dust. An appropriate grievance redress mechanism to handle conflicts arising between the contractor and the residents should be instituted. Further miscellaneous provisions for vibration impacts on houses should also be made.

7.3.2 Molo Sub - county Department of Environment

Several quarries exist within the area. The quarries are mostly commercial and some of the quarry sites are privately owned. The most common impacts of the quarry sites include land degradation and scarring of the landscape. Changes in aesthetics of the area are an element of concern especially for sites left unrehabilitated. Several cases of people drowning in ponded quarry pits were cited therefore community health and safety should be prioritized during implementation of the project.

Application for the noise and vibration control permits for the quarry should be promptly applied for especially for the blasting works anticipated at the quarry. Liaison with the County department of Environment should be an integral part of the project to ensure that emerging issues are handled effectively and promptly.

7.3.3 Kenya Forest Service

The vegetation of the project area should be profiled. The information should be well documented and used during revegetation of the site after completion of quarrying activities. In the event that there are indigenous species within the site, as far as practically possible these should be conserved by the project proponent. Mature species indigenous to the area should be replanted to the site. Construction machinery often serve as channels for transfer of invasive species and therefore periodic monitoring of the site for invasive species should be carried out to detect earlier cases of colonizing on the site and appropriate mitigation measures instituted.

7.3.4 Kenya Wildlife Service – Community Warden Molo

The project is not expected to have significant impacts on the wildlife withing the project area. However, blasting may scare the Columbus monkeys in the adjacent forested land. Monkeys are adaptable and there is growing evidence that disturbance of wildlife habitats can result in migration and alteration of the breeding cycles. Psychological trauma from vibrations caused by blasting may also be experienced. Nonetheless since blasting is a highly intermittent activity the impacts will be significantly low.

7.3.5 Kogo Primary School

The quarry has existed for a while and the main impact of the project is occasional noise to the school during blasting. These are however occasional and last a few hours. Health and safety concerns for the students has also been an issue of concern. However, measures such as changing the route that the kids use while commuting to and from schools has helped to alleviate some of the concerns. Intense counselling of the kids on substance and drug abuse by the teachers and parents has reduced cases of drug and substance abuse. However, it was noted that the school had very young children and cases of substance abuse may not be prevalent among the students.

7.3.6 Sachangwan secondary school

Sachangwan secondary school is located approximately 900metres from the project site. The school is headed by the principal, Mr. Benard Lanem (0722794101). The school benefits from the quarry site in terms of building materials such as ballast and quarry dust that it uses in the ongoing construction of more classrooms.

Due to the location of the school from the project site, the negative effects are not intense because of the distance. Some of the impacts such as noise and vibrations produced during blasting disrupt learning in the school however, the school acknowledged that they are always informed prior whenever blasting is to take place. Drug and substance abuse in the school especially alcohol and bhang is common and rises especially during quarry operation period

7.3.7 Oasis Medical Clinic and Sachangwan Highway Medical Centre

The previous quarry operations did not affect the operations of the two health centres within the project area.

7.3.8 Nguzu River Primary School

Nguzu River Primary School is located approximately 700m from the Quarry. Some of the impacts of the project include noise and excessive vibration from blasting which could be felt within the school. Other impacts included drop out cases of students to take up work at the quarry. Impacts occasioned by dust were not substantial and could be attributed to the distance from the school to the quarry and the vegetation buffer provided by the trees used for fencing the school compound.

7.4 Outcome of the Public Meeting

In accordance to the EMCA requirements, consultations should be done with local stakeholders through means that induce broad public participation to a reasonable extent so as to take into consideration the environmental and social factors in a way that is most suitable to local situations. The public participation meeting was conducted in Sachangwan at the Assistant County Commissioners Sachangwan division office premises. The local administration i.e., the chiefs and the village elders mobilized the residents and people operating within the vicinity of the project site. The topics covered during the public meeting included the design of the quarry including description of the infrastructure, project implementation plan, positive impacts, fears and concerns, HIV and AIDS / STIs and COVID 19. The forum was a major avenue for the community to propose measures to be implemented during the operation phase. Although the quarry had existed previously recommendations were also sought on measures to enhance the project benefits to the community.

Due to COVID prevention protocol, the number of people attending the meeting was limited. The public consultative meetings were attended by a total of 115 participants composed of 72 (62.6%) males and 46 (37.4%) females. The attendance list and the minutes detailing the proceedings of the meeting are attached

in Annex 1. The meetings were held under trees and supplemented by tents as portrayed in the sample photos below.

Plate 7-1: Sachangwan division ACC addressing participants

Plate 7-2: A member during plenary session

Plate 7-3: Client representative addressing the participants

Plate 7-4: ESIA team leader addressing the participants

Plate 7-5: Questionnaire respondence

Plate 7-6: Participants at the public meeting

7.4.1 Positive Impacts as perceived by the community

- The project will create employment for the local people
- Source of income
- Women empowerment
- Additional source of water after decommissioning from the borehole that is to be constructed at the site
- Skills transfer
- Growth of the economy

7.4.2 Negative Impacts As perceived by the community

- Noise and vibrations
- Dust/air pollution
- Health and safety risks especially to the children and the elderly
- Vegetation loss
- Water pollution
- Death of livestock especially goats as a result of vibrations and grazing from contaminated fields
- Possible miscarriages due to vibrations from blasting
- Spread of HIV/AIDS
- Potential for Substance abuse
- Potential for Child labour cases

7.4.3 Fears and concerns

Issue	**Concerns**
Air pollution	The members present raised a question on how dust and smoke from the quarry will be managed so as to minimize effects
Noise pollution	A question was raised on how noise and vibrations from blasting will be controlled.
Health and safety	There were concerns raised on health and safety on the community that included fencing of the quarry and compensations in case of accidents and injuries.
Project induced conflicts	The public inquired if there was a grievance redress mechanism in place for handling conflicts during the project period.
Employment	The members raised a concern on whether they will be made aware of the employment dates and preferrable locals be considered first before others.

Feeder roads	The members inquired whether the project will improve feeder road in the area
Duration	The members inquired of the project start date and duration.
Recommendation letters	The members inquired whether recommendation letters will be given to the workers at completion of the project

7.4.4 Recommendations and suggestions

The following recommendations were proposed at the public meeting;

- It is anticipated that a substantial number of unskilled work force shall be drawn from the local population. The locals should be made aware of employment dates earlier so that they can tender their applications in time for considerations. It was proposed that the contractor should put up announcement on where the recruitment will be undertaken to eliminate biasness in recruitment as previously witnessed when recruitment was done through the local administration. Consideration of women during recruitments was recommended.
- The project site should be fully fenced and manned by security to minimize accidents and injuries especially to the children and the elderly. The project site is currently a grazing field for animals and so fencing during operation will help create boundaries preventing the animals from entering hence avoiding accidents and injuries.
- The use of improved technology that reduces noise and vibrations caused during blasting and crushing. Such effects cause disruption of learning in the nearby schools and also disrupt local business operations. Women who complained of alleged miscarriages due to vibrations supported the suggestion of improved technology. In addition, there should be awareness creation to the community prior to blasting.
- The use of water to minimize dust generated from quarry operations should be encouraged. The dust affects nearby residential homes and also contaminates animals' feeds leading to death.
- Families who may be displaced because of the project should be compensated and relocated. Those who shall get accidents and injuries related to the project, those whose houses may crack or collapse due to blasting from the quarry should also be compensated.
- The public suggested that public consultation meetings should be done frequently so that they get a platform to air their concerns and suggestions regarding the project. In such forums, the project owners also get an opportunity to listen to the public and address their concerns accordingly.
- Recommendation letters should be given to the workers of the project at completion. This helps the individuals to increase their chances of employment in similar projects in other different locations countrywide.
- The channels of communication at project implementation should be clearly communicated to allow the locals to notify the contractor of their concerns and grievances to allow for effective and efficient resolution.

7.5 Outcome of questionnaire Analysis

Questionnaires were also administered to ensure that consultation was exhaustive and the main findings and feedback tabulated as shown below while sample questionnaires are attached in Annex 5.

Table 7-1: Outcome of questionnaire analysis

Positive impacts	Negative impacts	Mitigation measures	Unique considerations
• Employment creation • Source of income • Women empowerment • Additional source of water after decommissioning from the borehole that is to be constructed at the site • Skills transfer • Growth of the economy	• Noise and vibrations • Dust/air pollution • Health and safety risks especially children and the elderly • Vegetation clearance • Water pollution • Atmospheric pollution hence contaminated rain water • Death of animals especially goats as a result of vibrations and grazing from contaminated fields • Alleged miscarriages due to vibrations as a result of blasting • Spread of HIV/AIDS	• Fencing of the project site for protection • Use of water to minimize dust • Use of improved technology to reduce noise and vibrations during blasting	• Prior site assessment • Identification of a damp site • Supply of water to the community • Quarry fencing • Frequent public consultations • Employment of the locals

7.5.1 Positive impacts as perceived by the Respondents

The respondents raised positive outcomes anticipated from the proposed quarry project through questionnaires which were later analyzed in excel and presented in the Figure 7-1 below. Approximately 60% of the respondents anticipated that the project would provide employment to the local population while 15% of the respondents expected that the income earned would stimulate and grow the local economy Other positive impacts raised were skills transfer and infrastructure development. The figure 7-1 below shows an analysis of the positive impacts as perceived by the respondents

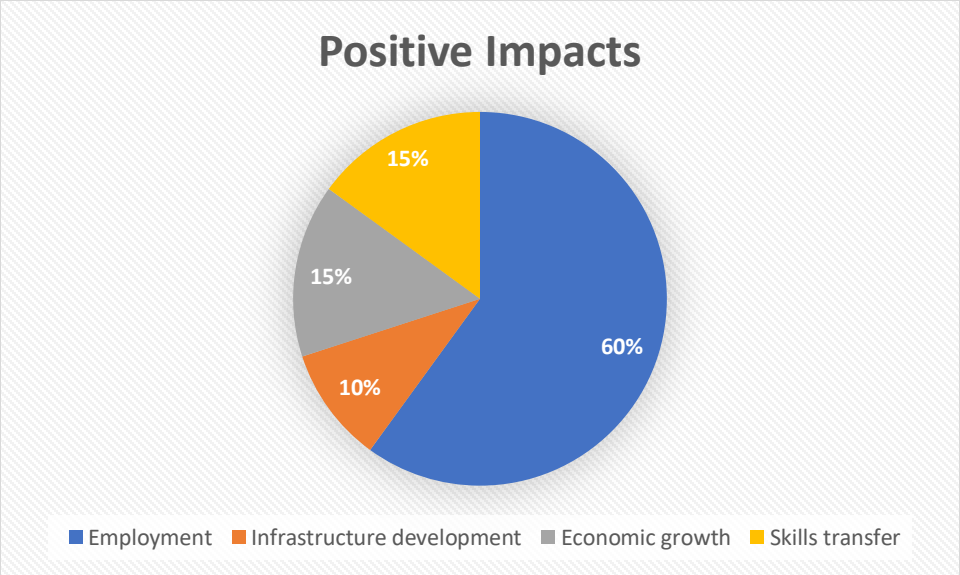


Figure 7-1: Positive impacts as perceived by respondents

7.5.2 Negative impacts as perceived by the respondents

Questionnaire analysis was done in excel and the results presented in Figure 7-2 as shown below. The most expected negative impacts from the proposed quarry were possibility of houses cracking, air pollution and noise and excessive vibration. Approximately 58% of the respondents anticipate that excessive vibrations from blasting may cause cracks on houses while 85% anticipate air pollution in the form of dust from the operations of the quarry which may have adverse effects on the health of residents and the local community. Other negative impacts raised were alteration of topography, miscarriages and spread of HIV/AIDS.

