NAIROBI - NAKURU- MAU SUMMIT HIGHWAY PROJECT

DRAFT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

For

ELEMENTAITA QUARRY AND CONTRACTOR'S CAMP

Prepared By

E-CUE ASSOCIATES LIMITED

Environmental Management Consultants
Karen connections, office suite 10
P. O. Box 14249 00800, Nairobi
Email: info@e-cueassociates.co.ke
0741726968

Client

SOGEA SATOM
Maple Court - Westlands Close - Westlands
P.O. Box 39367-00623
Nairobi Tel. : +254 780 555 629
sogeakenya@vinci-construction.com

October 2021

DOCUMENT DATA

General Information

Author(s)	T. OMENDA, N. MARWA, D. ODERO, M. OKOTH, J. GOSSAGE, C. ODUOR
Project	Nairobi - Nakuru – Mau Summit Road Project:
Document	Environmental and Impact Assessment or the proposed Elementaita Hardstone Quarry
Date	12 October 2021
Version	Version 0
Reference	SS NC1

Revisions

Version	Date	Written by	Approved by	Modifications
0		N. Marwa / Team Members	Tom Omenda	
1	12/10/2021	N. Marwa / Team Members	Tom Omenda	By Naveen Dinnoo
2	22/10/2021	Tom Omenda	Naveen Dinnoo	

Recipients

Name	Department	Comments
Naveen Dinnoo	Sogea Satom Kenya	Soft copy by mail
NEMA	NEMA	Soft copy and Hard copies

CERTIFICATION

I, **Tom Omenda**, NEMA Registration No. 0011 of E-Cue Associates, submit the following Environmental Impact Assessment (ESIA) Project Report for proposed Elementaita Quarry and Contractor's Camp in Gilgil Sub County, Nakuru County, Kenya.

The ESIA study has been carried out according to the Environmental Management and Coordination Act, 1999 (revised 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: 09/11/2021

The Environmental Impact Assessment Team

Tom Omenda	-	Lead Expert (Team leader)
Nancy Marwa	-	Environmentalist
Dan Odero	-	Geologist
Oduor Chrisphine	-	Noise and Air Quality Expert
Fredrick Maseno	-	Occupational Health and Safety Expert
Meryl Okoth	-	Environmentalist
Joe Gossage	-	Sociologist

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..... Naveen Dinnoo .....

Designation..... QHSE M. ..... Signature.....

Date..... 01.11.2021 .....

SOGEA SATOM KENYA
QHSE MANAGER
TEL: +254 780 419 077
Email: naveen.dinnoo@vinci-construction.com

ACRONYMS

ASALs	Arid and Semi- Arid Lands
BEP	Best Engineering Practice
CDA	Community Development Agreement
dBA	A-Weighted Decibels
DOSHS	Directorate of Occupational Safety and Health Services
EAC	East African Community
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GHG	Green House Gas emission
GoK	Government of Kenya
IUCN	International Union for Conservation of Nature
NBSAP	National Biodiversity Strategy and Action Plan
NCA	National Construction Authority
NCCAP	National Climate Change Action Plan
NCCRS	National Climate Change Response Strategy
NEAP	National Environment Action Plan
NECC	National Environmental Complaints Committee
NEMA	National Environmental Management Authority
NEP	National Environment Policy
NO_2	Nitrogen Dioxide
OEL	Occupational Exposure Limit
OHS	Occupational Safety and Health
OSHA	Occupational Safety and Health Act
PCC	Public Complaints Committee
PM	Particulate Matter
PMTCT	Prevention of Mother to Child Transmission
PPE	Personal Protective Equipment
PPP	Public Private Partnership
PWD	Persons With Disability
SDGs	Sustainable Development Goals
SERC	Standards and Enforcement Review Committee
SO_2	Sulfur Dioxide
ToR	Terms of Reference
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNFCC	United Nations Framework Convention on Climate Change
WRA	Water Resources Authority

EXECUTIVE SUMMARY

Introduction

The proponent, Sogea Satom Kenya, commissioned ECUE Associates Limited to conduct an Environmental and Social Impact Assessment (ESIA) Study Report for the proposed hardstone quarry and camp which is located in Elementaita within Ebburu/Mbaruk Ward, Gilgil Sub County, Nakuru County. The quarry is intended to supply aggregate materials for the construction of the Rironi-Nakuru-Mau Summit highway (A8). The ESIA study is prepared pursuant to Section 58 of Environmental Management and Coordination Act Cap. 387, Laws of Kenya. The report is an analysis of potential environmental and social impacts of the proposed quarry and associated infrastructure. In addition baseline environmental and social conditions of the project area are provided to enable future monitoring of the environmental and social performance of the project.

Methodology

The consultant conducted desktop studies, field surveys and necessary tests to establish the baseline conditions. In addition, questionnaires were administered to the public, public meetings and discussions with key informants in the vicinity of the quarry site were also done to get their views on the project. Among the tests done were ambient noise and air quality measurements and vibration. Considering that the site is within the Rift Valley at Elementaita, a heritage impact assessment was also undertaken.

Project location

The site is in Nakuru County, Gilgil Sub County, Ebburu/Mbaruk Ward at 0^{o} 24’ 52” S 36^{o} 15’ 23”E, 0^{o} 24’ 20” S 36^{o} 15’ 08”E. It is about 200m off set from the Nairobi-Nakuru Highway (A8). The entire site is about 82 acres of land of which 25 acres is for quarrying and 57 acres for installations and undisturbed areas.

Components

Other than the quarry itself, other installations at the site include: crusher plant, asphalt plant, material storage area, offices, workshop, emulsion plant, mixing plant, concrete plant and precast area, explosives store and other support infrastructure such as stand by generator. The main processes during quarrying are; blasting, excavation, loading and transportation of boulders to the crushers which will break them into different categories of aggregates.

Infrastructure utilities for the project include tapping electricity from the power line crossing the site, sinking one borehole to meet water demand and construction of a septic/soak pit for waste water management.

Policy, Legal and Regulatory Framework

The study also reviewed various policy, legal and regulatory frameworks and the most relevant ones are the Constitution of Kenya 2010, Environmental Management and Coordination Act Cap. 387 of the laws of Kenya, Mining Act, 2014, Explosives Act, 2016, Occupational Safety and Health Act, 2007, Public Health Act Cap. 242, Water Act, 2016, Physical Planning Act 2012, National Museums and Heritage Act, 2006 and Occupiers Liability act Cap 34.

Policies, institutional framework, National Environmental Guidelines, National Strategies and Action Plans, World Bank Environmental and Social Framework and Multilateral Environmental Agreements relevant to the proposed quarry project were also reviewed.

Baseline Environment

The proposed site is characterized by alluvial soils. Within the project area vegetation density varies from low to high but mean vegetation cover within the site is medium density with some mature trees mainly *Acacia xanthophloea*. Other species identified include *Euclea divinorum,* other non-tree species include *Aloe capitata var. quartziticola*, Opuntia Species and *Euphorbia trigona.* Another section of the proposed site has a medium density cover of mature *Acacia xanthophloea* and *Psiadia punctulata. Psiadia punctulata* is used by the locals for medicinal purposes i.e. to manage flues.

The proposed site has a seasonal stream crossing it. The stream drains into a private dam which when full drains into Lake Elementaita. There are also two existing boreholes on site (one is productive and another is non-productive).

The current baseline noise levels have exceeded the set limits prescribed by the Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009, averaging 35 dBA as opposed to 25 dBA limit. The major source of noise is the Nairobi-Nakuru Highway which is about 200m from the site. The baseline air quality levels were however within the set limits with the major air pollutants being vehicles using Nairobi-Nakuru Highway A8.

The proposed site is largely used for grazing. However, some wildlife notably are monkeys, rock hyrax, guinea fowls and snakes were spotted. The neighbouring Soysambu Conservancy about 2.4km from the site is a wildlife dispersal area. Soysambu conservancy is a host to large populations of zebras, buffalo, eland, impala, Thompson's and Grant's gazelle, waterbuck, reedbuck, warthog, steenbok, klipspringer, and colobus monkey. It is also home to the introduced population of Rothschild's Giraffe (*Giraffa camelopardalis rothschildi)* which is listed in the IUCN red list as an endangered species and the Kenya Horned Viper (*Bitis worthingtoni)* listed as vulnerable in the IUCN red list.

There are no major waste management challenges in the area as it's in a rural setting where wastes are mainly organic. There is no form of liquid waste management existing in the site.

Public Consultation

Public consultation was conducted through key stakeholder interviews, public meeting and administration of questionnaires. Due to COVID 19 the public meeting was restricted to 58 persons held on 7th September 2021and to augment this, 36 questionnaires were administered. The key environmental concerns that were identified include air and noise pollution and potential impacts of excessive vibration on buildings.

A second public meeting was held on 8th October 2021 with 18 people in attendance. The major concerns were excessive noise and vibration, potential contamination of Lake Elementaita, aesthetics and public and animal health and safety.

Anticipated Impacts

The proposed project will have both positive and negative impacts. The anticipated positive impacts include; creation of employment and business opportunities, source of revenue to the government, acquisition of new skills.

There are also various negative impacts anticipated. They were analyzed and ranked as shown in the table below;

Magnitude	Impact	Mitigation Measures
High	Potential for water contamination	• 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. This particularly applies to water emanating from concrete batching plants and concrete swills; • Ensure proper waste management so that no waste finds itself in the seasonal stream and eventually into the dam and lake • Ensure blasting and quarrying do not hit the water table, except borehole drilling • 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
	Land degradation	• Locate stockpiles, overburden and quarry waste away from sight where possible • Progressively backfill and rehabilitate quarry faces using the overburden generated during excavation
	Risk of accidents and incidents	• 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 • 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
	Excessive noise and vibrations	• 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 • Rock breaking methods adopted should be based on a balance between suitability, the required payload, cost and the impact on the environmental receptors. • Alert neighbors in advance before blasting on the day and time it has been scheduled • Provision and enforcement of relevant PPE to workers such as ear muffs and ear plugs • Regular monitoring of noise and vibration
	Air Quality	• Retaining existing vegetation in areas which are not earmarked for quarrying to act as dust screens and a buffer zone between quarrying area and neighbours • Sprinkling of water regularly around the quarry pit and other dusty areas using appropriate means such as water bowsers to suppress fugitive dust emission • 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
Medium	Pressure on	• Ensure proper use of water e.g. by installing automated taps and recycling

Magnitude	Impact	Mitigation Measures
	existing water resources	where possible • Practice rain water harvesting during the raining season to reduce pressure on existing resources • Sensitize workers on water conservation
	Clearance of vegetation	• Utilize the area without large vegetation cover • Clear only those trees that are within the area to be developed • Consider compensatory tree planting for trees cut
	Sedimentation of water resources	• Use of sandbags or silt fences to prevent sediments from leaving disturbed areas • Maintain maximum existing vegetation coverage • Store soil heaps away from water ways and on flat surfaces to minimize erosion
	Increased surface runoff	• Create proper storm water drainage channels to reduce soil erosion • Use porous material for the parking spaces • Minimize vegetation clearance to reduce storm water speed and increase water infiltration time • Avoid concreting areas that are not necessary
	Change in land use	• Avoid disturbing areas that won't be used for installations so their original state is maintained
	Impact on fauna health and safety	• Fence the site and erect relevant signage for herders so as to ensure there are no safety risks to animals
	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
	Exposure to soil erosion	• Excavated soil should be placed on flat surfaces and away from water ways • Cover any heaped soil to minimize erosion by wind
	Loss of wildlife habitat	• Stage vegetation clearance to reduce loss of habitat
Low	Spread of water borne diseases	• Backfill the pit if further exploration is not intended, to avoid stagnated water, hence water borne and water related diseases. • If further exploration is anticipated, create a drainage channel to ensure no water stagnates in the pit
	Spread of HIV/AIDS	• Contract a health practitioner to train and sensitize employees and possibly the adjacent community on HIV and AIDS. • Have HIV and AIDS educational posters around the site
	Spread of COVID 19	• 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.

Environmental and Social Management Plan

An ESMP was prepared to help mitigate the identified impacts during implementation. In addition to the ESMP, a monitoring plan was also prepared and a site rehabilitation plan too.

Conclusion and Recommendation

Quarry construction and operation phases have significant multifaceted environmental and social impacts. The ESIA has identified potential for water contamination, land degradation, risk of accidents and incidents, excessive noise and vibrations and particulate matter emissions as the anticipated high impacts. All these

impacts can be sufficiently mitigated by operational and engineering controls to minimize or eliminate the adverse environmental and social effects.

The other impacts identified were of medium and low intensity all of which are mitigable if the contractor implements the ESMP provided and also conducts monitoring for all aspects listed.

It is our recommendation that the project be allowed to go on provided the mitigation measures outlined in the report are adhered to, Environmental and Social Management Plan (ESMP) is implemented and the proponent adhere to the conditions of NEMA EIA license that will be issued.

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1 INTRODUCTION

1.1 Background

The Government of Kenya (GoK), through the Public Private Partnership (PPP) is implementing a strategic program to attract private investment in infrastructure projects in Kenya. Key among the infrastructure projects is the Nairobi- Mau summit road (A8) which is proposed for upgrading into a dual carriage and in cases where there is more traffic, there is the provision for a sixth lane to be added. The construction work will be funded under the Public Private Partnership Model (PPP) with Kenya National Highways Authority being the contracting agency. This project will also include the strengthening of Nairobi - Mai Mahiu – Naivasha road (C88).

The construction activities will require the use of materials such as rocks, stone chippings, sand and gravel. The proponent has opted to source the material himself thus the need to open up new quarries. This report has therefore been prepared in compliance to EMCA, 2019 for the proposed quarry sites.

1.2 Project Objectives

The main objective of the quarry is to acquire quality rock aggregates for construction of the Nairobi – Mau Summit Road (A8).

1.3 Justification of the project

The engineering works along the two roads (A8 & A8 South) will require the use of materials from quarries which include ballast and stone chippings. These materials will be mixed with bitumen for asphalt concrete for road works and cement for civil works. Material sites will be required to be located close to the construction to help in:

1. **Reducing the cost of construction**: when materials are sourced close to the project, the entire cost of the construction will be reduced due to reduced haulage distance and time.
2. **Job creation**: most of the quarrying activities will involve the use of machines and in some cases human labor. The locals with knowledge on machine operation will be employed in the quarry.