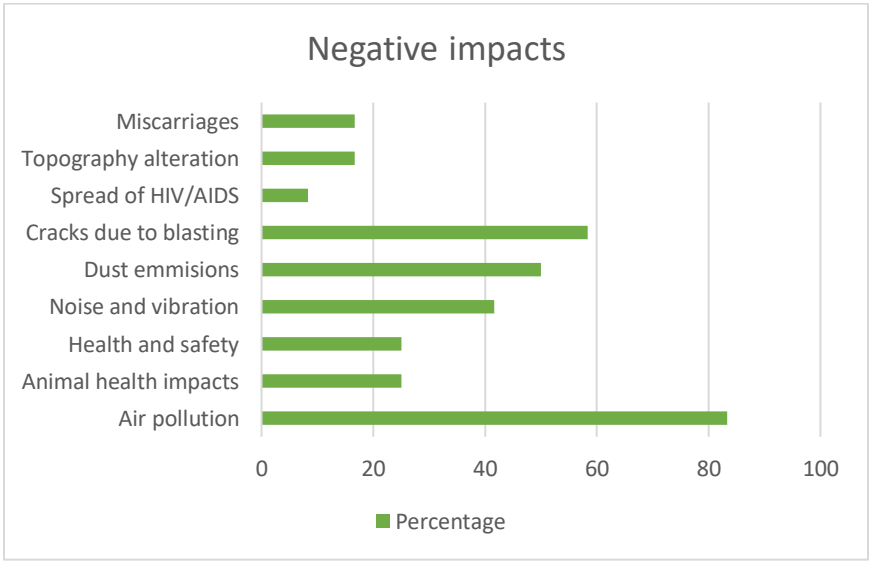


Figure 7-2: Negative impacts as perceived by respondents

7.5.3 Mitigation measures as proposed by the respondents

The public proposed a number of mitigation measures for the negative impacts raised through the questionnaires. Analysis was done in excel and the results presented in the chart below. Approximately 25% of the respondents proposed the residents should be made aware of impending blasting while using explosives with less vibrations. Other measures proposed include; installation of warning signs to prevent accidents, compensation of affected community members and good waste management practices. The Figure 7-3 below shows an analysis of the mitigation measures proposed by the respondents

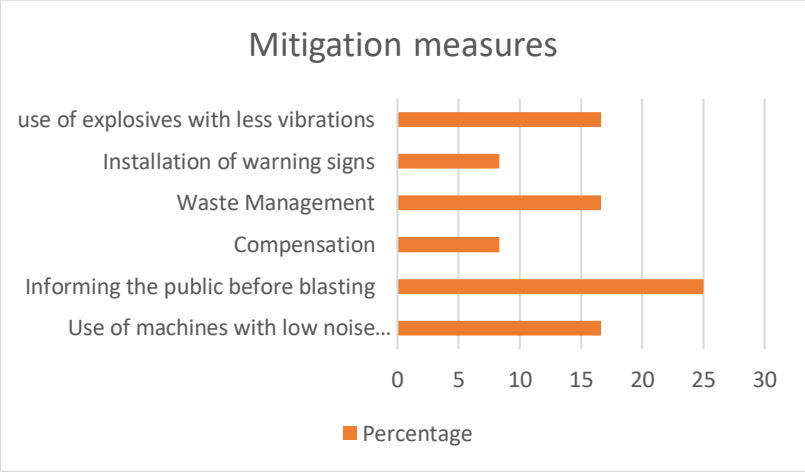


Figure 7-3: Mitigation measures as proposed by respondents

7.5.4 Unique considerations prior to project commencement

The public also suggested considerations they would wish to be undertaken during the project. The responses provided in the questionnaires were analyzed in excel and the results presented in Figure 7-4 below. Most members proposed that the quarry should be fenced to avoid accidents. They also asked for consideration of locals first during employment and frequent public participation. Other unique considerations were identification of a suitable dumpsite and community water supply.

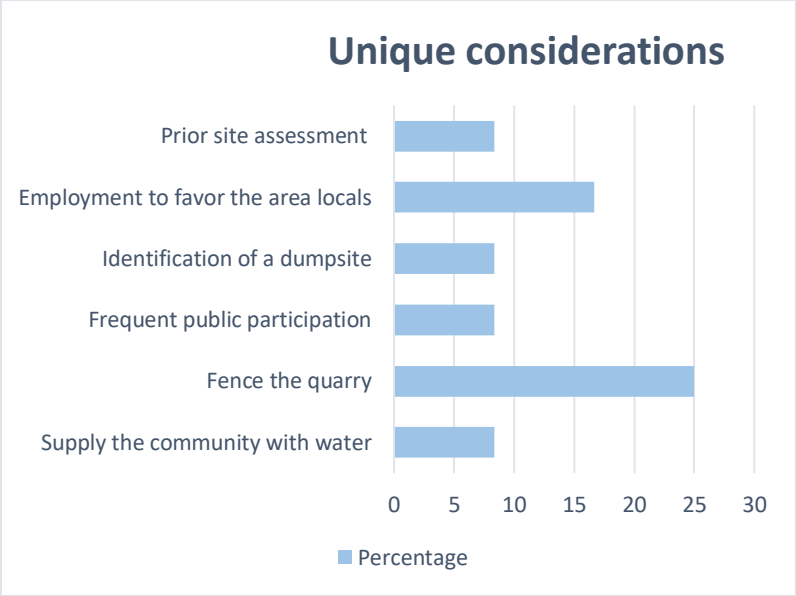


Figure 7-4: Unique considerations prior to project commencement

8 ANALYSIS OF ENVIRONMENTAL AND SOCIAL IMPACTS

8.1 Definition and classification of impacts

An impact in this context refers to any change that is likely to cause change in the environmental or socio – economic setting. The impacts can be either negative or positive. The impacts may also be direct or indirect, localized, dispersed or cumulative if they add to the already existing impacts. They may also occur immediately or may be delayed in their timing. Another description used is if the impacts are permanent in their persistence or temporary. The impacts are also described using the phase that they occur in i.e., planning, operation or construction. In this study the Leopold matrix was used for the evaluation of the impacts.

8.2 The Leopold matrix

A matrix is a grid that is used to identify the interaction between project activities, which are displayed along one axis, and environmental characteristics, which are displayed along the other axis. For the identification of impacts, a breakdown of the environment into elements or factors that may be affected and a breakdown of the various actions or activities of the project under study will be done.

8.3 Impact identification and evaluation

The Leopold matrix is an effective method of predicting impacts quantitatively. Quantification means using numbers to indicate the impact. It is helpful in presenting information in summary form to give readers an overview of the impact characteristics of the Project and the alternatives to it.

Once the list of impacts or changes on the different elements of the medium has been established, they are characterized using the following features and criteria:

- Sign (Nature)
- Type
- Intensity.
- Extension.
- Time.
- Reversibility
- Recoverability
- Persistence.

The following is a description and the meanings of the terms used;

1) **Sign/Nature:** Alludes to either the beneficial (**+**), or adverse (**-**) nature

2) **Intensity:** Refers to the degree of impact on the factor, in the specific area in which it operates. Ranked from 1 to 3, as major (MAJ=3), medium (MED=2) and minor (MIN=1). The 3 expressed an almost total destruction of the factor in the area in which the effect occurs.

3) **Extension/Location:** An area of influence covered by the impact in relation to the project environment. In this sense, if the action produces a much-localized effect within the space, it is considered that the impact is low and ranked (1). If, however, the effect goes beyond a precise location within the project environment, having a pervasive influence on all of the area or even beyond, the impact will be large (3). Intermediate situations are considered as partial (2).

4) **Timing:** Refers to the time lag between the onset of action and effect on the appearance of the corresponding factor. We consider three categories according to the time period (zero, up to 2 years, or more than two years), which are called respectively as immediately (3), medium term (2), and long term (1).

5) **Duration/ Persistence:** Refers to the time or persistence of the effect, from the onset of the action in question. Two situations are considered, depending on whether the action produces a temporary effect (1) or permanent (3). It is therefore as generic characterization because spaces are not discrete time course associated with these categories and because in any case it is very difficult to discern on a temporary or permanent effect.

6) **Reversibility:** It refers to the possibility of reconstructing the initial conditions once the effect has occurred. Can be characterized as short-term (1), medium term (3) and impossible (4).

7) **Recoverability:** It refers to the possibility of providing or not the corrective measures to avoid or minimize impact. Recoverability of positive impacts are not presented.

Table 8-1: Impact Evaluation and Rating

EVALUATION PARAMETER	RATING	RATING
Nature of impact (NI)	-Positive -Negative -Uncertain	+ - -/+
Intensity (IT)	-Major -Medium Minor	3 2 1
Extent (EXT)	-Dispersed -Medium -Localized	3 2 1
Timing (TM)	-Immediate -Medium -Delayed, long term	1 2 3

Reversibility (R)	-Short term, easily reversible -Long term, partially reversible -Not reversible	1 2 3
Persistence (P)	-Temporary effect -Permanent effect	1 3
Type of impact (TI)	-Direct -Indirect -Cumulative	3 2 1
Phase	-O -C	Operational period Construction period

Impact indicators

The Magnitude or Importance impact represents the entity or significance of the effect, includes the degree of incidence and the "form" of that effect, represented by other attributes. Its value is clear from taking the attributes described by the following formula:

Imp = Sign (3Iij + 2Eij +TMij + Pij + Rij),

Where:

Imp: Importance of the impact generated by the action on the project i j element of the medium

Ii: Intensity of the impact generated by the action on the project i j element of the medium.

Ei: Extent of the impact generated by the action on the project i j element of the medium.

TMi: Timing, the moment of impact generated by the action on the project i j element of the medium.

Pi: persistence of effect, from the onset of the action in question.

Ri: Possibility of reversibility.

Table 8-1 and 8-2 presents the scores of each environmental item as obtained from the formula.

Table 8-2: Impact Scoring Matrix

Topic	Element	Action	Impacts	NI	TI	EX	IT	R	TM	P	Phase	MG
Air Quality	*Air pollution*	*Civil works, stone crushing and asphalt plant operations*	Particulate matter emissions and exhaust fumes during works on sensitive receptors		3	2	3	1	1	1	C/O	16
Noise and Vibrations	*Excessive vibration above ambient*	*Rock blasting and stone crushing*	Excessive noise and vibration on sensitive receptors		3	2	3	1	1	1	C/O	16
Occupational Health Safety	Diseases, accidents and injuries	*Blasting and civil and general works*	Accidents, injury and exposure to diseases for workers		3	1	3	2	1	1	C/O	15
	Drugs and Substances abuse	*Civil works and Quarry operations*	Drugs and substance abuse among workers		2	1	1	1	2	1	C/O	9
Property	*Settlements*	*Rock Blasting*	Property damage associated with blasting		2	2	2	2	1	1	O	14
Land degradation and Aesthetics	*Landscape*	*Quarrying operations*	Change of visual impacts (landscape scarring) and slope alteration		1	1	2	2	1	1	O	12
Water resources	*Water quality*	*Civil works and quarrying operations*	Water pollution from sediment transport/ Handling of hazardous materials		2	3	1	1	2	1	C/O	13
		Blasting	Ground water pollution from accidental removal of aquifer casing		2	2	2	2	1	1	O	14
	Water quantity	*Civil works and quarrying operations*	Strain on existing supply		2	3	1	1	2	1	C/O	13

		Blasting	Impact on flow regimes of surface water sources		2	2	1	2	3	1	O	13
Land	*Land ownership*	*Whole site*	Conflicts between the land owners and the local community		2	1	2	1	1	1	C/O	11
Communicable Diseases	Diseases	*Civil works and quarrying operations*	Spread of HIV/AIDS and STIs among workers and the local community		2	1	1	2	2	2	C/O	11
	Diseases	*Civil works and quarrying operations*	Spread of COVID 19 among workers and the local community		2	3	1	1	2	1	C/O	13
Soil Resources	*Soil pollution*	*Civil works and quarrying operations*	Handling of hazardous materials		2	1	2	2	1	1	C/O	12
	Soil Erosion	*Civil works and quarrying operations*	Exposure to erosion agents		1	1	2	2	1	1	C/O	12
	Soil Physical properties	*Civil works and quarrying operations*	Loss of top soil hence alterations of soil profile		1	1	2	2	1	1	C/O	12
Fauna	*Loss of biodiversity*	*Location infrastructure requirements and quarrying*	Likely effect on number, diversity, breeding and eating habits		1	2	1	2	2	1	C/O	12
	Habitat disturbance	*Project footprint*	Consider extent of vegetation clearance required		1	1	1	1	3	1	C/O	10
Vegetation	*Trees, Grassland & bushes*	*Clearance of vegetation*	Vegetation loss from clearance of vegetation cover		1	1	2	2	1	1	C/O	12
Waste management	*Solid and liquid waste*	*Waste generation and handling*	Reduction in aesthetics and exposure to injury and poisoning		3	1	2	1	1	1	C/O	11

	Earth spoil	*Handling*	Reduction in aesthetics from earthspoil handling		1	1	2	1	1	1	C/O	11
Public Health and Safety	*Disease, accidents and injuries*	*Civil works and quarrying operations*	Accidents, injury and exposure to diseases for the public		2	1	2	1	2	1	C/O	12
Land - use	*Grazing*	*Civil works and quarrying operations*	Change of land use of part of the site from pasture to quarry site		3	1	1	1	2	1	C/O	9
	Farmland	*Civil works and quarrying operations*	Reduced agricultural yield due to loss of productive top soil		2	1	1	2	1	1	C/O	9

The impacts were rated as follows

High	≤ 16
Medium	15-13
Low	12-10
Insignificant	≤ 10

Table 8-3: Summary of Environmental Impacts

Impact Rating	**Topic**	**Impacts**
HIGH	***Air Quality***	Dust and/or smoke generation during works on sensitive receptors
	Noise and Vibrations	Excessive noise and vibration on sensitive receptors
	Community Health Safety and security	Accidents, injury and exposure to diseases for the local community
MEDIUM	**Property**	Property damage associated with blasting
	Land	land degradation and scarring of landscape
	Drugs and Substances	Drugs and substance abuse among workers and local community
	Water resources	Water pollution from sediment transport/ Handling of hazardous materials
	Water resources	Strain on existing supply during construction
	Land	Conflicts between the land owners and the local community
	Covid	Spread of COVID 19 among workers and the local community
	Water resources	Ground water pollution from accidental removal of aquifer casing
	Water resources	Impact on flow regimes of surface water sources

	Soil Resources	Handling of hazardous materials
	Soil Resources	Exposure to erosion agents
LOW	**HIV / AIDS and STIs**	Spread of HIV/AIDS and STIs among workers and the local community
	Soil Resources	Loss of top soil hence alterations of soil profile
	Fauna	Likely effect on number, diversity, breeding and eating habits
	Vegetation	Vegetation loss from clearance of vegetation cover
	Waste management	Reduction in aesthetics and exposure to injury and poisoning
	Waste management	Reduction in aesthetics from earth spoil handling
	Occupational Health and Safety	Accidents, injury and exposure to diseases for the workers
	Fauna	Consider extent of vegetation clearance required
INSIGNIFICANT	**Land - use**	Change of land use from pasture to quarry site
	Land - use	Reduced agricultural yield due to loss of productive top soil

9 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS

9.1 Positive Impacts

9.1.1 Employment Creation

One of the objectives of sustainable development goal no. 9 on Industry, Innovation and Infrastructure is to promote inclusive and sustainable industrialization. Additionally, by 2030, it aims to significantly raise the industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries.

The project will create employment opportunities for both skilled and unskilled personnel and thus contribute to achievement of the goal. Skilled personnel will be employed to handle specialized tasks such as operating construction machinery in the project, carrying out blasting operations, providing technical expertise among others while unskilled personnel shall be engaged as casual labourers. Other sources of employment include food vending and supply of items required on site e.g., safety equipment among others. This will provide a source of livelihood for the workers and the skilled workforce within the project area and thus improved living standards.

9.1.2 Growth of the Local Economy

The project shall employ both skilled and unskilled personnel. This will provide a source of income not just to the locals but other personnel with specialized skills. As a result, more money will be available and shall be injected into the local economy. Consequently, small businesses may begin to thrive and thus support growth of the economy.

9.1.3 Source of revenue to the government

The personnel employed shall be required to remit taxes to the government thus providing a source of revenue to the government. Additionally, the contract shall pay revenue in the form of cess to the local government thus providing a source of income to the government

9.1.4 Skills transfer

Several unskilled and skilled workers shall be employed in the project. The project proponent envisions a workforce of approximately 300 workers. The unskilled mainly employed as casual labourers will work closely with skilled labourers creating opportunity for skills transfer. Locals with little knowledge on quarry operations will have an opportunity to learn from the skilled workers. It is also anticipated that trainings on OSH matters shall also be incorporated in the project activities. First aid training shall be prioritized among the employees and workers with no previous knowledge of first aid measures shall benefit from such interventions.

9.2 Potential Establishment Phase Negative Impacts

9.2.1 Air pollution

Air quality is a measure of how clean or polluted the air is. It is defined by ambient air concentrations of specific pollutants determined to be of concern with respect to the health and welfare of the general public.

During this phase which would entail largely construction of the offices, sanitation facilities and the changing rooms the project is expected to have short term and minor impacts on air quality. Such impacts will primarily result from emissions e.g., carbon monoxide, hydrocarbons, nitrous oxides from construction machinery and particulate matter in the form of fugitive dust from excavation and general site clearance to pave way for the project.

Mitigation measures

- *Restrict construction vehicle speed within the site to a safe limit*
- *Provision and enforcement of PPE to workers such as dust masks*
- *Proper and frequent maintenance of construction vehicles to minimize exhaust fume emissions*
- *Sensitize construction vehicle drivers to turn off the engine when not in use*
- *Preparation and implementation of an air quality monitoring plan to ensure compliance to limits set in schedule 1 of EMCA, Air Quality Regulations, 2014*

9.2.2 Waste management

9.2.2.1 Solid waste

Significant volumes of solid waste will be generated during construction at the project site. Waste types will range from vegetation, earth spoil to typical construction waste such as waste concrete, packaging material such as cement, waste earth materials, pipes and electric materials, domestic and food waste from food consumed by the workers and other employees. If not properly managed besides compromising aesthetic effects of the site and the surrounding area, the waste can provide suitable environments for breeding of disease vectors. Improper waste management constitutes a short – term and easily reversible impact.

Mitigation measures

- *Properly labelled and strategically placed waste disposal containers shall be provided at all the places of work*
- *Construction workers shall be sensitized on the need for proper waste disposal*
- *No burying or dumping of any waste materials, vegetation, litter or refuse shall be permitted*
- *Provision for responsible management of any hazardous waste generated during the construction works shall be done*
- *Where feasible construction materials shall be recycled especially containers and cartons.*
- *In the event of excess earth spoil the locals may propose dumping areas e.g. for leveling school fields. This was requested during the public meetings*
- *For the spoil generated, disposal shall be done on pre identified sites more than 20 meters from watercourses and in a position that will facilitate the prevention of stormwater runoff from the site from entering the watercourse*
- *Additionally, the contractor (proponent) shall prepare a site waste management plan which details all the waste stream and the proposed disposal channels. For waste disposed by transfer to third parties the parties and transfer procedures shall be clearly defined*

9.2.2.2 Liquid waste

Various liquid wastes including grey and black water (respectively washing water and sewage), concrete washings, runoff from the workshop areas, and various liquid waste streams from washing construction vehicles and equipment washing will be generated. These wastes pose real toxicity and quality threats to the soil and ground water, and the existing water sources within the area in the event of uncontrolled discharge. This impact shall be short term for the duration of the project and localized to the quarry site.

Mitigation Measures

- *No grey water runoff or uncontrolled discharges from the site/working areas (including washdown areas) to adjacent watercourses and/or water bodies shall be permitted;*
- *Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for treatment prior to discharge into the environment. This particularly applies to water emanating from concrete batching plants and concrete swills;*
- *The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the site/working areas from discharging to adjacent watercourses and/or water bodies;*
- *Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered;*
- *Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted;*

9.2.3 Soil Pollution

During construction works accidental spillages of oil and fuel spills from construction machinery may infiltrate the soils and result in soil contamination. However, this impact is expected to be highly localized to the areas around the machineries and restricted to the affected areas. Therefore. this impact is rated low.

Mitigation measures

- *Proper maintenance of machinery and equipment to avoid or minimize leakages from such machines*
- *Spill prevention practices and response actions should be applied in refueling and vehicle-use areas to minimize accidental contamination of soil.*
- *Refuel in a designated fueling area that includes a temporary berm to limit the spread of any spill.*
- *Avail a spill kit on site in case any unavoidable spills/leaks occur*

9.2.4 Occupational Safety and Health

Any construction site is known to have health and safety risks and hazards. The construction phase of the quarry is no different. Some of the anticipated risks and hazards include: trips and falls, fall from height, cuts, injuries from operation of construction tools and machinery, electrocution, collision with moving vehicles and parts among others. The dust and noise emitted will also pose a health risk to the workers and visitors. These risks and hazards can be mitigated to reduce the accidents and incidences and even ensure work is complete without any fatalities.

Mitigation measures

- *Prepare and implement an Occupational Health and Safety Management Plan*
- *Train workers on safe work procedures and basics on health and safety at the work place*
- *Ensure relevant safety signs are erected at the required places*
- *High risk activities should only be conducted by persons well trained and experienced in the field*
- *Fence the site and restrict entrance to authorized persons only*
- *Provide the right tools for the right task*
- *Ensure machinery are inspected and maintained regularly*
- *Provide workers with relevant PPE for the different tasks being conducted*
- *Have relevant professionals to assist at the site such as a health and safety officer, first aider and fire fighters*

9.2.5 Spread of communicable diseases

The construction phase will have an influx of workers both from the area and others from different parts of the country. The workers could interact with the community members leading to a spread of HIV/AIDS. Due to the number of people required to work during this phase, there is a likelihood of the spread of COVID 19 if proper precaution is not taken.

Mitigation measures

- *Train workers on proper COVID 19 prevention measures*
- *Provide wash stations or sanitizers for workers around the site*
- *Monitor and keep worker records such as temperature when coming in and leaving the site*
- *Adhere to the recommended health measures put in place by the government to control the virus from spreading.*
- *Train and sensitize employees and the community on HIV and AIDS.*
- *Have HIV and AIDS educational posters around the site*

9.3 Potential Operation Phase Negative Impacts

9.3.1 Air pollution

The main source of air pollutants are the crusher plant, asphalt plant operations and mixers. Additionally fugitive dust will be generated from blasting, although this will be intermittent. Impacts of air quality on the health of the surrounding communities and workers include respiratory tract infections in addition to being a general nuisance.

Speeding construction trucks along the access roads can also generate substantial dust. The general public may withstand dust for the duration of the project in anticipation of better infrastructure in the near future. The construction workers however may not afford such a luxury as they would be exposed to severe dust for several hours each day which could adversely affect their health. This impact if not well mitigated may have serious health effects on the workers.

Mitigation measures

- *Train the workers and sensitize them on the importance of dust suppression on human health and road safety and about the suppression techniques available.*
- *Dust suppression measures e.g., spraying or sprinkling water in dusty areas should be implemented throughout the operation phase of the project*
- *Controlling the speed of construction related machinery and vehicles to a safe limit on the access road to reduce dust pollution or implement speed calming measures such humps*
- *Ensuring that construction machinery are regularly serviced and maintained to avoid excessive diesel exhaust discharges*
- *Providing workers with appropriate PPE e.g., effective dust masks and training them on proper and regular use*
- *Adherence to relevant provisions of Environmental Management and Coordination (Air Quality) Regulations, 2014*
- *Prepare and implement an air quality monitoring system that monitors the effectiveness of mitigation measures and help in compliance to limits set in schedule 1 of EMCA, Air Quality Regulations, 2014*

9.3.2 Noise

Assessment of ambient noise levels indicated that the current levels are above the EMC regulatory limits. Sources of noise anticipated during operation of the quarry include stone crushing which is expected to be largely continuous and blasting which is relatively intermittent and restricted to periods of blasting. Additional noise sources include construction machinery and vehicles on site.

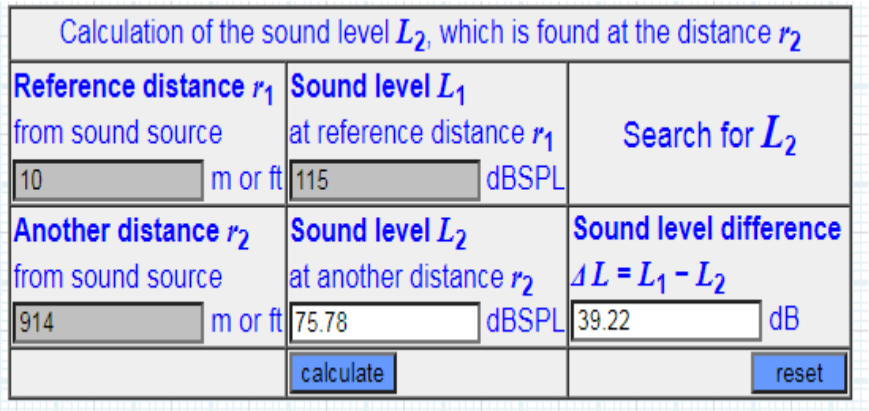
Noise impacts from the operations of the quarry is envisioned to be high due to proximity of the settlements but is short term and intermittent throughout the project life. While noise and excessive vibrations impacts to the locals could be traded off in anticipation of better infrastructure the health of the workers may be adversely affected through hearing damage or subsequent psychological trauma from high noise and vibration intensity if this impact is not properly mitigated.