1.4 ESIA Objectives

1.4.1 Broad Objective

This Environmental and Social Impact Assessment (ESIA) report has been prepared to identify the significant linkages of the quarry project to the environmental and social settings of the project area.

The ESIA report provides management plans and intervention actions that are based on the physical environment and social features, defined timelines and implementation cost elements.

1.4.2 Specific Objectives

- To identify all potential adverse environmental and social impacts of the proposed quarry.
- To assess the significance of these impacts
- To recommend mitigation measures for the significant negative impacts identified
- To assess the relative importance of the impacts of alternative plans, designs and sites.
- To provide information on the impacts of alternatives
- To generate baseline data for monitoring and evaluation of how well mitigation measures will be implemented to mitigate against expected impacts from the project.

1.5 Justification of the ESIA

According to EMCA, 1999 (Revised, 2019) second schedule, quarries are classified as high risk projects thus require an Environmental and Social Impact Assessment (ESIA) to be done before their implementation. The ESIA process is used to identify and asses the anticipated environmental and social impacts and their magnitude in order to recommend mitigation measures for the negative impacts. The report also contains an Environmental and Social Management Plan (ESMP) that will be applied during operation to ensure proposed mitigation measures are implemented and monitored.

1.6 Project Location

The proposed quarry site is located in Nakuru County, Gilgil Sub County, Ebburu/Mbaruk Ward at coordinates 0º 24’ 52” S 36º 15’ 23”E, 0º 24’ 20” S 36º 15’ 08”E. It can be accessed using the Nairobi-Nakuru Highway (A8) and is about 200m offset from the road. From the highway the site can be accessed using the old Nairobi-Naivasha road which is an all-weather road.

The proponent will develop 82 acres of land; 25 acres for quarrying and 57 acres for installations.

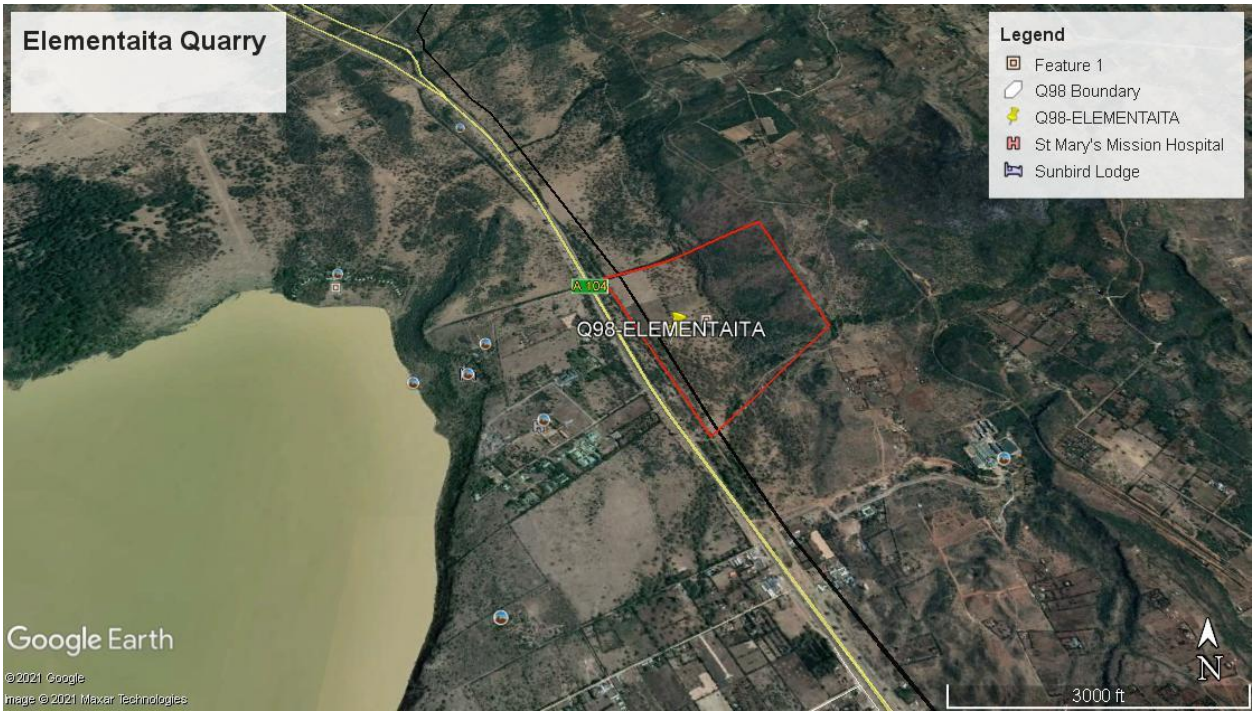


Figure 1-1: Google earth image of the project area

1.7 Project Proponent

The project proponent is Sogea Satom.

2 Methodology

The approach to this exercise was structured such as to cover the requirements under the EMCA 1999 (Amendment, 2019), 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 site layout plan and the implementation plan, as well as decommissioning.

Broadly, the project methodology shall be as follows

2.1 Screening

Environmental screening is undertaken to help determine whether or not the proposed project falls within a category that requires an ESIA prior to commencement. In addition, other considerations during the screening process include; determination of physical location, environmental sensitivity of the areas within and surrounding the site, nature of community and socio-economic 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 Desktop study

Available relevant literature was reviewed in order to get an understanding of the biophysical and social setting within the county and to get an in-depth understanding of the project area. These include published and unpublished literature on bio-physical conditions, socio-economic setting of the project area and legislative and policy framework applicable to the project.

2.3 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 to focus the ESIA process during the detailed study.

2.4 Site Assessment

These were carried out within the project area. The techniques used included tests, use of direct observations and recordings including photography, use of checklists and administration of questionnaires, public meeting and discussions with key informants in the vicinity of the site.

2.4.1 Baseline air quality measurement

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 quickly and accurately. It was customized for the applications as follows: 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.

2.4.2 Baseline noise measurement

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 providean expected typical or average daily condition.

A model Larson Davis LxT Type 1 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.

Description: Diurnal noise level Measurement in progress at SP2

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.

2.4.3 Vibration and velocity modelling

Rock samples were collected from the site on between 16th and 18th September 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 analyzed 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.

Regression analysis method was used to calculate peak particle velocities at various distances from blast source likely to be generated at the site by various charge weights See Annex VI for detailed methodology.

2.4.4 Archeological and Heritage Assessment

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.

To understand the archaeology of the proposed project area, a background study was undertaken, and relevant literature was 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.

2.4.4.1 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.

Figure 2: Archeological resources survey

2.4.4.2 Documentation

The previously mined quarry sites were fairly documented, whereas the proposed new quarry sites at Elementaita was documented through target sampling as outlined above. This 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 features. 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 proposed project site.

2.4.4.3 Restrictions

Some sections of the Elementaita new quarry could not be adequately surveyed because of among others, thick vegetation, lack of existing roads, rugged and hilly terrain. Bees colony in one of the rock shelters in which we wanted to make some test excavations. This limited the survey to some extent.

2.4.5 Baseline biological assessment

The baseline biological assessment was conducted on 18th and 19th August 2021 by walking through the proposed site noting the biological features, taking photographs and coordinates of key features. A checklist was used to ensure all environmental aspects were

captured.

Interviews with locals were also done to help identify plant species and their uses if any, water resources, their use and source and also in the identification of any wildlife at the proposed site.

2.4.6 Baseline social assessment

The social assessment was conducted through review of literature such as the Nakuru Integrated County Development Plan 2018-2022, 2019 Kenya Population and Housing Census among others. Site specific data was also collected on 18th and 19th August 2021 through interviews with locals, observation and photography. A checklist was used to ensure all social aspects were captured.

2.5 Identification and analysis of potential impacts and mitigation measures

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). A Leopold matrix was used in the analysis of the impacts.

2.6 Reporting

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

3 PROJECT DESCRIPTION

3.1 Project Activities

3.1.1 Construction Phase

- Preparation of a mine plan/layout and coordinating the activities on site
- Clearance of vegetation
- Improvement of access roads to the site
- Demolition of existing structures on site
- Installation of facilities and equipment such as crusher plant, storage for mining, offices, asphalt plant, workshop, emulsion plan, mixing plant, concrete plant and pre cast areas.
- Sinking of boreholes
- Connecting the site with electricity

3.1.2 Operation phase

- Vegetation clearance
- Removal of overburden
- Drilling of blasting holes and blasting
- Excavation of material using excavators
- Processing aggregates
- Transportation and processing of aggregates
- Transportation of final products to required area of use
- Asphalt plant operations
- Office operations
- Laboratories
- Routine maintenance

3.1.3 Decommissioning phase

- Uninstalling all components installed including crusher plant, storage for mining, offices, asphalt plant, workshop, emulsion plan, mixing plant, concrete plant and pre cast areas.
- Surface contouring of the site to create a stable land formation consistent with the surrounding landform
- Landscaping
- Site re-vegetation

3.2 Material Extraction Process

1. Vegetation clearing

The proponent will employ controlled clearing of vegetation in order to access the material site.

2. Removal of the over burden

The surface of natural rock beds are covered by some thickness of soil or lose material known as overburden. Irrespective of the methods of quarrying of stones, this over-burden will first be cleared before the actual quarrying operation could be started. Similarly, some loosely held rocks on the slopes will be removed to avoid accidents in the later operations.

The proponent will therefore follow/customize the outlined procedure in getting rid of the overburden.

3. Drilling and Blasting

A blast design will be prepared and shot holes plotted for drilling. Thereafter, blasting using explosives will be done to fragment and displace the solid rock.

4. Excavation

The blasted material will be excavated using excavators and transported using loaders and trucks to crushers for processing. The estimated area for excavation is about 10 Ha and an excavation depth of between 5m to 20m.

5. Crushing

The rocks will then be taken to the primary crusher, for processing through an impactor, jaw, or rotating crusher to generate a range of material sizes. Depending on the desirable size, a secondary crusher may be used to reduce the material size again before it is put through a sorting or screening process to ensure the resulting aggregate is of the correct size, shape and free of impurities.

6. Asphalt and concrete processing

The aggregate materials produced by the crushing processes are further processed, either by mixing it with bitumen in the asphalt mixing plant to form asphalt or by batching with cement and sand to form concrete. The resulting product is then transported to the construction site.

The approximate use of aggregates obtained for various works is as below;

a) Asphalt works (0/6, 6/10, 10/14) = 1,500,000 T
b) Civil work (0/5, 5/15, 5/25) = 700,000 T
c) Road Sub-base (GCS 0/30, GC3 0/20) = 3,000,000 T

The average estimated truck trips for the various products is a total of 70 trips. A breakdown per product is as shown below;

a) Asphalt 1 500 000T / 30T per truck = 50 000 trips on 4 quarries during 30 months of 20 days => 50 000 trips / 2400 days = 20 trip/day average

b) Concrete 700 000 T / 20T per mixer = 35 000 trips on 4 quarries during 30 months of 20 days => 35 000 trips / 2400 days = 15 trip/day average

c) GCS 1 100 000T / 30T per truck = 37000 trips on 4 quarries during 30 months of 20 days => 37 000 trips / 2400 days = 15 trip/day average

d) Subbase with cement 1 200 000T/30T = 40 000 trips on 4 quarries during 30 months of 20 days => 40 000 trips / 2400 days = 17 trip/day average

3.3 Expected period of use

The proponent has estimated a period of about 42 months for use of the proposed quarry.

3.4 Project Components

Other than the area to be quarried, the site will have other components installed on site. The table below shows the various components and the area they will occupy.

Table 3-1: Project components

	Installation			
	Area	Number	Unit Surface (m^2)	Total Surface (m^2)
Quarry	Quarry (in case of 5 m quarry wall)	1	100,000 m^2	100,000
	Storage for mining	1	1,700 m^2	1,700
	Crusher	2	13,500 m^2	27,000
	Aggregate storage area	2	54,000 m^2	108,000
Industry	Asphalt plant	2	10,500 m^2	21,000
	Emulsion plant	1	4,200 m^2	4,200
	Concrete plant	2	2,300 m^2	4,600
	Mixing plant	1	2,300 m^2	2,300
	Precast (small items)	2	8,600 m^2	17,200
	Precast (beams)	1	19,500 m^2	19,500
Office	Offices (100P)	2	9,200 m^2	18,400
	Workshop	1	7,600 m^2	7,600
			Total (m^2)	331,500 m^2
			Total (ha)	33.15 ha

The proposed layout of all the above components including the quarry areas is as shown in the figure below:

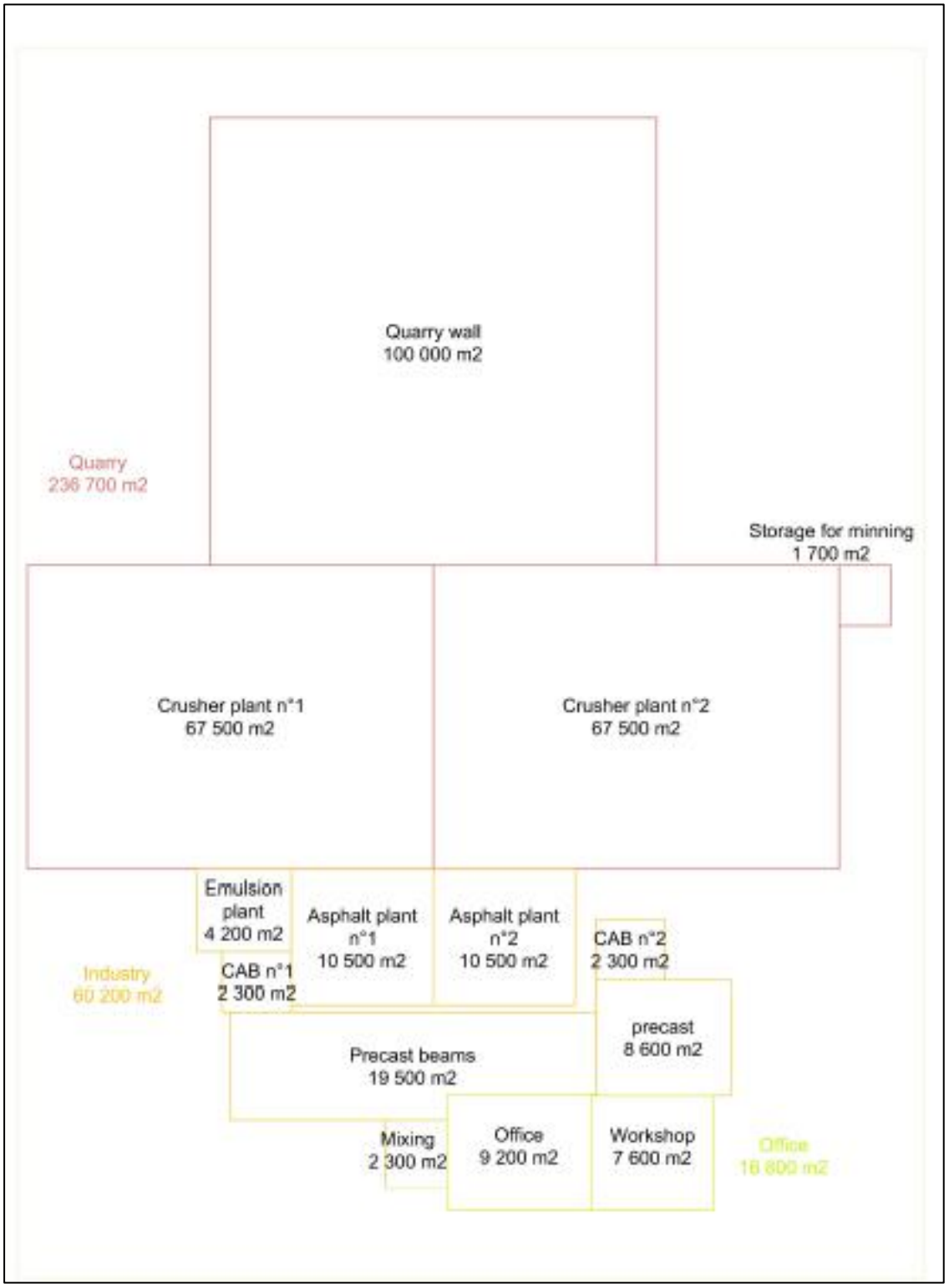


Figure 3-1: Proposed site layout

3.4.1 Crusher plant

A crusher uses a mantle that gyrates, or rotates, within a concave bowl. As the mantle makes contact with the bowl during gyration, it creates compressive force, which fractures the rock. The gyratory crusher is mainly used in rock that is abrasive and/or has a high compressive strength. The proponent will apply the wet crushing technique thus reducing amount of dust escaping into the air.

Production estimates are; 58,000 tonnes of aggregates are produced per month. It is dimensioned for a storage period of 4 months of production, i.e. (4 * 58,000) = 232,000 tonnes. An estimated average density of 1.5 t / m^3 and we must therefore store the equivalent of 155,000 m^3. Estimated storage height of 7m with a slope of 70%.

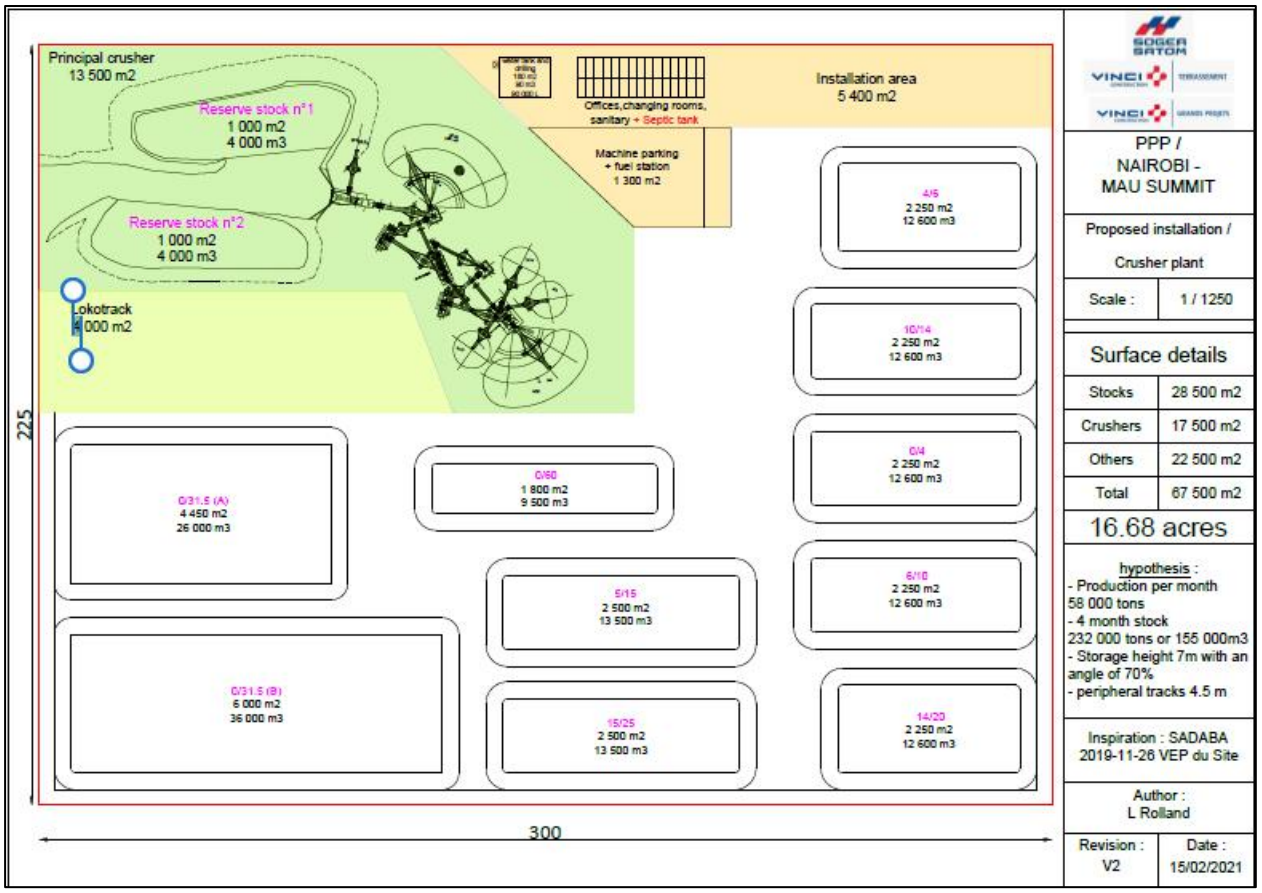


Figure 3-2: Crusher plant

3.4.2 Asphalt plant

Asphalt plant is equipment that can combine aggregates and bitumen to produce asphalt mix for road paving. Mineral fillers and additives may be required to add to the mixing process in some cases.

Daily asphalt production 1200 Tons - (asphalt composed of 99% pebbles, fines and sands) - Stock for 2-3 weeks - 1200 * 2.5 (weeks) * 6 (days) * 0.99 = (approximately) 18,000 Tons - Average granular density 1.5, i.e. approximately 11,500 m^3

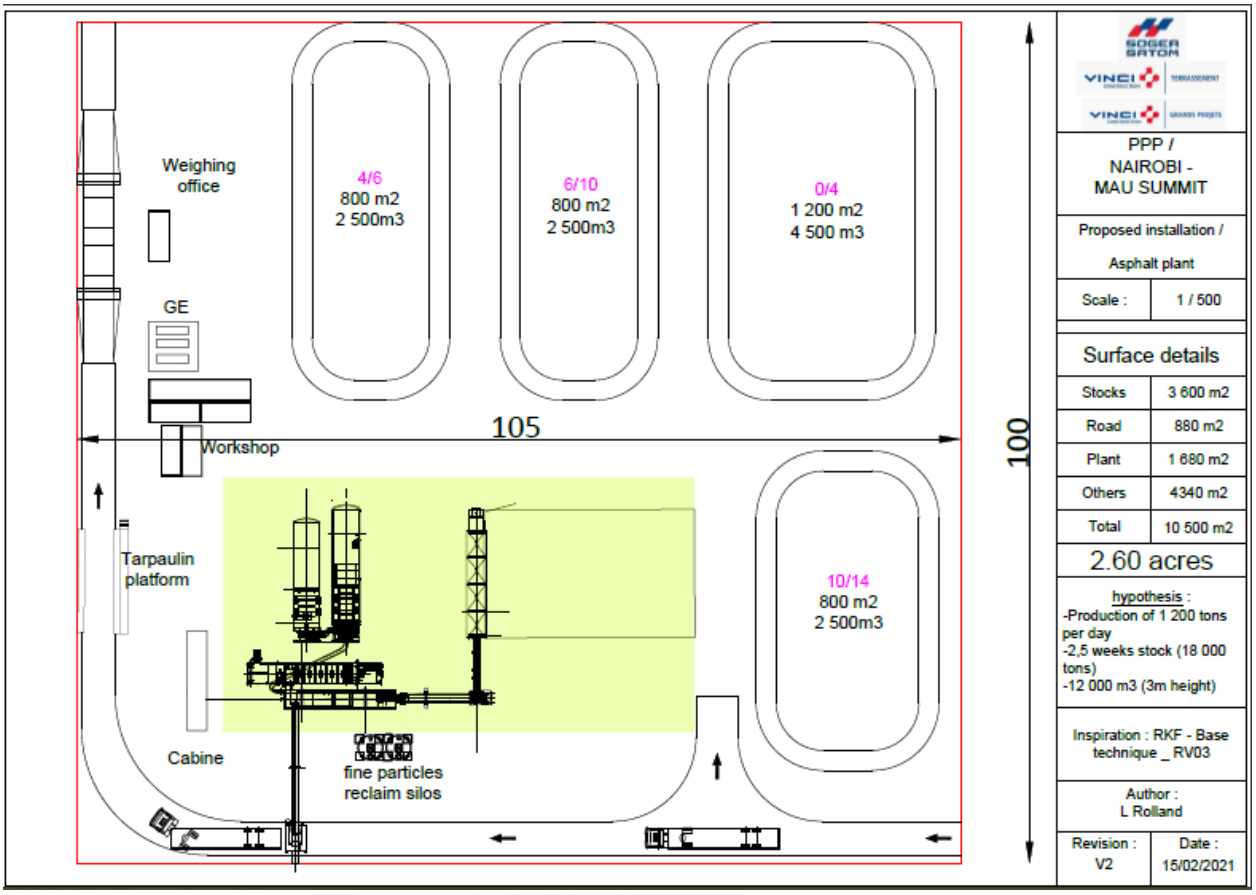


Figure 3-3: Asphalt plant

3.4.3 Storage for mining

The primary purpose of a mining storage facility is to provide safety of the tailings from the quarry mines, the explosives used in the quarry, and the final product from the crusher plant.

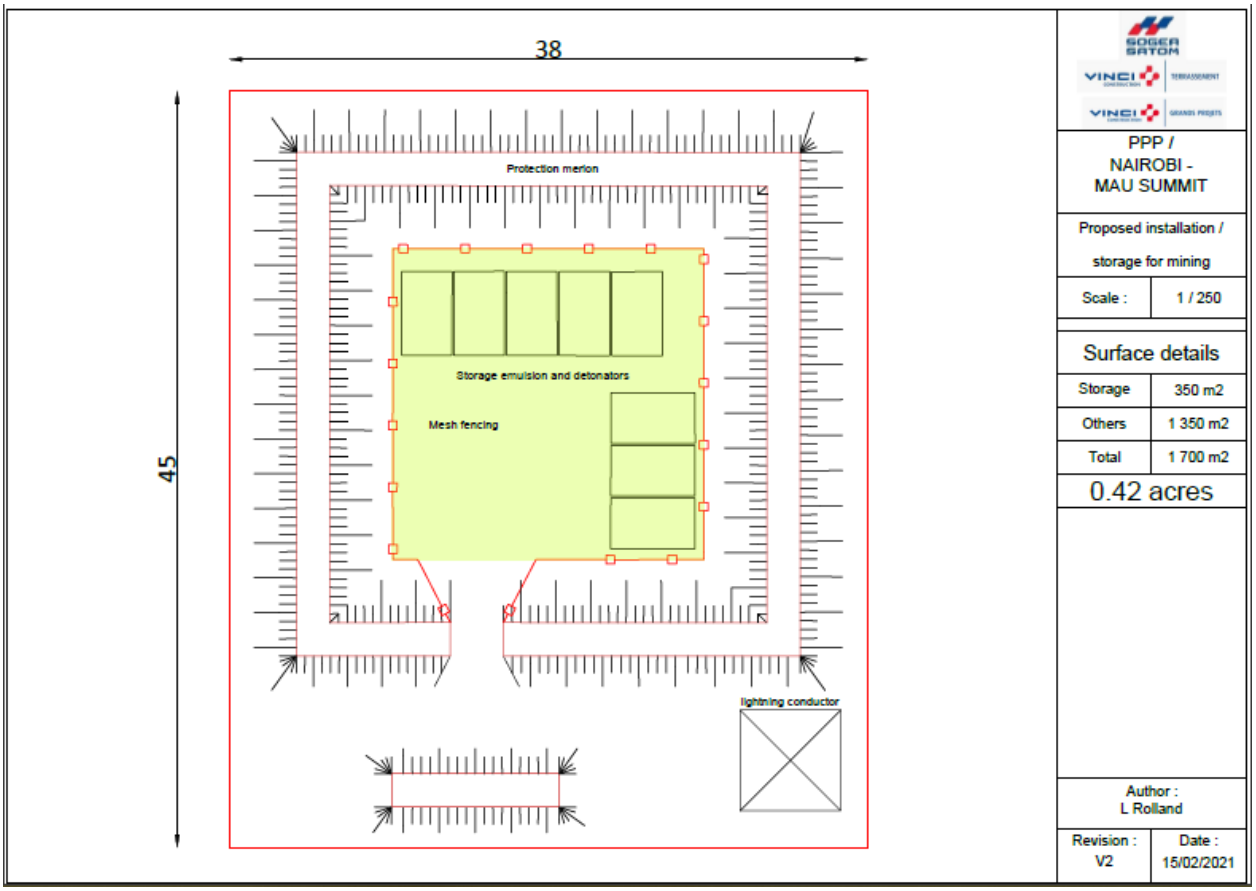


Figure 3-4: Storage for mining

3.4.4 Offices

These will be working areas for the people playing different roles in the running of the day to day activities of the quarry. The design is for 100 people with 40 offices, 84 parking spaces and a storage area of 684m$^{2.}$

Figure 3-5: Offices

3.4.5 Workshop

This area will be used for maintenance of machinery. This area will comprise of the actual workshop 1200m^2, offices 200m^2, parking machines 800m^2, a fuel station 500m^2 and others 4,950m^2.