*List of sensitive receptors next to the propose Sachangwan quarry and their respective distance***.**

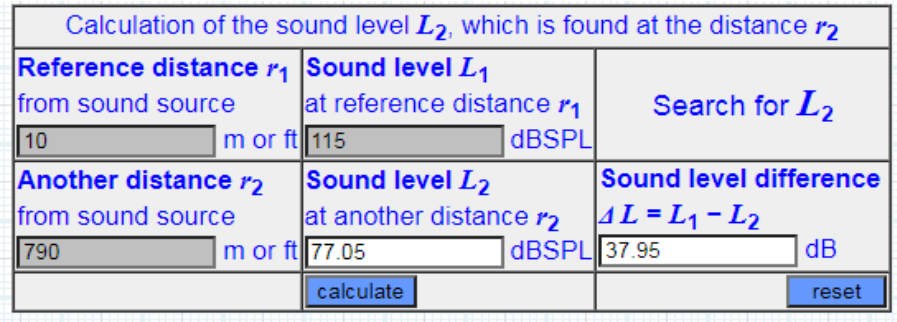
Area	**Zone**	**Approximate distance from quarry site (meters)**
Sachangwan Secondary School	Silent zone	914
Kogo Primary School	Silent zone	350
Nguzu River Primary School	Silent zone	700
Mukinyai Primary School	Silent zone	1369
Mukinyai Secondary School	Silent zone	1100
Sachangwan Dispensary	Silent zone	995
Assistant County Commissioner Office	Commercial zone	890
Oasis Health Centre	Silent zone	742
Highway Health Center	Silent zone	790

To assess vulnerability of these receptors, an online sound level dumping calculator model developed by Eberhard Sengpiel (http://www.sengpielaudio.com/calculator-distance.htm) to calculate the level of noise

exposure to sensitive receptors was used. Using the silent zone distance from a possible sound source, we calculated number of decibels in different areas during quarrying activities, excavation activity, noise from water boozer and blasting. A sample of calculation is shown in the figures below.



Blasting noise levels at 914 meters from source to Sachangwan secondary.



Noise from blasting 790m to Highway Health Center.

Assumptions

- Reference distance (r1) from sound source is 10m
- Maximum noise levels during various quarrying activities indicated in the various tables below.
- Maximum noise levels for quarrying activities being 109 dB (c) for hospitals and educational institutions and 114 dB (c
- The quarry is open and there is no sound proofing next to the sensitive receptors.
- The quarry operates at maximum capacity.

Disclaimer: The calculations above have been done from a number of assumptions as stated above; as such, the results from this study are only indicative and not a complete reflection of anticipated noise impacts on sensitive receptors.

Findings on sensitive receptors, distances, calculated noise pressure level, maximum permissible noise levels (NEMA) were tabulated for blasting, crusher plant, noise from water boozer and exactor as shown in the tables below

Table 9-1: Noise produced from blasting activity

Area	**Approximate distance from quarry site (meters)**	**Noise pressure levels produced at source (dB A)**	**NEMA recommended maximum (dB A)**	**Noise pressure level calculated at distance (dB A)**
Sachangwan Secondary School	914	115	109	75.78
Kogo primary School	350	115	109	84.12
Nguzu River Primary School	700	115	109	78.1
Mukinyai Primary School	1369	115	109	72.27
Mukinyai Secondary School	1100	115	109	74.17
Sachangwan Dispensary	995	115	109	75.04
Assistant County Commissioner Office	890	115	114	76.01
Oasis Health Centre	742	115	109	77.59
Highway Health Center	790	115	109	77.05

Table 9-2: Noise produced from crusher plant

Area	**Approximate distance from quarry site (meters)**	**Noise pressure levels produced at source (dB A)**	**NEMA recommended maximum (dB A)**	**Noise pressure level calculated at distance (dB A)**
Sachangwan Secondary School	914	85	109	45.78
Kogo primary School	350	85	109	54
Nguzu River Primary School	700	85	109	48.1
Mukinyai Primary School	1369	85	109	42.27
Mukinyai Secondary School	1100	85	109	44.17
Sachangwan Dispensary	995	85	109	45.04
Assistant County Commissioner Office	890	85	114	46.01
Oasis Health Centre	742	85	109	47.59
Highway Health Center	790	85	109	47.05

Table 9-3: Noise produced from excavator

Area	**Approximate distance from quarry site (meters)**	**Noise pressure levels produced at source (dB A)**	**NEMA recommended maximum (dB A)**	**Noise pressure level calculated at distance (dB A)**
Sachangwan Secondary School	914	74	109	34.78
Kogo primary School	350	74	109	43.12
Nguzu River Primary School	700	74	109	37.1
Mukinyai Primary School	1369	74	109	31.27
Mukinyai Secondary School	1100	74	109	33.17
Sachangwan Dispensary	995	74	109	34.04
Assistant County Commissioner Office	890	74	114	35.01
Oasis Health Centre	742	74	109	36.59
Highway Health Center	790	74	109	36.05

From the findings above, noise from quarrying activities received by sensitive receptors is not expected to exceed permissible noise levels as recommended by NEMA under the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009. However it is still recommended that noise should still be controlled by applying the following recommendations:

Mitigation measures

- *Restrict high noise generating activities to daytime when ambient noise levels are generally high and avoiding work at night*
- *Rock blasting should be done during the day when the ambient noise levels are generally high*
- *Workers operating equipment that generate noise should be equipped with noise protection gear including ear muffs and plugs. Workers operating equipment generating noise levels greater than 80 dBA continuously for 8 hours or more should use earmuffs whereas those experiencing prolonged noise levels of 70 - 80 dBA should wear earplugs.*
- *All construction workers to be trained on the proper use of PPE and especially the ear protectors*
- *It is recommended that the explosives weight for any blasting event is between 50 and 100 Kg or employ alternative methods that would keep noise to the NEMA limits.*
- *Give sufficient notice to neighbors within 500 m radius of the blasting day and time, preferably not less than 1 week to the event.*
- *Ensure compliance to EMCA, Noise and Excessive Vibration Pollution (Control) Regulations, 2009*

9.3.3 Excessive vibrations

A vibration modelling of the quarry site was conducted to determine the vibrations vulnerability of the site. it was assumed that any part of the site can be worked on and therefore vibration scenarios cover the whole designated area. The EMCA peak particle velocity (ppv) requirement is< 0.5 cm/s at the receptors and thus three quarry working scenarios were modelled and the peak particle velocities superimposed on google earth as shown in figure 9 – 1 below.

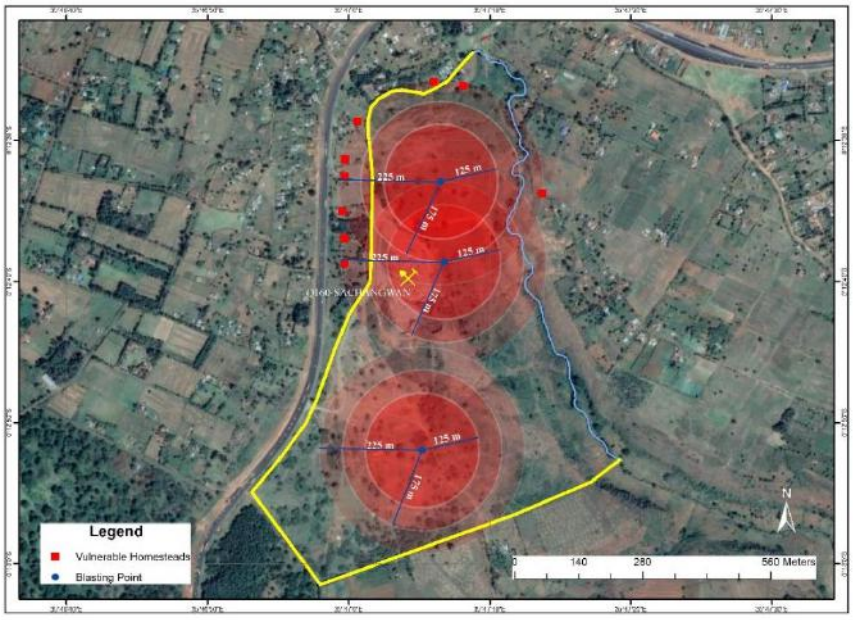


Figure 9-1: Distribution of distances at which ppv of <0.5 cm/s is attained for different charge weights across the quarry

From the results obtained, working the northern part, with a working area of 250 meters wide then the ppv limit of 0.5 cm/s should be reached within 125 meters. The model results show that this maximum radius at which this vibration impact level is achieved is for ppv triggered when a charge weight of 50 kg is applied. With increased weight, the radius goes to just over 175 metres for 100 kg weight, 225 metres for 150 kg and 250 metres for 220 kg. Data from the regression analysis is presented in Table 9-1.

Table 9-4. Regression modelling results

Explosive weight, kg	**Distance from blast source, m**										
	50	**75**	**100**	**125**	**150**	**175**	**200**	**225**	**250**	**275**	
50	1.9	1.09	0.73	0.54	**0.42**						**PPV, cm/s**
100		1.76	1.18	0.87	0.68	0.55	**0.46**				
150			1.5	1.15	0.9	0.72	0.6	0.51	**0.44**		
200					1.09	0.88	0.73	0.62	0.54	**0.47**	

It is also estimated that when working this area, a total of 8 homesteads are likely to be impacted at a charge greater than 100kg. This impact could further be compounded by the structural integrity of the houses since detonation of explosives within a borehole often result in the development of very high gas and shock pressures. Therefore, the maximum charge weight for blasting plans on the site should not exceed 100 kilograms. Additionally, depending on the payload required per cycle during quarrying operations explosive blasting, non-explosive hydraulic splitting or expansive chemical agents can be used while maintaining environmentally and legally acceptable levels of impact. The full Vibration Velocity Model Report is attached in Annex 8 of the report.

Mitigation measures

- *Rock breaking methods adopted at the quarry site be based on a balance between suitability, the required payload, cost and the impact on the environmental receptors.*
- *It is recommended that the explosives weight for any blasting event is between 50 – 100kg or alternative methods that would keep noise levels to the NEMA limits should be applied*
- *All loading and firing should be directed and supervised by competent person(s) thoroughly experienced in this field and accredited accordingly.*
- *Employing qualified personnel to handle and store the explosives*
- *Blasting should be done at the scheduled times and the affected public, within approximately 500 m radius, duly informed. Appropriate warning signs on the road will also need to be erected.*
- *Providing and enforcing the use of earmuffs/ear plugs to all workers and visitors to the facility*
- *The proponent should map out all susceptible structures within 300 m radius before commencement. Conduct structural integrity tests on the 8 houses that are within the 250 m radius of the site before commencing quarrying activities*
- *Inform potentially affected people or institutions located within 250 m of a potentially noisy activity at least one week in advance - of the intention to undertake noisy operations and advice on the timing. Information should also advice the potentially affected people of actions they are required to take to avoid or minimize noise or vibration impacts on themselves.*
- *.Adhere to the provisions of the Explosives Act, 2012*

9.3.4 Land degradation

Land at the project site has been substantially degraded by previous quarrying activities and therefore land degradation is expected to be cumulative but localized to the project site. The project area is located in a region classified as agriculturally productive. However, continued mining on the land will increasingly make the land unsuitable for agriculture in the future due to loss of top soil, depletion of nutrients and supportive microflora that are necessary for substantial yields.

Quarrying also significantly scars the landscape creating badlands which are both visually intrusive and aesthetically unappealing. Expansion of the quarry will exacerbate the degradation that has already occurred on the project site. This impact is therefore expected to be medium, localized but long term and partially reversible with proper rehabilitation of the site at completion of the project operations.

Mitigation measures

- *Rehabilitation of the site at project completion in accordance with the Integrated Land Use Guidelines, 2011 and the Rehabilitation plan*
- *Revegetation of the site to the native species identified during baseline studies*
- *Create drainage channels so water does not accumulate in the pit*

9.3.5 Landscape scarring

Stone extraction involves significant excavation works which can extend into great depths. Excavation of the site scars the landscape resulting into badlands that are visually intrusive. Similarly, stock piles on site often alter the slope of the land and change the topography of the site. Once the extraction stops, the resultant derelict becomes a potential hazard.

Mitigation measures

- *The Proponent will be expected to adhere to the principles of the Quarry Rehabilitation Plan proposed in the report*
- *Rehabilitate the quarry pits by cutting back quarry faces and backfilling to the extent possible and planting indigenous vegetation*

9.3.6 Vegetation Loss

The project site is an existing quarry which has been extensively cleared for establishment of the quarry and construction of offices. However, additional vegetation clearance on the site for expansion of the quarry and installation of additional infrastructure will contribute to overall vegetation loss. It is therefore anticipated that any impacts on vegetation loss are cumulative and localized to the site. Nonetheless there are a few endemic mature species of Acacia on the South Eastern part of the site that would be affected during expansion of the quarry face.

The species diversity is minimal and as such vegetation clearance will not cause loss to species that are rare, threatened or are of conservation values. Additionally, no endangered species would be affected by vegetation clearance. Therefore, impact on vegetation is anticipated to be low.

Mitigation measures

- *The clearance of the site for construction purposes shall be kept to a minimum. The use of existing cleared or disturbed areas for construction of offices, workshop and sanitary facilities, stockpiling of materials etc. shall be encouraged;*
- *Areas to be cleared should be agreed and demarcated before the start of clearing operations;*

9.3.7 Waste management

9.3.7.1 Solid waste

Solid waste will be generated during operations at the site. Waste types will range from vegetation, earth spoil to typical construction waste such as waste concrete, packaging material such as cement, waste earth materials, domestic and food waste from food consumed by the workers and other employees. If not properly managed the waste can pollute the environment and provide suitable breeding sites for disease vectors besides compromising aesthetic effects of the site and the surrounding area. Improper management of the waste constitutes a short – term and easily reversible impact.

Mitigation measures

- *Prepare and implement a Waste Management Plan which details all waste stream and the proposed disposal channels. For waste disposed by transfer to third parties the parties and transfer procedures shall be clearly defined including those of hazardous waste as per the EMCA Waste Management Regulations*
- *Contract a licensed waste handler to properly collect and dispose the waste as per EMCA waste management regulations, 2009.*

- *Re-use overburden and topsoil in backfilling the quarry*
- *Reuse quarry fines and other quarry waste or stockpile to use in backfilling the quarry*
- *Construct a septic/soak pit for liquid waste management*
- *Create awareness among workers on proper waste management practices such as collection, segregation and disposal*
- *No burying or dumping of any waste materials, vegetation, litter or refuse shall be permitted*
- *Where feasible construction materials shall be recycled especially containers and cartons.*

9.3.7.2 Liquid waste

Various liquid wastes including grey water from installations and others and black water from effluents as well as concrete washings, runoff from the workshop areas, and various liquid waste streams from washing construction vehicles and equipment washing will be generated. These pose toxicity and quality threats to soil, ground water, and the existing Sachangwan River. This impact shall be short term for the duration of the construction and localized to the operation phase of the quarry site.

Mitigation Measures

- *No grey water runoff or uncontrolled discharges from the site/working areas (including washdown areas) to the adjacent Sachangwan River shall be permitted;*
- *Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for treatment prior to discharge into the environment. This particularly applies to water emanating from concrete batching plants and concrete swills;*
- *The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the site/working areas from discharging to adjacent watercourses and/or water bodies;*
- *Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered;*
- *Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted;*
- *The Contractor shall notify the Independent Engineer of any pollution incidents on site.*

9.3.8 Community health, safety and security

The proposed quarry site neighbors a densely populated area to the North East. The nearest settlement to the site is located less than 50m away from the project site. During blasting splitting and flying rocks may affect the houses. Additionally, vibration impacts may affect the homesteads around the project site. Children may wander into the project area and sustain injuries if the site is not properly secured. Community livestock may also stray into the project site. Since the project area is in a rural setting, school children especially those in high schools may drop out to work at the quarry sites. Although the impact on community health and security is high due to the close proximity to the settlements, this impact is expected to be partially reversible if mitigation measures are properly implemented.

Mitigation measures

- *Fence off the entire quarry site and delineate the quarry site from the rest of the project site to prevent unauthorized access to the quarry site.*

- *Regularly inspect and repair the quarry fence as necessary to prevent unauthorized access*
- *The final rock face must not be a safety hazard to trespassers or livestock in the event that the perimeter fence is breached*
- *Strict adherence to blasting schedules and notification / warning systems*
- *Engage a registered and licensed blaster to undertake the blasting works on site*
- *Warnings signs of appropriate font size and in the appropriate language should be erected in all quarry entries and in areas with high cliffs e.g., Danger Quarry Deep Pit' or 'Caution Flying Stone and Debris'.*
- *All roads to and from quarries to be made safe and accessible and transportation of quarried material to follow a designated route.*
- *Prohibit child labour in the quarries as stipulated the Children Act 2008*

9.3.9 Impacts on soil

9.3.9.1 Soil Erosion

The project area receives high amounts of rainfall. In addition, the soils in the project site are shallow and weakly developed hence prone to soil erosion. Increased excavation and vegetation clearance to pave way for material extraction and installation of the facilities may exacerbate soil erosion on the project site. However, it is anticipated to be both a short term and long-term impact depending on whether appropriate measures are instituted to control soil erosion on the affected areas. The impacts of soil erosion will be significant in the long term if uncontrolled after repeated incidents of rainfall.

Earth spoil stock piled on site may be washed downstream into the river though this impact is expected to be minor due to the buffer of vegetation and farmland between the project site and Sachangwan River located 150m north east of the project site.

Mitigation measures

- *Areas susceptible to soil erosion should be closely monitored for evidence of soil erosion and controlled*
- *Landscaping of cleared sites that are nolonger required should be done as soon as practically possible*
- *Site clearance should be staged so that areas not required immediately are left unexposed until later*

9.3.9.2 Soil Pollution

Accidental fuel and oil spills from the construction machinery, construction vehicles, fuel pump, materials yard and workshop may infiltrate into the soils and result in soil pollution. Since there will be long periods of concentrated activities within the site this impact is anticipated to be moderate if not mitigated but can be sufficiently mitigated by the measures proposed.

Mitigation measures

- *Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for treatment before discharging to the environment. This particularly applies to water emanating from concrete batching plants and concrete swills;*

- *The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the site/working areas from discharging to adjacent watercourses and/or water bodies;*
- *Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered;*
- *Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted;*
- *Refuel in a designated fueling area that includes a temporary berm to limit the spread of any spill.*

9.3.10 Faunal habitats disturbance

Site clearance to pave way for the installation of project infrastructure and expansion of the quarry phase is expected. On the south western side of the site, mature acacia species which serve as nesting sites for birds and tall grasses that act as habitats for rabbits may be cleared hence disturbing their habitats. Quarry operations such as blasting may affect the breeding patterns of some species found in the area such as birds and rabbits and can occasion their migration to other areas. None of the wildlife species identified are threatened, endangered or are of conservation value. Therefore, the impacts on biodiversity are anticipated to be low to insignificant owing to the narrow species diversity and population on site.

Mitigation measures

- *Vegetation clearance should be restricted to the project footprint to avoid unnecessary clearing of vegetation*
- *Decisions to clear should be carefully evaluated prior to implementation*
- *As far as practically possible the project site should be revegetated with species endemic to the project area*
- *All vehicles that will be used for material transport should be kept to the same paths and routes in and out of the quarry to avoid unnecessary disturbance to the surrounding habitat.*

9.3.11 Impacts on water sources

Impact on ground water

The project area is located within a micro catchment area. Quarrying especially blasting, if not well handled, can breach aquifer casing which acts as its protective cover and this can cause contamination of ground water since ground water may mix with the surface water through cracks. Another potential source of contamination is fuel and oil that may leak from the fuel tanks or machines on site.

Another potential impact of blasting is alteration of ground water flow paths, changes in the pattern of groundwater movement and changes in the quantity of water flowing through the system. The flow path may change direction and contribute to another subsystem or spring. Thus, the volume of water abstracted from boreholes within the project area that are fed by the system may decrease.

Impact on surface water resources

Approximately 200m from the project site is Sachangwan River. The river is a permanent river which is recharged during the rainy season with levels running low during the dry season. A large portion of Sachangwan community draw water for domestic use and livestock watering from the river. In the event that water is abstracted from the river to supplement construction and operation phase water needs of the

project, the supply could be strained ultimately compromising the volume of water available for use by the community. Possible contamination of the water by pollutants transported through storm water from the construction site may also alter the water quality of the river. The impact on water quality is however expected to be low due to the vegetation buffer between the project site and the river allowing for some degree of infiltration.

Mitigation measures

- *Blasting should only be done by a person qualified and registered with Department of Mines and Geology*
- *Blast operatives should ensure that all material is ignited*
- *Ensure runoff from asphalt plant and concrete batching plant areas are contained or directed into a sedimentation tank or pond for retention and treatment as necessary so as not to reach the stream or infiltrate into ground water.*
- *Proper waste management within the entire site, including grey and black effluents to ensure no waste gets to the stream, dam, lake or seeps into the ground water reservoir.*
- *The maximum depth of the quarry pit should be way above the water table by estimating the aquifer depth prior to commencement of quarrying*
- *To the extent possible the quarry area should be free draining to avoid ponding*
- *Use of sandbags or silt fences to prevent sediments from leaving disturbed areas*
- *Store soil heaps and aggregate stockpiles away from water ways and on flat surfaces to avoid washing sediments downstream*
- *Regular servicing of construction vehicles to ensure there are no leaks*
- *Servicing of vehicles in a bunded area so that any spills are contained*
- *Ensure a spill kit is availed on site to handle any spills/leaks that may occur*
- *Drill a borehole to supplement the water source and reduce pressure on the existing water sources*

9.3.12 Occupational health and safety

Quarrying presents a variety of occupational safety hazards and consequently risks. The workers engaged in the project are at risk of accidents which could occur from practically all forms including being hit by split and flying rocks, cuts, falls, knocks, machine and vehicle operations.

Possible hazards include lifting at the materials yard, noise and excessive vibrations exposure from blasting and crushing works, dust and emissions, working at heights, eye hazards from welding works at the workshop, chemical hazards e.g., from use of explosives, slip and tripping at the materials yard. The Contractor and supervisors will be required to implement all reasonable precautions to protect the health and safety of workers. Preventive and protective measures will be introduced according to the following order of priority:

a) Elimination where an activity that presents the hazard is completely avoided to eliminate the risk

b) Substitution – involves substitution of one hazard with another that creates less risk

c) Engineering controls – where an engineering solution is provided to control the hazard. It may involve

- *Isolation or enclosure of the hazard so that no one is exposed to the hazard,*
- *Separation or segregation so that the hazard is placed in an accessible location*
- *Partial enclosure*
- *Safety devices which ensure that the item that presents the hazard is used in the correct way that does not present a safety risk to the worker*

d) Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.

e) Provision of personal protective equipment while training the workers on proper use and maintenance of the PPE provided

Mitigation measures

- *Registration of the quarry site as workplace by the directorate of occupational safety and health (DOSHS)*
- *Undertake a detailed risk assessment once all the installations have been established*
- *Prepare and implement an Occupational Health and Safety Management Plan that is informed by the outcome of the risk assessment*
- *Train workers on safe work procedures and basics on health and safety at the work place. Maintain periodic toolbox talks with workers during operations at the site*
- *Fencing off the quarry site and stationing a security personnel to control entry into the quarry site*
- *Keep workers a minimum 350 m away from the blast spot to avoid scattering stones. If possible, machinery and other facilities should also be kept at least 200m from the blast site. These distances will, however, depend upon the charge power.*
- *The workers should return to the working zone at least 10 minutes after the explosion.*
- *An insurance cover for all the workers should be provided*
- *Standard first aid kits should be provided on site*
- *The proponent should comply with guidelines provided in the OSHA, 2007 and the International Labour Organization (ILO) Guidelines on Safety and Public Health in both construction and operation phase activities*
- *Warnings signs of appropriate font size and in both English and Kiswahili should be erected in all quarry entries and in areas with high cliffs e.g. Danger Quarry Deep Pit' or 'Caution Flying Stone and Debris'.*
- *A safety officer who has sufficient knowledge of safety procedures should be present on site to ensure that all the workers have guidance on the safety procedures.*
- *Provide the workers with complete PPE namely helmets, ear muffles, reflector jackets, safety boots among others as appropriate. Workers handling electricity and related components to be provided with shock resistant gloves, shoes and other protective gears*

- *Ensure workers sign a code of conduct that binds them to safe work practices while on site*

9.3.13 Public Health

Nakuru county has a HIV prevalence rate of 5.3% with a total number of 66,295 PLHIV with 58,397 being adults and 7,898 being Children according to the KAIS. It is among the seven counties in Kenya that bear the burden of HIV and AIDS according to the Kenya HIV prevention revolution roadmap. It is anticipated that a group of employees comprising the skilled labour workforce may be recruited from other areas into the project area.

Considering the mobility of such jobs most of the employees often travel without their families. Sexual interactions with the local population may lead to spread of HIV/AIDS and STIs within the area. Considering the low population within the immediate project environment any increase in HIV and AIDS will have a significant bearing on the statistics of the area. HIV and AIDS affects households by increasing the medical and health obligations, reducing their savings and further increasing poverty as households spend on funeral expenses while losing productive members of their households. This has a direct impact on various sectors of the economy that rely on skills to grow. Therefore, the proponent in collaboration with KENHA should implement a systematic approach to curb or control possible new HIV/AIDS infections. Additionally, presence of many people within an area increases the chances of the spread of the Covid-19 virus if proper precaution is not undertaken. The increased spread of the virus is anticipated to be short term and reversible or irreversible in cases where one succumbs to the virus.