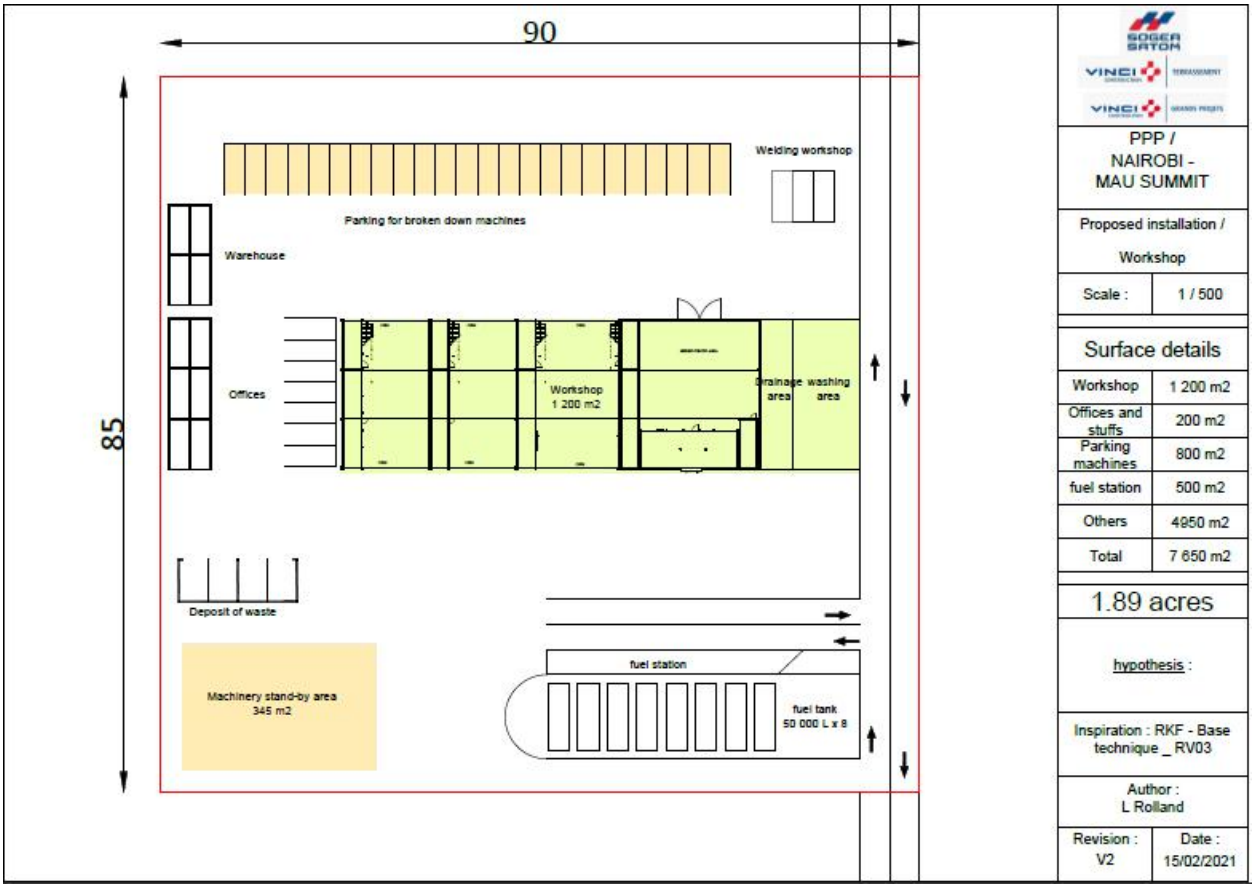


Figure 3-6: Workshop

3.4.6 Emulsion Plant

Bitumen emulsion plants are equipment specially used to produce emulsified bitumen by melting bitumen and dispersing resulting fine particles in water. Production of 125 tons per day 3 weeks of stock, i.e. 2250 tons distributed in 40 bitumen containers of 67 m^3 (40 feet) on two installations.

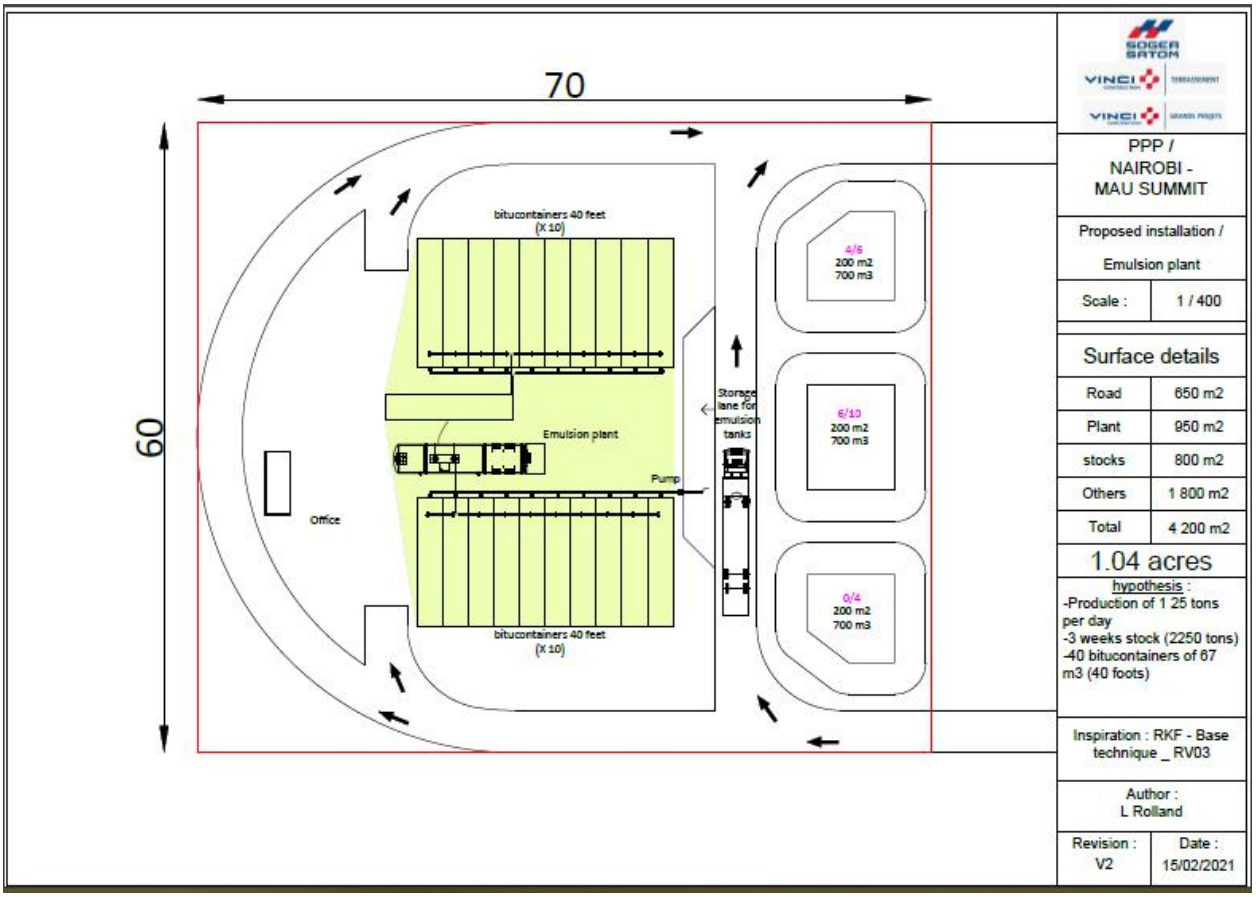


Figure 3-7: Emulsion plant

3.4.7 Mixing plant

The purpose of the mixing plant is to coat the surface of all the aggregates with cement paste, and to blend all the ingredients of the concrete into a uniform mass. The plant will have a central of 566m^2, water tank within 180m^2 cement storage silos in 140m^2, others are 874m^2 .

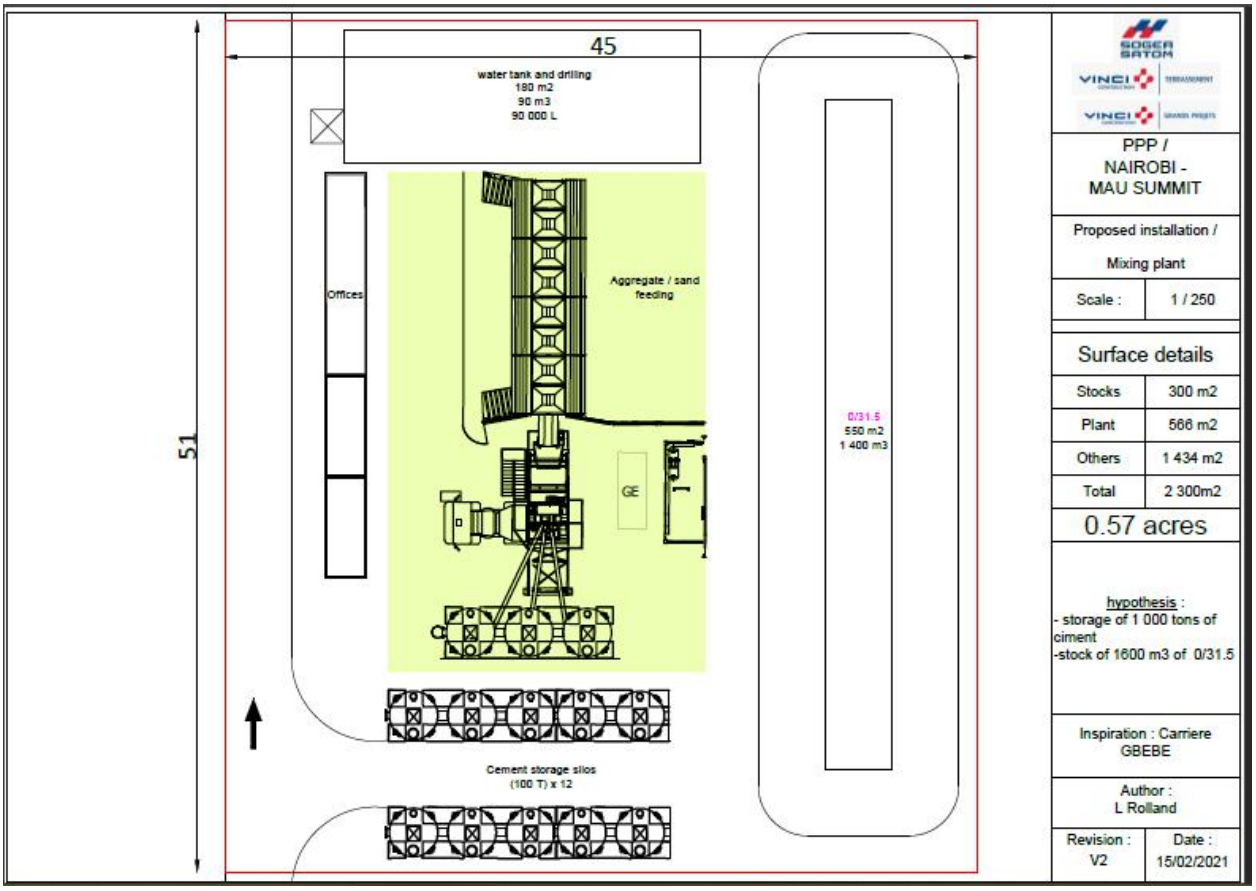


Figure 3-8: Mixing plant

3.4.8 Concrete plant

A concrete plant is equipment that combines various ingredients to form concrete. Some of these inputs include water, air, admixtures, sand, aggregate (rocks, gravel, etc.), fly ash, silica fume, slag, and cement. Production of 200 m^3 / d making one week of stock, i.e. 1125 m^3 of stock aggregates on 300 m^2.

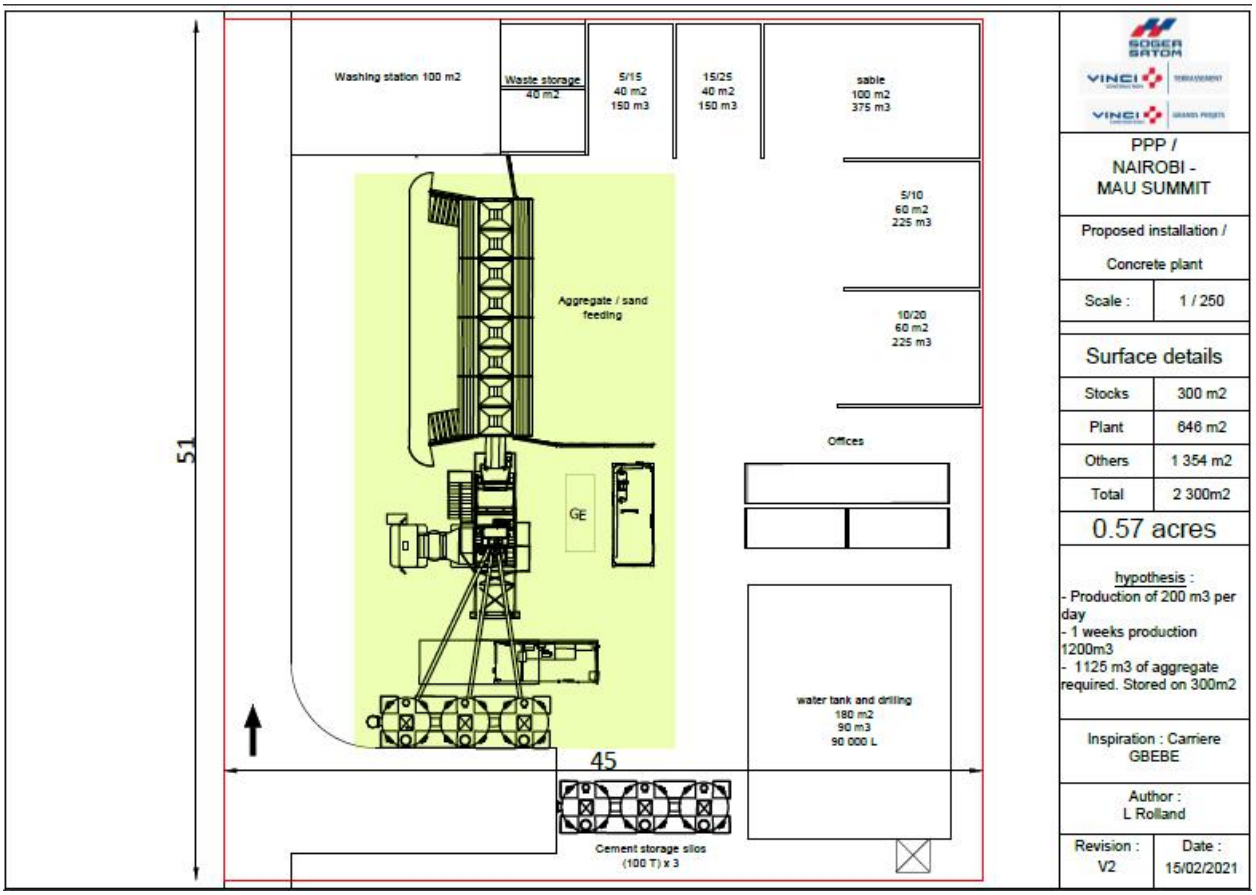


Figure 3-9: Concrete plant

3.4.9 Precast area

Precast concrete is a construction product produced by casting concrete in a reusable mold or "form" which is then cured in a controlled environment, transported to the construction site, and lifted into place. In contrast, cast-in-place concrete is poured into site-specific forms and cured on site. The site shall have two precast areas; one for small items and another for beams.