Mitigation measures

- *Conduct regular campaigns to create awareness on HIV / AIDS and STIs prevention and control*
- *Provision of condoms on site and locating them in strategic locations to improve access*
- *Post HIV AIDS prevention posters at strategic locations within the site*
- Have in place COVID 19 prevention measures and train workers on hygiene practices
- Provide wash stations or sanitizers for workers around the site
- Adhere to the recommended Ministry of Health measures to control spread of the virus.

9.3.14 Child labor

According to the International Labour Organization (ILO), child labour is defined as work that is mentally, physically, socially or morally dangerous and harmful to children. Such interferes with their schooling by depriving them of the opportunity to attend school hence obliging them to leave school prematurely. In some cases, children are forced to combine school attendance with other heavy works. The project area is surrounded by quite a number of schools and settlements hence cases of child labor are highly probable for instance, during the previous operation period of the quarry, some schools recorded cases of drop outs as a result of children opting to work in the quarry. The associated impacts are children being exposed to hard labor, drug and substance abuse, risks of sexual abuse and contraction of diseases like HIV/AIDs and STIs.

Mitigation measures

- *Recruitments should be done using identity cards to ensure that all employees are 18 years and above.*
- *Provision of designated sheds for the various vendors at the project site in order to vet all the vendors*

- *Prohibit hawking in and around the project site*

9.3.15 Impacts on Education

Blasting of rocks at the quarry site is expected to take place during the day. Blasting is by use of explosives and other methods such as gas pressure blasting pyrotechnics, to break rocks for excavation. The schools that are in close proximity namely Kogo primary School, Nguzo Primary and Sachangwan Secondary might briefly disrupt learning due to the high intensity of noise and vibrations generated.

Mitigation Measures

- *The schools in the area should be informed one week prior to the blasting. This will help the school in planning and preparing the students of the expected impacts from blasting.*
- *Blasting can also be done on the weekends or after school hours when there are few or no school activities.*

9.4 Decommissioning phase Impacts

Decommissioning of the quarry may occur due depletion of material sources, withdrawal of the proponent, expiry of the licenses and permits or closure by government agencies. In other cases, financial feasibility of continued quarrying at the site may prove unviable. Anticipated impacts at decommissioning include;

- Safety and health risks
- Resultant derelict land
- Air pollution (Dust)
- Waste generation
- Noise and excessive vibration

9.4.1 Health and safety

Quarry pits may be deeply excavated presenting safety hazards to children and animals who may wander into the quarry site or breach the quarry fence. Additionally, the pits may have water ponding making it likely for animals or children to drown.

Mitigation measures

- *At a minimum, the Proponent is expected to comply with all the relevant safety and health regulations currently in force in Kenya including Occupational Safety and Health Act.*
- *The proponent should ensure there are safety signs within the quarry area and at approaches to the quarry*
- *No idler should be allowed within site during the day or night*
- *Ensure that the quarry site is properly fenced. In case of breaches repairs should be done as soon as possible*

9.4.2 Solid waste generation

Demobilization of quarry installations and related infrastructure at the quarry will result in appreciable quantities of solid waste. The waste will contain the materials used in construction including, prefabricated material for the buildings, concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. There is growing evidence that large quantities of such waste may lead to release of certain hazardous chemicals into the environment. In addition, even generally non- toxic chemicals such as chloride, sodium, sulphate and ammonia which may be released as a result of leaching of demolition waste are known to lead to degradation of ground and surface water quality.

Mitigation measures

- *A site waste management plan should be prepared prior to commencement of demolition activities. This should include designation of appropriate waste storage areas, collection and removal schedule, identification of approved disposal site and system for supervision and monitoring*
- *Any vegetation and combustible waste must not be burned on the site*
- *Demolition debris should be stock piled in safe areas*
- *Reusable materials like doors, windows and timber should be sold to licensed scarp dealers*
- *Make arrangements for the collection of litter and demolition debris from the site by a licensed solid waste transporter for dumping at an approved site*

9.4.3 Air pollution

Demolition works are associated with substantial generation of dust. These shall involve demolition of the the infrastructure installed on site including the offices and sanitation facilities. Excavation works may also occasion generation of dust which may affect the demolition staff through respiratory tract infections. The following measures shall be implemented to control air pollution

Mitigation measures

- *Access roads and exposed ground must be wetted in a manner and at a frequency that effectively keeps down the dust*
- *Demolition equipment should be properly and regularly serviced*
- *Workers should be issued with proper protective equipment*
- *Compliance with all provisions of the Environmental Management and Co-ordination (Air Quality) Regulations, 2014*

9.4.4 Noise and excessive vibrations

Demolition activities are always accompanied by excessive noise which leads to the deterioration of the acoustic environment. The settlements and institutions located within 300m radius are regarded as potential receptors of noise.

Mitigation measures

- *Inform the neighbours beforehand via notices and advisories of pending noisy periods and solicit their consent well before the commencement of civil works*
- *All demolition equipment should be regularly inspected and serviced*
- *Workers operating equipment that generate noise should be equipped with noise protection gear including ear muffs and plugs.*
- *No unnecessary hooting by project and resident vehicles, including operating equipment*

9.5 Typical site decommissioning plan

At the end of the project life-cycle the quarry shall be decommissioned. The contractor, referred to as the proponent in the document, under supervision of the Independent Engineer (IE), will use this Rehabilitation Plan as a guideline for rehabilitation of the quarry site. The decommissioning phase of the quarry is integrated in a rehabilitation plan with the following objectives:

- Minimize the environmental impacts of the project during the development and operational phases,
- Ensure that protection of water quality and erosion control works are implemented,
- Ensure progressive rehabilitation is completed as soon as practicable,
- Minimize visual impacts during the operational phase as well as post-quarrying phase,
- Ensure that site drainage and sedimentation structures remain stable and functional,
- Ensure that vegetative matter and topsoil is made available for the site rehabilitation as required,
- Guarantee that the resource is extracted and the site rehabilitated in a manner that will ensure the quality of surface runoff at all times,

9.5.1 Rehabilitation procedure

This only applies where the land owner opts to have the site rehabilitated after operations.

The Proponent will adopt a progressive rehabilitation approach where out-of-pit location areas will be rehabilitated concurrently with the material extraction process. However, rehabilitation of the actual extraction areas will be carried out when the material extraction process has been completed.

Table 9-5: Quarry Site Rehabilitation Plan

No.	Activity	Actor (s)	Monitoring
1.	Slope grading shall ensure that all unconsolidated materials are in such an angle as to minimize possibility of slides and be consistent with future use of land which shall be agreed upon at a later time	• Contractor • Independent Engineer	• NEMA • County Government
2.	Clearance of rubbish, surplus materials, temporary structures and equipment shall be carried out	• Contractor • Independent Engineer	• NEMA • County Government
3.	Safety provisions shall be communicated and given for persons and animals in the adjacent settlements to the site during rehabilitation	• Contractor • Independent Engineer	• NEMA • DOSH • Mines and Geology
4.	The proponent shall ensure configuration of the overburden and soil to accepted conservation practices suitable for proposed subsequent land use	• Contractor • Independent Engineer • KeNHA	• Department of Mines and Geology • NEMA • County government
5.	The quarry pit shall be backfilled with clean stock pile/earth spoil or inert fill. It shall then be covered with top soil.	• Contractor • Independent Engineer • KeNHA	• NEMA • County government
6.	Suitable drainage shall be constructed to avoid conditions where small pools of water are likely to gather and become	• Contractor • Independent Engineer • KeNHA	• NEMA • Water Resource Authority

	noxious, present safety risks or become foul in the mined area.		
7.	Landscaping of the quarry area shall be done to conform to the accepted and recommended agronomic practices as established by Ministry of Agriculture, NEMA and other relevant Lead agencies. Further, endemic species to the area shall be preferred.	• Contractor • Independent Engineer • KeNHA	• Ministry of agriculture • NEMA • KFS
8.	The quarry site shall be graded to match or blend with existing contours	• Contractor • Independent Engineer • KeNHA	• Department of Mines and Geology • NEMA
9.	If the access and haul roads are considered unnecessary after material extraction has been completed then they shall to be restored in a mutually agreeable manner	• Contractor • Independent Engineer • KeNHA	• Ministry of Roads • NEMA

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

10.1 Introduction

The Environmental and Social Management Plan (ESMP) describes the range of environmental issues associated with the Project and broadly outlines corresponding management strategies that will be employed to mitigate potential adverse environmental and social impacts. The ESMP also conveys the project's environmental and social constraints. The project will comply with all local laws and regulations, which seek to ensure that the construction and operation works do not adversely affect the environment and social community resources.

The guiding principle for the Environmental Management and Social Plan will follow the national objective of enhancing environmental, social and economic benefits to the people living in the region. To achieve this, acceptability by the beneficiary community and minimal effects to the physical and biological environment need to be integrated in the project through constant consultations, evaluations and review of the design aspects throughout the project period. Mitigation measures, design features, or actual impacts shall be monitored to ensure environmental acceptability of the project during construction and operation phases of the project.

The objectives of the ESMP are:

1. To bring the project into compliance with applicable national environmental and social legal requirements;
2. To outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimize, mitigate or compensate for adverse environmental and social impacts, or to enhance the project beneficial impacts;
3. To address capacity building requirements within the project dimensions if necessary.

10.2 Responsibilities

10.2.1 Sogea Satom

The quarry site is under the jurisdiction of Sogea Satom and therefore the responsibility of ensuring that the Environmental and Social Mitigation measures outlined in the ESMP are properly implemented. The cost of implementing the obligations in the ESMP and facilitation of the administrative and engineering controls are equally the responsibility of Sogea Satom. The Company will appoint an Environmental and Social Officer whose responsibilities shall include;

- Updating environmental aspects (not covered in the ESIA / ESMP) during project implementation;
- Auditing environmental and safety aspects at the work sites;
- S/He shall participate in the definition of the no working-areas and the location of campsite, borrow pits, quarries and other areas;
- Recommending solutions for specific environmental and social issues;

- S/He shall facilitate the creation of Community Liaison Groups and shall monitor the compliance of the social clauses of the Contract, in terms of local labour force and HIV/AIDS campaign;
- Overseeing strategies for sensitizing the local population on health and safety problems;
- Attending consultations held at key stages of the project with the community and interested parties;
- S/He will be required to liaise with the respective Environmental Authorities on the level of compliance with the ESMP achieved by the Contractor on a regular basis for the duration of the contract;
- Controlling and supervising the implementation of the ESMP;
- Preparing quarterly environmental and social progress or "audits" reports on the status of implementation of measures and management of work sites.

10.2.2 NEMA

The responsibility of the National Environmental Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment and to ensure that all mitigation measures proposed are actually implemented.

10.2.3 County Government

The relevant departmental officers in the county government should be called upon where necessary during project implementation to provide the necessary permits and advisory services to the project implementers. Some of the areas for which the officers will be required include:

- Liaising with the NGOs in the project area to assist in the sensitization campaigns for HIV/ AIDS and public health to the workforce and the local community;
- Issuing permits for exploitation of the quarry
- Identifying locations for disposal of construction debris;
- Issuing permits or relevant documentation for health and safety monitoring in accordance with local health and safety legislation and / or ILO standards.
- Issuance of permits for noise and development approvals

10.3 Environmental Management Plan

The set of instructions provided in this Chapter constitute the Environmental and Social Management Plan (ESMP). To facilitate the use of this ESMP, the environmental management instructions are presented according to the sequence of project stage activities as follows:

1. Construction;
2. Operation.
3. Decommissioning

The following issues require special attention:

1. Designs must take into considerations the topography and soil conditions, climate, ground cover and social settings.

2. The Contractor shall ensure that all pertinent permits, certificates and licenses have been obtained prior to any activities commencing on site and are strictly enforced / adhered to;
3. The Contractor shall maintain a database of all pertinent permits and licenses required for the contract as a whole and for pertinent activities for the duration of the contract.

10.3.1 Construction phase

The ESMP has put in place measures to avoid and mitigate impacts and optimize benefits arising from activities during the construction phase of the project including clearing of vegetation at the project site and excavation works to pave way for the project. The project proponent hereafter referred to as the contractor will be responsible for ensuring that the project is implemented in accordance with best industry practices as well as workplace safety, health and environmental (SHE) standards.

10.3.2 Operation phase

The contractor will assign adequate budget and a proper implementation schedule for all mitigation measures specified in the EMP In addition, the specific roles and responsibilities will be assigned to project personnel, such as environment, safety and health management roles.