3.4.9.1 Precast area for small items

The area has been designed for about 30 people. It shall comprise of; precast area 2500m^2, steel, processing 495m^2, steel storage 450m^2, precast storage 1,400m^2, crane and truck parking 200m^2, offices 200m^2, road 1,400m^2 and autres 1,955m^2.

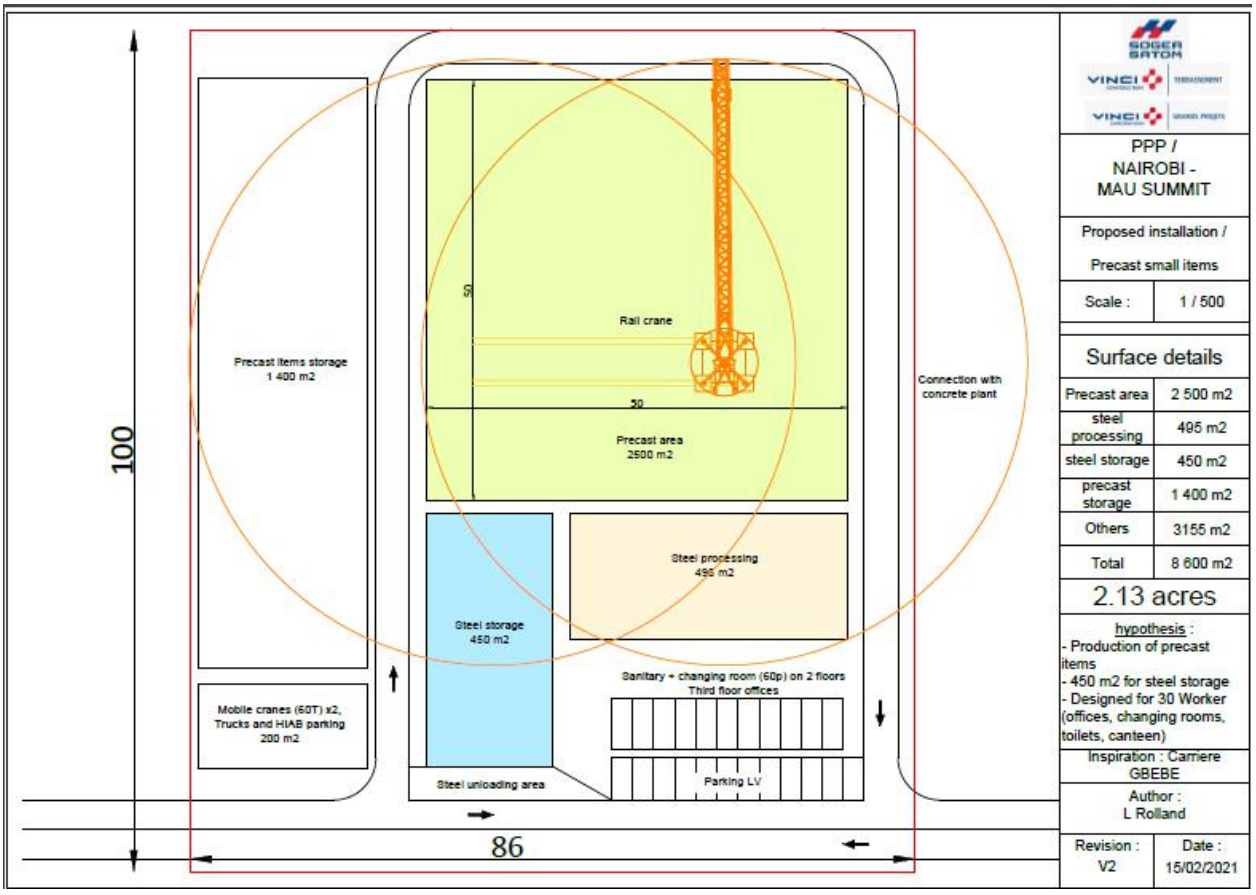


Figure 3-10: Precast area for small items

3.4.9.2 Precast area for beams

This area shall have two prefabrication benches, 245 m long with assembly, casting and storage under the overhead crane changing rooms, toilets and recreation area for 130 people.

It will comprise of a pre casting bench 5,000m^2, steel processing 1,600m^2, crane and trucks parking 600m^2 offices 1,110m^2 and others 9,140m^2.

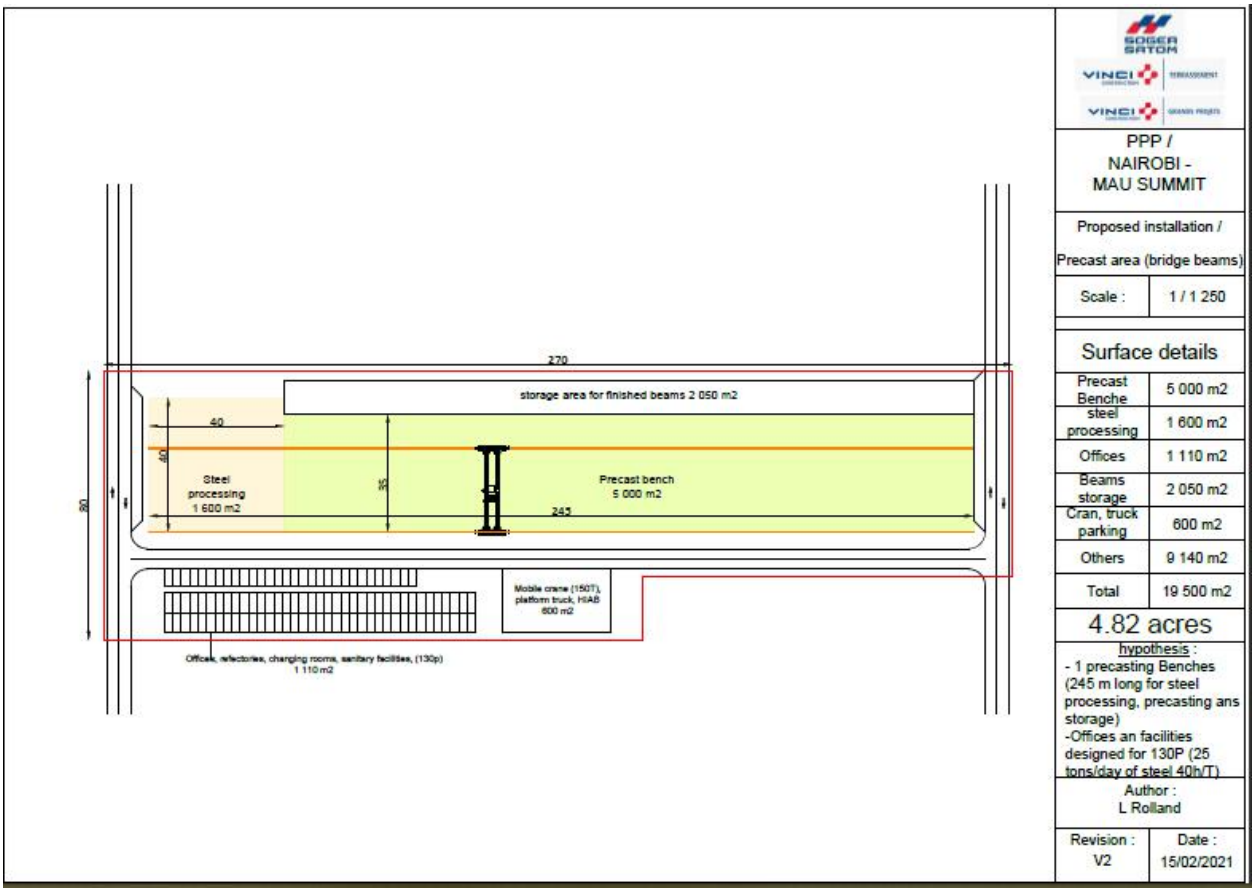


Figure 3-11: Precast area for beams

3.5 Infrastructure utilities

Electricity - The proponent intends to tap electricity from the electrical line crossing the project site but could complement with standby generators.

Water - The proponent intends to sink one borehole to meet the various water needs during the project life.

Access road – The old Naivasha road will be used to access the site after exiting the A8. Roads within the project site will be expanded as need be.

3.6 Products, By Products and Waste Management

The anticipated by products during the quarry operation include; stone aggregates, concrete, asphalt and material discarded after crushing, as being too fine, irregular, or flaky for constructional work.

The resultant waste will be managed by a licensed waste handler contracted by the proponent. Liquid waste will be managed by use of a septic tank and a soak pit.

4 ANALYSIS OF ALTERNATIVES

The alternatives to the proposed project are as discussed below

4.1 No Project Alternative

This option in respect to the proposed project implies that the project achievements be reversed. Under this alternative, the proponent's proposal would not receive the necessary approval from NEMA. The site will not be available as a material source for the Nairobi-Nakuru Highway project meaning the materials will need to be sourced from elsewhere. In this scenario the project costs is likely to rise since the sites were identified because of the quality of materials and the cost effectiveness.

4.2 Sourcing of materials from existing quarries

The proponent has the alternative of sourcing for materials from existing quarries and installing whatever components are vital for processing of material on the sites. This alternative will maintain the proposed site as unexploited land and continue being used for farming and grazing thus eliminating any negative impacts that may be brought about by the implementation of the project. However, costs associated with this alternative are likely to be very high when all factors are considered including haulage distances.

4.3 Alternative to project site

This alternative requires that the proponent should get land elsewhere that has good quality material for extraction. This alternative is not suitable as it will require additional costs to conduct material tests for possible alternative sites and will delay construction of the A8 road. Among other factors to consider is an alternative site is the proximity of settlements, sensitive receptors, wildlife habitat and access. Economic factors include costly haulage distance to work sites. The current site is convenient and does not have dense settlements around or sensitive receptors thus suitable for exploitation. It is also next to the road that the quarry and camp site is intended to serve.

4.4 Waste management alternative

Nakuru County has challenges with solid waste disposal areas. The proponent can choose to build an incinerator so that all solid waste generated can be combusted on site. The challenge with this alternative is that it increases the amount of emissions into the air reducing air quality and also requires approval and licensing by NEMA.

5 POLICY, LEGAL AND REGULATORY FRAMEWORK

The chapter presents a package of instruments which include policies, laws, regulations, guidelines, national strategies and action plans, which govern the mining sector of Kenya.

5.1 The Constitution of Kenya, 2010

The Constitution of Kenya, is the supreme law of Kenya, thus it is the ultimate reference point where all policies and laws emanate from. Environmental provisions are discussed below:

Article 42 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.

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.

Article 69 provides that natural resources must be utilized for the benefit of the people of Kenya, while Article 67 specifies that local communities have to benefit from such exploitation.

Relevance of the Constitution to the proposed project

- *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 also entitled to a fair administrative decision-making process from NEMA and other State organs.*

5.2 Policy Framework

A policy is a document that identifies issues that the government wishes to address and then it provides a road map on how to address the issues, for purposes of socio-economic development. The enactment of a law is ordinarily preceded by a policy.

5.2.1 Mining and Minerals Policy, 2016

The Government of Kenya formulated the Mining and Minerals Policy, 2016, to enable the country obtain maximum benefits from its mineral deposits after operating without a clear policy for many years since the colonial times.

The Policy Strategies with environmental prescriptions include:

Strategy 4: To develop legislative mechanisms for accessing land for mineral development

Strategy 5: To 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: To pursue a responsive regulatory framework that ensures that benefits accruing from the mining sector are maximized for greater socio-economic development

Strategy 9: To design mechanisms for sharing benefits accruing from exploitation of minerals between the National Government, the County Governments and Local Communities

Strategy 10: To develop and implement mechanisms to enhance participation of Government (National & County), affected communities and other stakeholders in mining investments

Strategy 11: To develop a framework for mainstreaming and formalizing artisanal and small scale mining operations in order to support livelihoods and entrepreneurship

Strategy 12: To 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

5.2.2 National Environmental Policies

In addition to the Mining and Minerals Policy (2016), there are other policies that directly impact the mining sector, and therefore form part of the mining governance framework. Relevant national environmental policies are presented in the table below, together with their roles and the institutions responsible for their implementation.

Table 5-1: National Environmental Policies

National Policies	Environmental Provision	Institution
1. National Environment Policy 2013	The National Environment Policy provides guidelines for environmental governance the country. The Policy takes cognizance of high population growth (increased 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 highlights the need rehabilitation and restoration of environmentally degraded areas such as disused quarries and mines, deforested areas, riverbanks, wetland hilltops and eroded shorelines.	Ministry of Environment and Forestry
2. National Land Policy 2009	The National Land Policy aims at ensuring land is put into productive use on a sustainable basis by facilitating the implementation of land-use and conservation principles. In order to achieve a sustainable management and governance of	Ministry of Lands & Physical Planning

National Policies	Environmental Provision	Institution
	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 should be harmonized with the legal framework established under EMCA, 1999. It also provides for public participation in auditing of environmental land management.	National Land Commission
3. National Land use Policy 2016	The aim of the policy is to ensure a balance between different, yet related interests in land utilization such as concerns such as food security, human settlements, environmental protection and climate change; and other economic pursuits. Section 51(d) of the policy requires the Government to establish development control standards, processes and procedures that are efficient, transparent and accountable, while taking into account International Conventions and national policies relating to the sustainable use of land and environmental conservation. Section 3.4.3.4 promotes Environmental Management and Audit as land management tools and encourages public participation in the process.	Ministry of Lands & Physical Planning
4. Wildlife Conservation and Management Policy 2017	The aim of the policy is to create an enabling environment for the conservation in perpetuity, Kenya's rich diversity of species, habitats and ecosystems for the wellbeing of its people and the global community in accordance with the Constitution of Kenya, 2010.	Ministry of Environment & Forestry
5. National Climate Change Framework Policy 2014	The policy was developed in order to facilitate a coordinated, coherent and effective response to the local, national and global challenges and opportunities that climate change presents. The policy seeks to enhance adaptive capacity and build resilience to climate variability and change It also seeks to promote low-carbon development pathways.	Ministry of Environment & Forestry
6. National Water Policy 2012	The objective of the National Water Policy is to take cognizance of the existing water resources situation in thecountry and provide direction for action in a unified national perspective.	Ministry of Water, Sanitation and Irrigation

National Policies	Environmental Provision	Institution
7. National Policy on Water Resources Management 1999	The policy provides directions for effective water resource management as key to both basic human needs and sustainable economic development	Ministry of Water, Sanitation and Irrigation
8. National Policy on Occupational Safety and Health 2012	The policy applies to all workplaces in all sectors and is expected to promote basic principles of assessing occupational risks and/or hazards; combating hazards at source; and developing a national preventative safety and health culture that includes information, consultation, research and training. The objective of the policy is to prevent and control work-related accidents and diseases and ensure compensation and rehabilitation of workers who are injured in the course of work, and those who contract occupational-related diseases.	Ministry of Labour
9. National Environmental Sanitation & Hygiene Policy 2016-2030	The policy commits the Government, at both National and County levels, to pursue a robust strategy that will enable all Kenyans to enjoy their right to highest attainable standards of sanitation and a clean and healthy environment, as guaranteed by the Constitution of Kenya, 2010.Ultimately, this policy aims at ensuring better health, dignity, social well-being and quality of life for all the people of Kenya.	Ministry of Health
10. National HIV and AIDs Policy 2009	The policy provides directions for dealing with the day-to- day HIV and AIDS related issues and problems that arise within the workplace, and also outlines employee's rights, responsibilities and expected behavior in the workplace.	Ministry of Health
11. National Gender and Development Policy 2000	The policy advocates for gender mainstreaming and empowerment of women. It states that it is the right of women, men, girls and boys to participate in and benefit equally from the development process. In so doing, the policy provides a framework for mainstreaming gender in all policies, planning and programming in Kenya and puts in place institutional mechanisms for effective implementation.	Ministry of Devolution & ASALS
12. National Policy for Disaster Management 2009	The policy seeks to institutionalize disastermanagement and mainstream disaster risk reduction in the country's development initiatives.	Ministry of Devolution & ASALS

National Policies	Environmental Provision	Institution
13. Policy Statement on Public Private Partnerships 2011	The objective of the policy is to articulate the Government's commitment for an enabling environment for attracting private sector partners, by providing appropriate public-private partnership framework which will in turn enhance the attainment of Kenya Vision 2030 sector - development goals.	National Treasury

5.3 Legal Framework

The mining sector in Kenya is governed by the Mining Act of 2016 and a wide range of other laws that impact various elements of the mining sector, including investment promotion, employment, occupational safety and health, land legislation, physical planning legislation, and HIV/AIDs prevention and control.

5.3.1 Environmental Management and Coordination Act, 1999 (Amendment 2019)

The Environmental Management and Coordination Act (EMCA) of 1999 was the first legislation to formally define EIA within the Kenyan context, as well as establish procedures and supporting institutions for the EIA process.

Section 58 of the Act directs that any project of the nature specified under the Second Schedule of the Act should submit an EIA study report of the project to NEMA, for the purpose of processing an EIA license.

Section 68 (1) directs 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) directs 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.

Relevance to the proposed 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.*

5.3.1.1 Environmental Management and Coordination (Waste Management) Regulations, 2006

The Waste Management Regulations of 2006 apply to all categories of waste including solid waste, industrial waste, hazardous, pesticides and toxics, biomedical waste and radioactive substances. The Regulations provide the procedure for licensing, fees, offences /penalties and operational guidelines.

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.

The Regulations prohibit activities likely to generate any hazardous waste without a valid EIA license. The Fourth Schedule of the Regulations provides a list of hazardous waste, which includes explosives, flammable solid and liquids, corrosives, radioactive and carcinogenic substances, among others. Such waste requires specialized handling, treatment and disposal due high damaging effect to the environment and human health. The Regulations provide that 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.

Relevance to the proposed project

The proponent shall adopt sound waste management practices throughout the project's implementation to ensure compliance with the Regulations.

5.3.1.2 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

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

(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.

Relevance to the proposed project

The proposed site has a seasonal stream crossing it which drains into Lake Elementaita, a world heritage site. The proponent should therefore ensure that the water bodies are not polluted as a result of project activities.

The proponent intends to sink a borehole and will therefore require an ESIA conducted for the same.

5.3.1.3 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. Regulation 3(1) prohibits 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.

Regulation 4 prohibits anyone from causing excessive vibrations in a manner that annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. In addition, The Regulations prohibit anyone from causing excessive vibrations that exceed 0.5 centimeters per second beyond any source property boundary, or 30 metres from any moving source.

Regulation 12 prohibits anyone from operating a motor vehicle that -(a) produces any loud and unusual sound; and (b) exceeds 84 dB(A) when accelerating. The Regulation prohibits anyone from sounding the horn or other warning device of a vehicle, except when necessary to prevent an accident or an incident. All provisions of the Traffic Rules apply to this Regulation.

Regulation 14 provides that where defined work of construction, demolition, mining or quarrying is to be carried out in an area, the NEMA may impose requirements on how the work is to be carried out including but not limited to requirements regarding the type of machinery that may be used, and the permitted noise levels, as stipulated in the Second and Third Schedules to these Regulations. The relevant lead agency should ensure that mines and quarries that use explosives and machinery are

located in designated areas and not less than two kilometers away from human settlements. In addition, any person carrying out construction, demolition, mining or quarrying work should ensure that the vibration levels do not exceed 0.5 centimeters per second beyond any source property boundary or 30 metres from any moving source.

The Third Schedule to these Regulations provides the maximum permissible level of noise in mines and quarries, as outlined in the table below;

Table 5-2: Maximum permissible noise levels for mines and quarries (measured within the facility)

Facility	Limit Value in dB(C) Max
1. For any building used as health facility, educational institution, convalescent home, old age home or residential building	109
2. For any building used for residential purpose and one or more of the following: commerce, small-scale production, entertainment or any residential apartment in an area that is used for purposes of industry, commerce or small-scale production, or any building used for small-scale purpose of industry, commerce or small-scale production	114

Regulations 15 provides that any person intending to carry out construction, demolition, mining or quarrying work should, during conduct an EIA study to identify natural resources, land uses or activities which may be affected by noise or excessive vibrations from the construction, demolition, mining or quarrying; determine the measures which are needed in the plans and specifications to minimize or eliminate adverse construction, demolition, mining or quarrying noise or vibration impacts; and incorporate the needed abatement measures in the plans and specifications.

Relevance to the proposed project

- *The project he 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.*
- *The proposed quarry project shall involve use of explosives and machinery. Therefore, the proponent is required to ensure that the vibration levels do not exceed 0.5 centimeters per second beyond any source property boundary or 30 metres from any moving source.*

5.3.1.4 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 proposed 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 dust suppression 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*

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

These Regulations provide the general guidelines for undertaking EIA, environmental auditing (EA) and monitoring in Kenya. They 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 state that EIA should be conducted in accordance with approved terms of reference (ToR) developed by the proponent during the scoping exercise, the general EIA guidelines provided in these Regulations.

Regulation 17 provides that the proponent should, in consultation with the Authority, seek the views of persons who may be affected by the project.

Regulation 31 (1) provides that an environmental audit study should be undertaken on any development activities likely to generate adverse impacts on the environment, including - (a) ongoing projects that commenced prior to the coming into force of the EIA /EA Regulations; or (b) new projects undertaken after completion of an EIA study report. For a project that has undergone an EIA study, Regulation 31 (4) {b} provides that the Proponent of should undertake an environmental audit of the project within 12 months of commencement, and not more than 24 months after the completion, whichever is earlier.

Relevance to the proposed project

- *This ESIA study has been conducted in accordance with the TOR prepared during scoping and the as guidelines and procedures provided under these Regulations.*
- *In the event that the project is granted an ESIA license, the proponent will undertake an environmental audit of the project within 12 months of commencement, and not more than 24 months after the completion of the project, whichever is earlier. The Environmental audit shall be conducted in accordance with the approved TOR.*

5.3.3 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.

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.

1. 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. Section 152 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.

2. 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.

Conditions for Granting Mining License

Section 103 provides that an applicant of a mining license should have:

- an approved EIA license, a social heritage assessment plan and EMP;

- a proposal for procurement of local goods and services;
- a proposal with respect to employment and training of Kenyan citizens;
- project feasibility study; and
- a proposal with respect to engaging in community investments is socially responsible

Health, Safety and Environment

Section 42 (1) provides conditions should be met before the granting of mineral right, including, protection of the environment; community development; safety of prospecting and mining operations; health and safety of persons undertaking those operations; and protection of the lawful interests of the holders of any other mineral right.

Section 176 provides that a mining license should not be granted to a person under this Act, unless the person has obtained an EIA license, social heritage assessment plan and the EMP has been approved. Section 179 directs that a holder of a permit or mining license should adopt sustainable land use practices, including -

- 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
- rehabilitation of land to its original status or as close as possible to its original state, upon completion of mining operations

Regarding the safety of workers and mine operations, Section 187 provides that operators undertaking prospecting or mining operations should comply with the requirements of the Occupational Safety and Health Act, 2007. Additionally, Section 217 requires the mining operators to maintain insurance cover in respect of the attached risks, especially for health and safety of workers.

Local Content (Participation) Requirements

Regarding employment opportunities, Section 47 provides that 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.

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.

Transparency and Accountability

The 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 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. In addition, public officers are prohibited from acquiring or retaining a share or interest in any mining company in Kenya, directly or indirectly.

Dispute Resolution

Section 154 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.

Relevance of the Mining Act to the proposed project

- *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 through Gazette notice.*

- *When applying for the stone quarrying permit, the proponent will provide proof of submission and approval of this ESIA study report to NEMA, local content plans, a proposal for involving local communities and Kenyans at large (particularly regarding employment and business opportunities); as well as a plan for resettlement of communities affected by mining operations.*

5.3.3.1 Mining Act Regulations

The table below presents a list of mining regulations that apply to the proposed quarry project.

Table 5-3: Mining Act Regulations

Mining Regulations	Purpose
1. Mining Act (License and Permit) Regulations, 2017	The purpose of these Regulations is to regulate the issuance of licenses and permits for mineral rights and dealings in minerals.
2. Mining Act (Use of Local Goods and Services) Regulations, 2017	The purpose of these regulations is to:- - promote job creation through the use of local expertise, goods and services, businesses and financing in the mining industry value chain and their retention in the country; - create mining and mineral related supportive industries that will provide jobs and sustain economic development; - 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; and, - provide for a robust, transparent monitoring and reporting system
3. Mining Act (Community Development Agreement), 2017	These regulations provide guidelines for engagement between mining companies and communities likely to be impacted by their operations. Key defining features include: - 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
4. Mining Act (Dealings in Minerals) Regulations, 2017	These regulations provide 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.
5. Mining Act (Employment and Training) Regulations, 2017	The purpose of the regulations is to:- - 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; - develop local capacities in the mining industry value chain through education, skills and technology transfer, research and development;

	- achieve the minimum local employment level and in-country across the entire mining industry value chain; - 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 / monitoring schedule of holders of mineral rights, to ensure that Kenyan nationals are employed and properly trained
6. Mining Act (State Participation) Regulations, 2017	The Regulations provide for State participation in prospecting or mining operations carried out by the holder of a mineral right.
7. Mining Act (Work Programmes and Exploration Reports) Guidelines, 2017	These regulations provide guidance to applicants for, and holders of, reconnaissance, prospecting and retention licenses, on how to prepare and submit compliant work programmes and exploration reports.

5.3.4 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 prohibits anyone from purchasing or otherwise acquiring blasting materials except under the authority of, and to the extent authorized in, a written permit issued by an inspector. Section11 prohibits anyone from using 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

Relevance to the proposed project

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

5.3.5 The Land 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 Proposed Project

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

5.3.6 National Land Commissions Act, 2012

This Act provides that the National Land 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 (Section 5). 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 proposed 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.

5.3.7 Physical and Land Use Planning Act, 2019

This Act provides for the preparation and implementation of physical development plans. The Director of Physical Planning is empowered to prepare physical development plans. Development of land within a certain area must be done in compliance with the physical development plan for that area and the development permission of the local authority in charge of that area. Such powers are currently exercised by the respective County Governments and are governance provisions that promote environmental and natural resources conservation.

Relevance to the proposed 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.

5.3.8 Water Act, 2016

This Act aligns the water sector with the Constitution's primary objective of devolution. Other constitution provisions that touch upon water include: affirmative action programs to ensure water for marginalized groups; the responsibility of the national government for management of the use of international waters and water resources and definition of national versus county public works.