10.3.3 Decommissioning phase

The proponent will prepare a decommissioning plan with details on the quarry rehabilitation plan; waste disposal mechanisms and final disposal sites; manpower and labour required including both skilled and unskilled manpower and relevant cost estimates.

10.4 Environmental monitoring and audit

Environmental monitoring and audit are essential in project's lifespan as they are conducted to establish if project implementation has complied with set environmental management standards for Kenya as spelt out in EMCA 1999 (Amendment 2015) and the Environmental (Impact Assessment and Audit) Regulations, 2003(amendment 2016). The proponent will ensure regular environmental monitoring and audit is carried out on this project to ensure that identified potential negative impacts are mitigated during the project's implementation period.

10.5 Implementation of corrective action(s)

There are several mechanisms for implementing corrective action, both during the construction and operational phases. The main mechanisms to address transgressions include verbal instruction (in the event of minor transgressions from established procedure, usually following a site inspection); written instruction (identifying sources of problems, usually following an audit) and issuance of contract notice (following possible breach of contract).

10.6 Documentation / Reporting

The findings of all of the above will be structured into instructive reporting that provides information to all required parties on environmental performance, together with clearly defined corrective action, where necessary. Monitoring and inspections reports will be generated continuously. In addition, a review function will be created within the reports, in order to allow for continuous assessment of the reports and suggestion of corrective actions, where necessary.

These reports will include the provision of information on the environmental performance to external stakeholders and surrounding communities.

10.7 Management review

The final component of the EMP management cycle is a formal management review that takes place at defined intervals, both during the construction and operational phases. The purpose of the management review is for senior project management to review the environmental management performance during the preceding period and to propose measures for improving that performance in the spirit of continuous improvement.

Table 10-1: Environmental and Social Management and Monitoring Plan

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
Construction Phase				
Clearance of vegetation	Utilize the area without dense vegetation cover	One off		Contractor
	Clear only those trees that are within the area to be developed	-		Contractor
	Consider compensatory tree planting	One off	100,000	Contractor
Contamination of surface water	Ensure proper waste management so that no waste finds itself in the seasonal stream and eventually into the river Sachangwan	Daily	BEP	Contractor
	Place stockpiles on flat or raised surfaces	Daily		Contractor
	Regular servicing of construction vehicles to ensure there are no leaks	Per manual		Contractor
	Servicing of vehicles in a bunded area so that any spills and contained	Throughout		Contractor
	Ensure a spill kit is availed on site to handle any spills/leaks that may occur	Throughout		Contractor
Pressure on existing water resources	Ensure proper use of water e.g. by installing automated taps and recycling where possible	One off	BEP	Contractor
	Practice rain water harvesting during the raining season to reduce pressure on existing resources	Throughout	BEP	Contractor
	Sensitize workers on water conservation	Biannually		Contractor
Loss of habitat	Stage clearance so as to minimize clearance of areas that will not be used	Throughout		Contractor
Change in land use	Avoid disturbing areas that won't be used for installations so their original state is maintained	Throughout		Contractor
Impact on soil	Excavated soil should be placed on flat or raised surfaces	Throughout	BEP	Contractor
	Ensure proper maintenance of construction vehicles to minimize spills and leaks	Per manual		Contractor
	Avail a spill kit on site in case any spills/leaks occur	Throughout		Contractor
	Servicing of vehicles in a bunded area so that any spills are contained	Throughout	-	Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
Reduced air quality	Impose an appropriate speed limit at the site	Throughout		Contractor
	Apply aggregates on access road or sprinkle water along the access road and excavation areas as need be	When need be	BEP	Contractor
	Provision of PPE to workers and enforcement of usage	Throughout	Contractual	Contractor
	Proper and frequent maintenance of construction vehicles to minimize exhaust fume emissions	As per maintenance schedule		Contractor
	Sensitize construction vehicle drivers to turn off the engine when not in use	Annually	BEP	Contractor
	Cover conveyors to contain dust generated during crushing	Throughout		Contractor
	Preparation and implementation of an air quality monitoring plan to ensure compliance to limits set in schedule 1 of EMCA, Air Quality Regulations, 2014	At commencement	100,000 annually	Contractor
Excessive noise and vibration	Provision and enforcement of PPE to workers such as ear plugs/ear muffs	Throughout	Contractual	Contractor
	Construction vehicles and machinery should be fitted with noise dumpers to reduce the amount of noise produced	One off	BEP	Contractor
	Sensitize construction vehicle drivers to avoid unnecessary hooting and running of engines	Annually		Contractor
	Ensure compliance to EMCA, Noise and Excessive Vibration Pollution (Control) Regulations, 2009	Throughout		Contractor
Waste management	Develop and implement a waste management and monitoring plan for proper management of solid waste	Continuous	BEP	Contractor
	Provide for bins at various locations within the site. Practice waste segregation	One off	100,000	Contractor
	Avail a skip on site for disposal of all solid waste.	One off	10,000	Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
	Contract a licensed waste disposal company to collect and dispose general and hazardous waste	One off		Contractor
	Create awareness among workers on proper waste management practices such as collection, segregation and disposal	Quarterly		Contractor
	Construct a septic/soak pit for liquid waste management	One-off		Contractor
Occupational Health and Safety	Prepare and implement an Occupational Health and Safety Management Plan	One off		Contractor
	Train workers on safe work procedures and basics on health and safety at the work place	Quarterly		Contractor
	Ensure relevant safety signs are erected at the required places	One off		Contractor
	High risk activities should only be conducted by persons well trained and experienced in the field	Throughout		Contractor
	Fence the site and restrict entrance to authorized persons only	One off		Contractor
	Provide the right tools for the right task	Throughout		Contractor
	Ensure machinery are inspected and maintained regularly	As per machine specifications	BEP	Contractor
	Provide workers with relevant PPE for the different tasks being conducted	Throughout		Contractor
	Have relevant professionals to assist at the site such as a health and safety officer, first aider and fire marshals	Throughout		Contractor
Spread of diseases	Train workers on proper COVID 19 prevention measures	As appropriate		Contractor
	Provide wash stations or sanitizers for workers around the site	One off		Contractor
	Monitor and keep worker records such as temperature when coming in and leaving the site	Through out	100,000	Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
	Adhere to the recommended health measures put in place by the government to control the virus from spreading.	Throughout		Contractor
	Train and sensitize employees and the neighbouring community on HIV and AIDS prevention.	Quarterly		Contractor
	Have HIV and AIDS educational posters around the site	Throughout	50,000	Contractor
Operation Phase				
Air Quality	Sprinkling of water regularly using appropriate means around the quarry pit and other dusty areas to control fugitive dust	Daily	Contractual	Contractor
	Apply aggregates or sprinkle water regularly on the access road.	When need be		Contractor
	Restrict construction vehicle speed within the site to a set maximum limit	Throughout		Contractor
	Proper and frequent maintenance of construction vehicles and machinery to minimize exhaust fume emissions	As per maintenance schedule		Contractor
	Sensitize construction vehicle drivers to turn off the engine when not in use	Annually		Contractor
	Workers should be provided with dust masks or respirators depending on the area they are working to prevent inhalation of small dust particles that can cause respiratory illnesses. The use of this PPE should also be enforced to ensure their protection	Throughout		Contractor
	Preparation and implementation of an air quality monitoring plan to check on the effectiveness of mitigation measures and ensure compliance to limits set in schedule 1 of EMCA, Air Quality Regulations, 2014	One off	100,000	Contractor/NEMA
Excessive noise and vibration	Alert neighbors in advance before blasting on the day and time it has been scheduled	When blasting		Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
	Sensitize construction vehicle drivers to avoid unnecessary hooting and running of engines	Quarterly		Contractor
	Provision and enforcement of relevant PPE to workers such as ear muffs and ear plugs	Throughout		Contractor
	Regular monitoring of noise and vibrations	Annually	100,000 annually	Contractor
	Ensure compliance to EMCA, Noise and Excessive Vibration Pollution (Control) Regulations, 2009	Throughout		Contractor
Impact of blasting	From the vibration and velocity analysis, the maximum charge weight for blasting plans should be 100 kilograms. Blast-hole design should therefore take this into account	Throughout	BEP	Contractor
	Rock breaking methods adopted at each quarry site be based on a balance between suitability, the required payload, cost and the impact on the environmental receptors	Throughout	BEP	Contractor
	Give a minimum 1 week notice indicating day and time of blasting to people within 500 m radius	When blasting		Contractor
	Explain the expected effects/experience of blasting to the community prior to blasting	One off		Contractor
	All loading and firing should be directed and supervised by competent person(s) thoroughly experienced in this field and accredited accordingly.	Throughout		Contractor
	Employing qualified personnel to handle and store the explosives	Throughout		Contractor
	Providing and enforcing the use of earmuffs/ear plugs to all workers and visitors to the facility	Throughout		Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
	The proponent should map out all susceptible structures within 250 m radius before commencement	One off		Contractor
	Adhere to the provisions of the Explosives Act, 2012	Throughout		Contractor
Clearance of vegetation	Stage vegetation clearance	Throughout		Contractor
	Identify an area for compensatory tree planting	One off	100,000	Contractor
Contamination of ground and surface water resources	Proper waste management to ensure no waste gets to the stream, dam, lake or seeps into the ground water reservoir.	Throughout		Contractor
	Any waste water from machinery such as the crusher, mixing plant, batching plant and the rest should be properly disposed and not find its way to the seasonal stream, dam or lake	Throughout		Contractor
	Ensure blasting and drilling are not undertaken to the water table	Throughout		Contractor
	Use of sandbags or silt fences to prevent sediments from leaving disturbed areas	One off	BEP	Contractor
	Maintain maximum existing vegetation coverage and plant more trees along the boundary wall to act as buffers	Throughout		Contractor
	Store soil heaps away from water ways and on flat surfaces to minimize erosion	Throughout	BEP	Contractor
	Regular servicing of construction vehicles to ensure there are no leaks	As per maintenance schedule		Contractor
	Servicing of vehicles in a bunded area so that any spills and contained	Throughout		Contractor
	Ensure a spill kit is availed on site to handle any spills/leaks that may occur	Throughout		Contractor
Pressure on existing water resources	Ensure proper use of water e.g. by installing automated taps and recycling where possible	One off	BEP	Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
	Practice rain water harvesting during the raining season to reduce pressure on existing resources	Throughout		Contractor
	Sensitize workers on water conservation	Annually		Contractor
Increased surface runoff	Create proper storm water drainage channels to reduce soil erosion	One off	BEP	Contractor
	Use porous material for the parking spaces	One off	BEP	Contractor
	Minimize vegetation clearance to reduce storm water speed and increase water infiltration time	Throughout		Contractor
	Avoid concreting areas that are not necessary	One off	BEP	Contractor
Impact on fauna	Stage vegetation clearance to reduce the impact on loss of habitat	Throughout		Contractor
	Workers should not injure or kill any wildlife for any reason including game meat	One off	BEP	Contractor
Waste generation	Contract a licensed waste handler to properly collect and dispose the waste as per EMCA waste management regulations, 2009.	Through out		Contractor
	Re-use overburden and topsoil in quarry backfilling	One off		Contractor
	Reuse or give out quarry fines instead of dumping	Throughout		Contractor
	Construct a septic/soak pit for liquid waste management	One off		Contractor
	Provide for bins at various locations within the site. Practice waste segregation	One off		Contractor
	Avail a skip on site for disposal of all solid waste.	One off		Contractor
	Create awareness among workers on proper waste management practices such as collection, segregation and disposal	Quarterly		Contractor
	Put in place a waste management and monitoring plan for proper management of solid waste	Throughout		Contractor
	Prepare and implement an Occupational Health and Safety Management Plan	Throughout		Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
Occupational Health and Safety	Conduct toolbox talks on safe work procedures and basics on health and safety at the work place	As needed		Contractor
	Ensure relevant safety signs are erected at the required places	One off		Contractor
	High risk activities should only be conducted by persons well trained and experienced in the field	Throughout		Contractor
	Fence the most risky site(s) and control access	One off		Contractor
	Provide the right tools for the right task	Throughout		Contractor
	Ensure machinery are inspected and maintained regularly	As per machine specification	BEP	Contractor
	Provide workers with relevant PPE for the different tasks being conducted	Throughout		Contractor
	Have relevant professionals to assist at the site such as a health and safety officer, first aider and fire fighters	Throughout		Contractor
	Ensure workers sign a code of conduct binding them to observe all safety requirements	One off		Contractor
Impact on soil	Best engineering practices e.g. staging the construction site to avoid clearing areas that are not required	Throughout	BEP	Contractor
	Temporal heaps should be stored in flat areas and away from storm water channels	Throughout	BEP	Contractor
	Proper maintenance of machinery and equipment to avoid or minimize leakages from such machines among others	As per machine specification	BEP	Contractor
	Service and fuel vehicles within a bound area	Throughout		Contractor
	Ensure a spill kit is availed on site	Throughout		Contractor
Visual intrusion	Backfill the quarry pits with the overburden generated during excavation if quarry is to be fully decommissioned upon project completion	When need be		Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
	Create drainage channels so water does not accumulate in the pit	As needed	BEP	Contractor
Spread of diseases	Train workers on proper COVID 19 prevention measures	One off		Contractor
	Provide wash stations or sanitizers for workers around the site	One off		Contractor
	Monitor and keep worker records such as temperature when coming in and leaving the site	Daily		Contractor
	Adhere to the recommended health measures put in place by the government to control the virus from spreading.	Throughout		Contractor
	Train and sensitize employees and the adjacent community on HIV and AIDS prevention and avoidance	Quarterly		Contractor
	Have HIV and AIDS educational posters around the site	One off		Contractor
Decommissioning Phase				
Risk of accidents	Ensure there are sufficient, visible danger-sign posts at the site to warn passers-by or workers as they approach high risk areas.	One off	BEP	Contractor
	Fence off the most risky sites	One off	BEP	Contractor
	Limit high risk activities to those who are well trained and experienced in the area	Throughout		Contractor
	Adopt a comprehensive health and safety plan as outlined in the Occupational Health and Safety Act (2007).	Throughout		Contractor
Reduced air quality	Stabilize dust emissions on all on-site access roads and auxiliary structures to be demolished by effectively spraying them with water.	When need be		Contractor
	Minimize idling time of machines and vehicles.	Throughout		Contractor
	Limit the hours of operation of heavy duty equipment and/or the amount of equipment in use.	Throughout		Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
Excessive noise and vibration	Provide sufficient protective gear such as ear muffs/ear plugs to demolition work force operating equipment with noise levels greater than 70dBA continuously for 8 hours and those workers near noisy areas.	Throughout		Contractor
Waste generation	Prepare a site waste management plan which outlines expected waste streams and modes of disposal.	One off		Contractor
	Contract a licensed waste handler to collect and dispose the waste as per EMCA, waste management regulations, 2006.	One off		Contractor
	Where practicable, reuse or give away demolition waste	One off		Contractor
	Re-use overburden and topsoil in quarry backfilling	One off		Contractor
Liquid waste	No grey water runoff or uncontrolled discharges from the site/working areas (including washdown areas) to the adjacent Sachangwan River shall be permitted;	Throughout	Best practice	Contractor
	Prevent discharge of sediment and other suspended materials loaded run – off from the site/working areas to the adjacent Sachangwan and Molo rivers.	Throughout		
	Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered;	Throughout		
	Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted;	Throughout		