The Water Resources Authority (WRA) is vested with the responsibility for overall sector oversight, including policy formulation, coordination, and resource mobilization. The WRA serves as an agent of the National Government and regulate the management and use of water resources. Water resources management functions that have been allocated to the National Government are spelt out in the Fourth Schedule, Part I, and include use of international waters and water resources; National Public Works and Services - water resources development, especially on permitting and ensuring compliance to permit conditions on water-retaining infrastructure and works on water bodies; protection of the environment and natural resources to establish a durable and sustainable system of development, including, in particular - water protection, securing sufficient residual water, hydraulic engineering and the safety of dams; disaster management- water-related disasters like flooding, drought, and landslides; and capacity building and technical assistance to the counties.

On the other hand, the water resources management functions that have been devolved to County Governments are spelt out in the Fourth Schedule Part 2. These include implementing specific national Government policies on natural resources and environmental conservation, including soil and water conservation; County Public Works and Services, including storm water management systems in built-up areas; firefighting services and disaster management, especially on water-related disasters.

Relevance to the proposed project

The proponent shall take reasonable measures to ensure the quarry project does not to pollute any surface water resources. They shall apply for a water abstraction permit from the WRA before using water from a river or sinking a borehole for their quarry operations.

5.3.9 Climate Change Act, 2016

The Climate Change Act provides measures for managing climate change, including reducing greenhouse (GHG) emissions. The Act introduces the need for a National Climate Change Action Plan with measures and mechanisms for adopting energy conservation, efficiency, and use of renewable energy in industrial, commercial, transport, domestic, and other uses.

Relevance to the proposed project

The proponent shall adopt relevant climate change mitigation measures as required by the Act.

5.3.10 The Occupational Safety and Health Act, 2007

This is an act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at the workplace. The key areas addressed by the Act include:

a) General duties including duties of occupiers, self-employed persons and employees

b) Enforcement of the act including powers of an occupational safety and health officer

c) Registration of workplaces

d) Health General Provisions including cleanliness, ventilation, lighting and sanitary conveniences

e) Machinery safety including safe handling of transmission machinery, hand held and portable power tools, self-acting machines, hoists and lifts, chains, ropes & lifting tackle, cranes and other lifting machines, steam boilers, air receivers, refrigeration plants and compressed air receiver

f) Safety General Provisions including safe storage of dangerous liquids, fire safety, evacuation procedures, precautions with respect to explosives or inflammable dust or gas

g) Chemical safety including the use of material safety data sheets, control of air pollution, noise and vibration, the handling, transportation and disposal of chemicals and other hazardous substances materials

h) Welfare general provisions including supply of drinking water, washing facilities, and First Aid

i) Offences, penalties and legal proceedings

Relevance to the proposed project

- *The proponent shall comply with all sections of the Act so as to protect all involved from work related injuries or other health hazards.*

5.3.10.1 OSH Rules

The Table below describes the OSH rules that are applicable to the project

Table 5-4: OSH Rules

Rules	Purpose
1. 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. They 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.
2. 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. They also 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.
3. 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. Factories (Building Operations and Works of Engineering Construction) Rules, 1984	These Rules cover 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. They also require contractors and occupiers to observe good safety standards while performing the above-mentioned building operations.
5. 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.
6. Factories and Other Places of Work (Noise Prevention and Control) Rules,	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.

2005	
7. 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 health hazards. They specify occupations requiring medical examinations, and the types of examination of employees at the employer's cost.
8. 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. Additionally, the Rules prescribe annual fire safety audits, the formulation of a fire safety policy, and training of workers on fire safety issues.
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.

5.3.11 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 proposed project

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

5.3.12 The Work Injury Benefits Act, 2007

This Act provides for compensation payment to employees for work related injuries and diseases contracted in the course of employment and include the provision of compulsory insurance for employees.

Relevance to the proposed 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 while working.

5.3.13 Persons with Disability Act, 2019

This Act provides for the rights and rehabilitation of persons with disabilities in order to achieve equalization of opportunities for 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 proposed project

The proponent will install facilities that accommodate the needs of persons with disability.

5.3.14 Sexual Offences Act, 2006

This Act provides for to make provision about sexual offences, their definition, prevention and the protection of all persons from harm from unlawful sexual acts, and for connected purposes. This Act also protects children and young girls from defilement and other adult persons from all forms of harassment and discrimination.

Relevance to the proposed project

The proponent and his agents will be advised on the requirements of the Act, not to discriminate on the basis sex during hiring of workers, on sexual harassment, and awareness creation among the workers.

5.3.15 HIV and AIDS Prevention and Control Act, 2006

This Act provide measures for the prevention, management and control of HIV and AIDS, to provide for the protection and promotion of public health and for the appropriate treatment, counseling, support and care of persons infected or at risk of HIV and AIDS infection, and for connected purposes.

Relevance to the proposed 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.

5.3.16 Public Health Act CAP 232

This Act concerns the protection of public health in Kenya and lays down rules relative to, among other things, food hygiene and protection of foodstuffs, the keeping of animals, protection of public water supplies, the prevention and destruction of mosquitoes and the abatement of nuisances including nuisances arising from sewerage.

Relevance to the proposed 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.

5.3.17 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 proposed project

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

5.3.18 County Government Act, 2012 (Revised 2020)

This Act provides County Governments' powers, functions and responsibilities to deliver services and for connected purposes. It contains elaborate provisions on public participation, public communication and access to information, and civic education, all of which have an implication on natural resources management at the County level. It also provides the principles upon which citizen participation in counties should be based. These include timely access to information, data, documents, and other information relevant or related to policy formulation and implementation.

Further, the Act calls for reasonable access to the process of formulating and implementing policies, laws, and regulations, including the approval of development proposals, projects, and budgets, the granting of permits, and the establishment of specific performance standards. It is an important procedural aspect of natural resources management that enables the public to appreciate the whole process and to be able to voice their concerns and proposals regarding the whole process.

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 proposed project

The ESIA study process includes consultation with local communities to ensure their participation during the early phase of project planning.

5.3.19 The Energy Act, 2019

This Act provides for the establishment, powers and functions of the energy sector entities; promotion of renewable energy; exploration, recovery, and commercial utilization of geothermal energy; regulation of midstream and downstream petroleum and coal activities; regulation, production, supply and use of electricity and other forms of energy; and for connected purposes. By providing for renewable energy, the law provides for promoting environmental conservation.

Relevance to the proposed project

The proponent will adopt energy conservation measures in the project, and where possible explore use of renewable sources of energy as a way of minimizing cost of electric energy. They shall conduct energy audits carried out annually to identify and eliminate wastage of energy.

5.3.20 Kenya Roads Act, 2007

This Act protects against destruction of road and its accessories like culverts and drainage system. Section 50 (1) (a) of the Act states that wherever road is damaged by reason of any vehicle passing over it in contravention of the provisions of any rules made by an authority made by this Act, the person operating the vehicle will be liable for the damage.

Relevance to the proposed project

The proponent will ensure the trucks are not overloaded in manner to damage the road.

5.3.21 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 proposed project

The ESIA process should include an Archeological and Cultural Assessment of the site.

5.4 Institutional Framework

5.4.1 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 specializedagencies, whose mandates are outlined in the table below;

Table 5-5: Directorates and agencies governing the mining operations in Kenya

Directorates/Agency	Function
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).
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

Directorates/Agency	Function
	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 frameworks 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
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
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.
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;

Directorates/Agency	Function
	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.
National Mining Corporation	The National Mining Corporation was established under section 22(1) of the mining Act of 2016 to serve as the investment arm of the government in respect of minerals. The Corporation is responsible for ensuring that mineral wealth is protected and harnessed for present and future generations. It may also engage in mineral prospecting and mining, and hold interests in mining projects..
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.
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.
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.

5.4.2 EMCA 1999 (Amendment 2019) Institutions

This law provides for the establishment of an institutional framework for environmental management, as outlined below.

5.4.2.1 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.

5.4.2.2 County Environment Committee

The County Environment Committee (CEC) is responsible for management of the environment 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.

5.4.2.3 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).

5.4.2.4 National Environment Tribunal

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).

5.4.2.5 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.

5.4.3 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

5.4.4 County Government of Nakuru

The proposed quarry is located within the County of Nakuru. The County is government is responsible for licensing the quarry development.

5.5 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. The table below provides a summary of guidelines and standards that apply to the mining sector.

Table 5-6: 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. 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.
3. 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.

5.6 National Strategies and Action Plans

The table below describes the national strategies and plans for environmental sustainability in 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

Strategy / Action plan	Environmental role
	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.

5.7 INTERNATIONAL FINANCE CORPORATION PERFORMANCE STANDARDS

5.7.1 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

5.7.2 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.

5.7.3 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

5.7.4 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.

5.7.5 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.

5.7.6 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.

5.7.7 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.

5.7.8 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.

5.8 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 5-7** presents some of the Multilateral Environmental Agreements (MEAs) ratified by Kenya, and which are relevant for the mining sector operations.

Table 5-7: 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

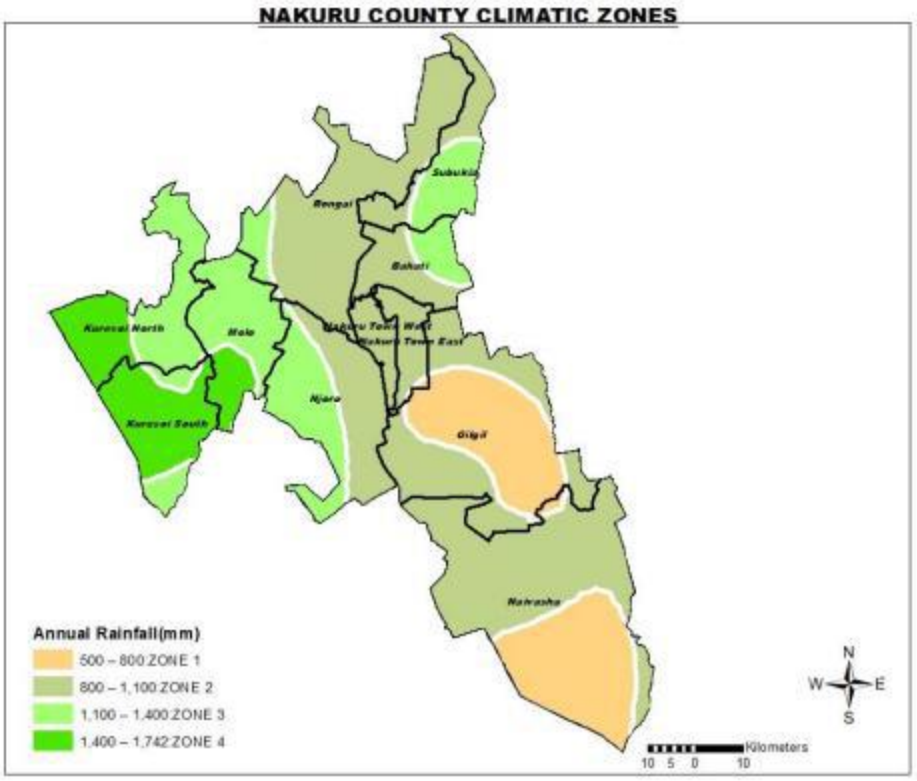
6 BASELINE CONDITIONS

6.1 Physical Environment

6.1.1 Climate

Rainfall

The climate of Nakuru County is strongly influenced by the altitude and physical features. There are four broad climatic zones as shown in the figure below



Source: Nakuru County Integrated Development Plan 2018-2022

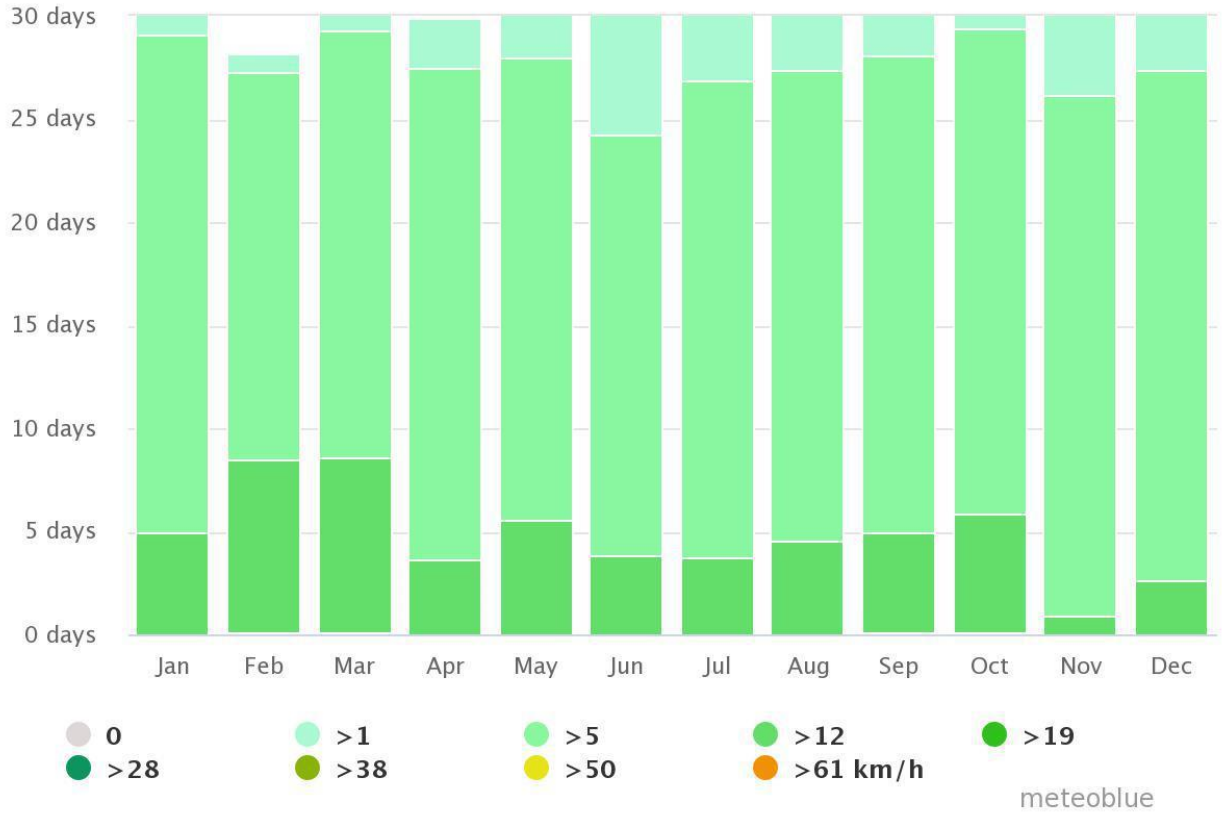
The quarry site lies in zone 1 which has lowest mean annual rainfall of about 500-800mm per annum. This zone covers Gilgil and Naivasha sub-counties.