11 ENVIRONMENTAL AUDITING AND MONITORING PLAN

1.1 Introduction

An Environmental Monitoring Plan is required to ensure full and systematic implementation of the Environmental Management Plan. It entails assessment of environmental performance of the proposed project by documenting, tracking and reporting any changes in environmental parameters in space and time. The purpose of environmental monitoring is to ensure that impacts do not exceed legal standards specified under Environmental Management and Coordination Act Cap 287 of the laws of Kenya and where they exceed appropriate mitigation measures and early warning systems are provided. The frequency of monitoring will vary depending on the parameters, stage of project implementation and the severity of the anticipated/predicted environmental impacts. The monitoring plan is developed not only in relation to satisfying the statutory requirements of the EIA process, but also as a proactive tool for the proper implementation of the project, within the context of its relationship to the integrity of the environment as well as the stakeholders in the area.

The proposed monitoring plan will have the following components;

1. Health and safety monitoring plan
2. Air quality monitoring plan
3. Water quality monitoring plan
4. Solid waste monitoring plan
5. Noise monitoring plan
6. Rehabilitation and biodiversity monitoring plan
7. Energy monitoring plan

1.2 Health and safety monitoring plan

Quarrying activities pose potential threats to the health and safety of workers and visitors. This may be in the form of dust from excavation works, fumes from machinery and vehicles accessing the site, accidents from machinery and equipment, injuries that may result from excavation activities and accidental falls. During rainy seasons, abandoned quarry pits may become important breeding grounds for disease causing pathogens or lead to drowning in case of accidental falls. The purpose of health and safety monitoring plan is to assess existing controls alongside potential health and safety risks in order to develop an effective plan of action and to ensure compliance with Occupational Safety and Health Act, 2007.

1.2.1 Monitoring frequency

The responsibility for implementing this monitoring plan will vest in the Occupational and Safety Services and of course the Management.

1.2.2 Monitoring strategy

The monitoring schedule will involve conducting occupational health and safety reviews and reports by the proponent, fire safety audits, energy audits among others that will be necessitated by operational activities of the quarry. There will be need for incidents register to document all occurrences, date, place, time, nature

of incident, who was involved, action taken and preventive measures implemented throughout the year. The ideal indicators of success will include zero accidents and fatalities and reduction in the number of incidents and accidents at the site.

1.3 Air quality monitoring plan

Potential sources of air pollution at the project site are mainly dust from excavation activities, drilling and blasting and stone crushing. Other sources include emissions from machinery/ equipment and exhaust fumes from vehicles accessing the site and standby generator. Air pollution and emissions above the acceptable level can potentially cause health problems which include respiratory diseases and visual irritants. The purpose of the air quality monitoring plan is to therefore measure the concentrations of dust and gaseous emissions emanating from the project activities and the results compared to the Air Quality Regulations, 2014 to ensure compliance. In addition, the results will be used to evaluate if the adopted air pollution controls and management are effective.

1.3.1 Monitoring parameters

The standard specified target values for the purpose of environmental monitoring and protection are stipulated in the First Schedule of the Air Quality Regulations, 2014. The main pollutants of concern associated with quarries are; PM_{10} $PM_{2.5}$ TSP, VOCs, SO_2, NO_2 and O_3.

1.3.2 Monitoring location

Air quality monitoring will be conducted within the site and areas in close proximity to the residential developments and other neighborhoods. These locations are considered to be sensitive receptors.

1.3.3 Monitoring frequency

Monitoring will be done on a quarterly basis in collaboration with a NEMA or by a NEMA accredited laboratory.

1.3.4 Test equipment

The instruments to be used during Air Quality measurements should be similar to the one used during the baseline survey to ensure accuracy of inspection, measurements and results. Measurement of the air quality parameters will therefore be achieved using the AQM-09 air quality monitor for Henan Oceanus which was the equipment used for baseline survey.

1.4 Noise monitoring plan

Quarrying involves several activities that generate significant amount of noise. These include blasting, use of powered machineries to transport the aggregates and processing plants that will crush and grade the materials. The purpose of noise monitoring plan is to therefore ascertaining the extent of the impact due to the establishment and subsequent operation of the Quarry and other installations in compliance with the Environmental Management and Coordination (Noise and Excessive Vibrations pollution) (control) Regulations, 2009. The results will be compared to the results that were obtained during the baseline survey and the maximum permissible noise levels stipulated under the Environmental Management and Coordination (Noise and Excessive Vibration pollution) (control) Regulations, 2009.

Table 11-1: Maximum permissible noise levels (mines and quarries) as per the Environmental Management and Coordination (Noise and Excessive vibrations) Regulations, 2009

Facility	Limit Value in dB (C) Max

For any building used as a health facilities, educational institutions, convalescent home, old age home or residential building	109 dB (C)
For any building in an areas used for residential and one or more of the following purposes: Commerce, small-scale production, entertainment, or any residential apartment in an area that is used for purpose of industry, commerce or small-scale production or any building used for the purposes of industry, commerce or small-scale production	114 dB (C)

1.4.1 Monitoring location

Noise level measurements shall be conducted at the same locations as for air quality monitoring.

1.4.2 Monitoring frequency

Monitoring will be done on a quarterly basis in collaboration with a NEMA, DOSH or by a NEMA accredited laboratory. Noise levels will be measured in dB (A).

1.4.3 Test equipment

The instruments to be used during noise measurements should be similar to the one used during the baseline survey to ensure accuracy of inspection, measurements and results. Larson Davis Type 1 is the instrument that was used to measure noise level during the baseline noise study.

1.5 Water quality monitoring plan

The quarry will exert pressure on water for washing of vehicles and machinery, sanitation purposes, dust suppression, material processing and general housekeeping around the area. The objective of the monitoring plan is to provide data and information to improve water quality and management of effluent and to comply with the standards prescribed by the Third Schedule of the Environmental Management and Coordination (Water Quality) Regulations, 2006. This is important because there is a potential impact for contamination and/or sedimentation of River Sachangwan.

1.5.1 Monitoring parameters

The water quality parameters to be monitored and the corresponding values prescribed in the Water Quality Regulations, 2006 are shown below.

Table 11-2: Water Quality Monitoring Parameters and the standards prescribed by the Environmental Management and Coordination (Water Quality) Regulations, 2006

Parameter	**EMC (Water Quality) Regulations, 2006 Standards**
PH Value	6.5-8.5
BOD mg/L	30max
Chemical Oxygen Demand mg/L	50 max
Total Suspended Solids mg/L	30 max
Ammonia-NH+;mg/L	100 Max
Total Dissolved Solids mg/L	1200 Max
E. Coli Colonies count/100ml	Nil
Total coliform count/100ml	1000/100ml

1.5.2 Monitoring frequency

The frequency of monitoring will be quarterly. This will be implemented in collaboration with NEMA or by a NEMA accredited laboratory.

1.6 Solid waste monitoring plan

Solid waste generation is likely to emanate from workforce at the site, construction activities and servicing of machinery, equipment and motor vehicles. Poor disposal of solid waste causes environmental pollution and therefore a health risk to communities. The purpose of the monitoring plan is to therefore ensure solid waste is managed in such a way that it protects both the public health and the environment.

1.6.1 Monitoring frequency

The frequency of solid waste monitoring will differ from the collection to the disposal stage in order to ensure reduced odours and accumulated heaps of waste. The table below describes the outline for which the activity will be monitored but can be adjusted depending on the amount generated.

Table 11-3: Sample outline for solid waste monitoring plan

Parameter	Frequency	Critical level (Tons)	Target	Responsibility
Storage	Weekly			
Management	Monthly			
Collection	Weekly			
Disposal	Weekly			

1.6.2 Monitoring strategy

The solid waste monitoring plan will document the collection, storage and disposal of solid wastes from the different working areas in the site. There is need to code each of the collection points, note the capacity and critical levels, frequency of disposal and the personnel responsible. In addition, it will be important to characterize the waste streams at the collection points to inform investments in segregation infrastructure. Indicators of success will include timely collection and disposal of wastes by the contractors, waste disposal tracking documents and certificates issued at the disposal sites in case of hazardous wastes.

1.7 Rehabilitation and biodiversity monitoring plan

Quarrying activities will lead to creation of ecologically vulnerable land by tampering with the soil structure leaving pits and exposing the site to possible landslide and soil erosion, and destruction of various fauna and flora. A rehabilitation and biodiversity monitoring plan will ensure the site is restored to its near natural productive state and it will inform continual improvement of the ecological state after rehabilitation.

1.7.1 Monitoring frequency

The proponent will ensure monitoring is carried out annually.

1.7.2 Monitoring strategy

Monitoring will entail documenting on the flora and fauna species and ecological communities present at monitoring sites, monitoring of subsidence and erosion from areas re-profiled and rehabilitated and

providing recommendations where necessary to enable continual improvement of the ecological management of the project area.

1.8 Energy monitoring plan

Energy consumption will be monitored through power bills from the Kenya Power and the fuel consumption by the standby generators and other machinery on a monthly basis. The quantitative audit findings will aim to inform substantial practical guidelines for continuous improvement of consumption efficiency and identifying cost saving opportunities in energy efficiency.

12 CONCLUSION AND RECOMMENDATIONS

The findings of the ESIA study indicate that the project will have general positive impacts on the socio-economic environment. The most important socio – economic benefits are employment creation, skills transfer, source of revenue for the government and growth of the local economy. The most important negative impacts are air pollution, land degradation and noise and vibrations.

Other potential negative impacts include community health and safety risks, occupational health and safety risks, waste management, potential for substance abuse, potential for child labour. Moderate to low impacts anticipated on the bio – physical environment can be mitigated by the measures proposed. In general most of the environmental and social management measures proposed are generally straight forward but others require creative and innovative ways to implement. Nonetheless, most of the measures relate directly to sound operating practices both during the construction phase and subsequently over the operational life of the quarry. Therefore, it is anticipated that the project will have minimal residual negative impacts on both the socioeconomic and biophysical project environment if the mitigation measures proposed in this report are implemented. It is recommended that a copy of the ESMP should be provided to personnel in charge of implementation for reference throughout the project life cycle.

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