Temperature

The average monthly temperature ranges from 15.9°C to 17.8°C. The rain seasons are from April to May and October to November. The annual potential evaporation is estimated at about 1700 mm.

Wind Speed

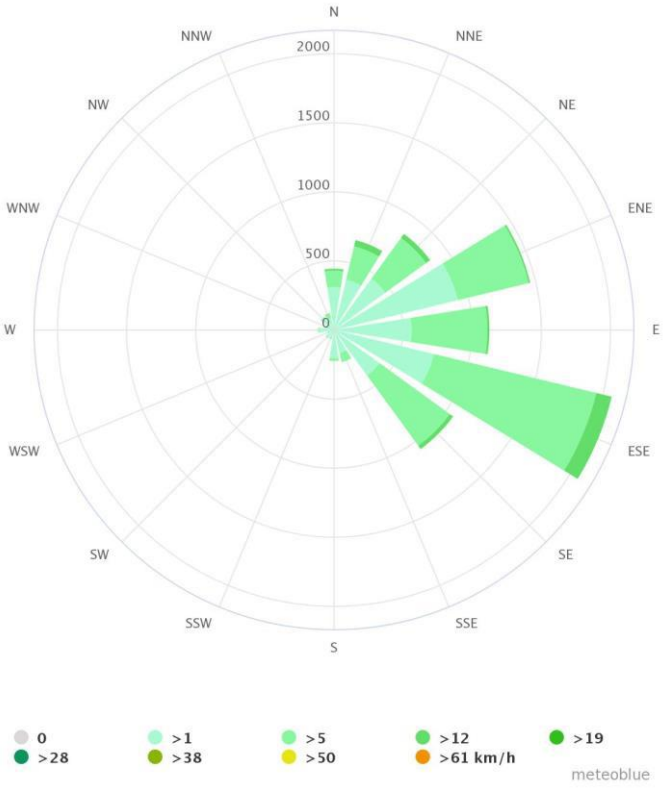
The average wind speed around the proposed site is >5km/h but < 12Km/h. The fastest speed experienced is < 12Km/h but only occurs 0-8.5 days in a month. Below is a chart showing speeds recorded in a year.



Source: Meteoblue

Wind Direction

Wind around the site mainly blows from North West to South East. The Wind rose below shows wind direction across the year.



Wind Rose of the Area (Source: Meteoblue)

6.1.2 Water Resources

The site has a seasonal stream crossing it. The stream originates from the hills at Thogonoi and drains into Lake Elementaita. At 0º 24' 40" S 36º 15' 28" E, the stream has been diverted by the land owner to drain into his dam which is across the A8 road at 0º24'36"S 36º15' 05"E. When the dam is full, water is then allowed to flow downstream into the lake. During the rainy season when water is flowing, the Maasai's take their cattle to the nearest point to drink water.

The site also has two boreholes; one is productive (0º24'49.79"S 36º 15' 22.94"E) and the other is not (0º 24' 29.00"S 36º15'21.37"E). The productive borehole is next to the homestead and is used to meet the daily domestic water needs. A generator is used to pump water from the borehole. There is also a concrete tank that is not in use at 0º24'28.54"S 36º15'25.05"E.

There is piped water near the site from Nakuru Water and Sanitation Company (NAWARSCO). Flower vendors next to the site use this water to water their flowers and plants.

About 1km from the site is Lake Elementaita. The lake is a soda lake thus has not been exploited for domestic or industrial use but is home to magadi tilapia fish, various wildlife, and plenty of bird species.

Plate 6-1: Section of the seasonal stream. Circled area is the point of water redirection (0° 24' 40" S 36° 15' 28")

Plate 6-2: Dam (0°24'36"S 36°15' 05"E)

Plate 6-3: Nonproductive borehole and pump house (0° 24' 29.00"S 36°15'21.37"E)

Plate 6-4: Concrete tank (0°24'28.54"S 36°15'25.05"E)

Figure 6-1:Mapped water resources google earth screenshot

6.1.3 Geology

The geology of the area comprises the following volcanic rocks in succession:

i. Superficial deposits
ii. Trachytes and trachyphonolites
iii. Olivine basalts
iv. Tuffs (agglomeratic, eutaxitic and welded tuffs)

These units are described in more details below.

6.1.3.1 Superficial deposits

These deposits are thin and consist of ashy pyroclastic sediments, sometimes forming murram, but rarely gravels and sands.

6.1.3.2 Gilgil trachytes

These trachytes overlie the olivine basalt in small outliers in the facing at the foot of the Bahati Escarpment north of Mbaruk. The trachyte is fissile and usually well crystallized, and is characterized by a carious weathered vesicular upper surface. Similar trachytes overlie the Mbaruk basalt on Soysambu Estate and extend as far east as the Gilgil Escarpment where they form a facing on the older succession of ignimbrite and trachyte. At Kariandusi these trachytes underlie the Middle Pleistocene sediments and form a ridged, faulted terrain, on which the sediments were deposited.

6.1.3.3 Olivine basalts – the Mbaruk basalt

It is a porphyritic felspar-phyric-olivine basalt which forms a prominent facing cliff at the foot of the Bahati Escarpment at Mbaruk, hence the name. It was also recognized on Soysambu Estate, and in the cliffs immediately west of Lake Nakuru, where it again seems to form a facing on an older eroded escarpment in the Mau tuffs. The rock type in this formation is very uniform. The lava when fresh is a light grey rough-surfaced rock, showing prominent well-formed white, slightly translucent, felspar phenocrysts.

The basalt is not very thick, probably little more than 30 metres in all; sometimes more than one flow can be recognized. The basalt forms rather restricted flows localized along certain fault zones and does not extend continuously from Elementaita towards Lake Nakuru.

Vesicles are very common, and alteration by weathering to a reddish-brown decomposed lava is a very common feature, decomposition being apparently accelerated on account of the easy breakup of the rock by a process of crumbling along cracks bordering the large felspars.

6.1.3.4 Bahati and Kinangop tuffs

These occur as a continuous series of tuffs and ignimbrites, extending from an area east of Menengai, through Gilgil onto the Kinangop plateau. The main rock types in the succession are:-

a) Cream to yellow pumice tuffs (with local development of water-lain graded tuffs).
b) Thin welded tuffs of the type known as claystones.
c) Massive flows of welded tuff with coarse fragmental, laminar and lenticular textures.
d) Trachyte lavas, both well-crystallized types and streaky vitreous fragmental types,

The series shows a great variation throughout the area and one suite cannot be successfully extrapolated into another area, since suites vary laterally. There is a lower "ignimbrite" throughout the area and near Gilgil. Pumice tuffs occur throughout the succession, and within them lacustrine sediments (graded tuffs of similar composition) occur locally at many different horizons.

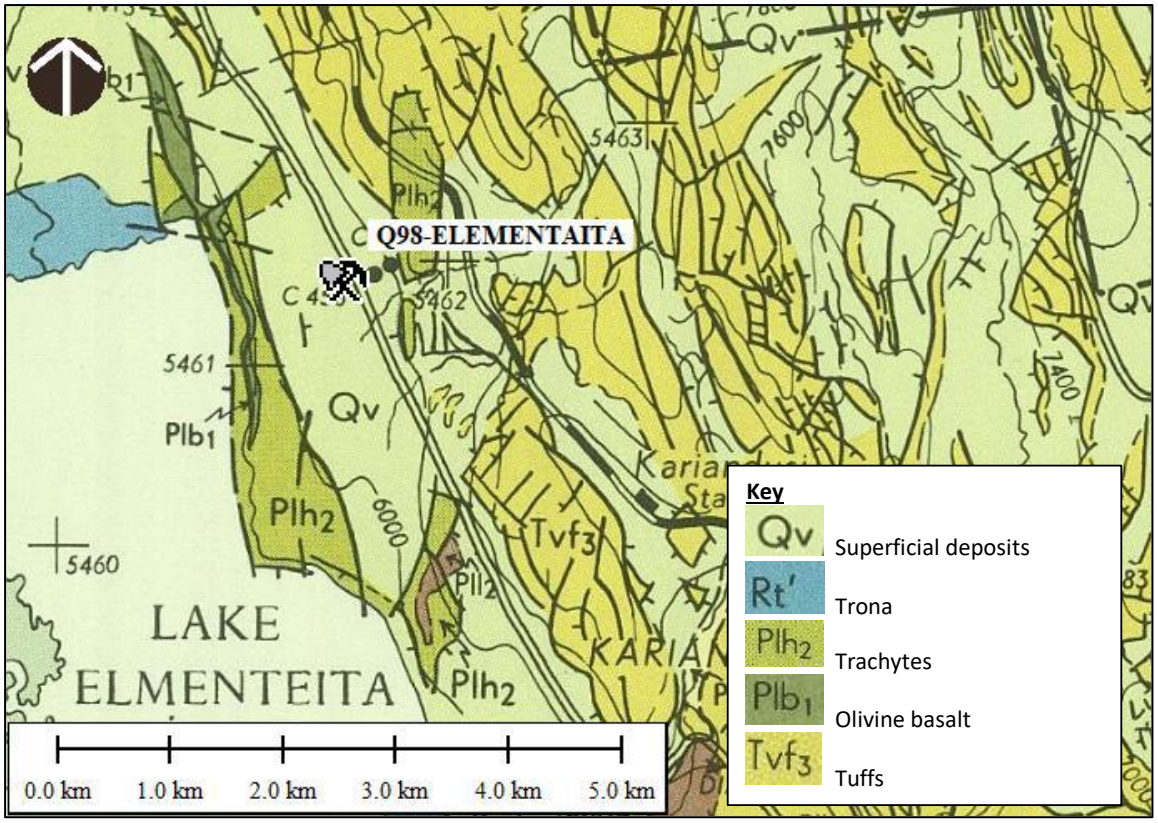


Figure 6-2: Geology of Elementaita Area

6.1.4 Soils

The distribution of soil types within Nakuru County is complex which is attributed to the influence of climatic conditions, volcanic activities and underlying rock type. The proposed site is characterized by alluvial soils. They are shallow soils resulting from volcanic ash sediments as well as other sources. They are light, porous, fertile and brown in colour. There were no evident signs of pollution.

Plate 6-5: Brown alluvial soils

6.1.5 Topography

The site is in Gilgil Sub-County whose land topography is characterized by mountain ranges and savannah vegetation cover that support various species of wildlife. The land topography is predominantly rolling hills.

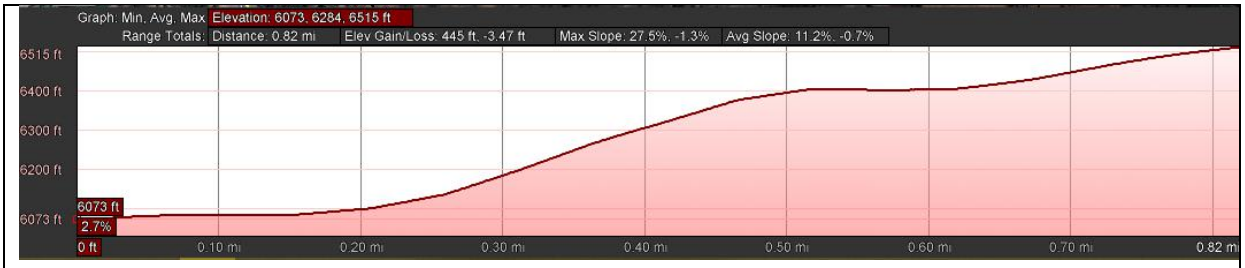


Figure 6-3: Elevation across the West-East Plain 1.3km length

6.1.6 Air Quality

The project site is within a rural setting. Emission from vehicle exhaust pipes is the main air pollutant due to high traffic along A8 road which runs adjacent to the site. Further, the wind direction is dominantly North West to South East therefore the main air quality sensitive receptors will be the homesteads neighboring the site to the East, Kariandusi Primary and Heavens Gate Prayer Mountain.

Table 6-1: Air quality sensitive receptors

Receptor	Approx. distance from the site (m)
Homesteads	550
Kariandusi Primary	1000
Heavens Gate Prayer Mountain	1000

The ambient levels of pollutants such as VOCs, PM_{10} and $PM_{2.5}$, NO_2, O_3, and SO_2 were assessed within the project site and at surrounding receptors. The concentrations measured in this baseline data survey are presented in the table below;

Table 6-2: Air quality monitoring points

Site ID	Sampling Location	Site category	Description (main sourceof air pollutants)	Parameters monitored
1	SP2	Inside the project area	Vehicular emissions, movement of large herds of cattle on loose grounds	PM, SO_2, NO_2, VOCs & O_3

2	SP1	Residential home	Vehicular emissions, Homestead activities and movement of large herds of cattle on loose grounds	PM, SO_2, NO_2, VOCs & O_3

6.1.6.1 Particulate matter

Results of Particulate Matter (PM) tests are presented in the Table below.

Table 6-3: Results for particulate matter at the site

Sampling Location	**Dates**	**PM_{10} ($\mu g/m^3$)**	**$PM_{2.5}$ ($\mu g/m^3$)**	**TSP ($\mu g/m^3$)**	**Comments**
SP1	22^{nd} – 23^{rd} Aug2021	13	7	28	Movement of large herds of cattle on loose surfaces the major source of dust. Heavy traffic along the Nairobi Highway also another source of the reported levels
SP2	23^{rd} – 24^{th} Aug 2021	26	13	36	Movement of large herds of cattle on loose surfaces the major source of dust. Heavy traffic along the Nairobi Highway also another source of the reported levels
Limits		*100 - EMC limits*	*75 & 50 (WHO interim targets 1 & 2 respectively*	*180 -EMC limits*	*All values are within the respective limits*

The PM concentrations measured within the site in the month of August 2021 are presented in the table above. Particulates (PM_{10} and TSP) levels are all within the respective EMC regulatory limits for Residential, Rural and Other areas of 100 $\mu g/m^3$ and 180 $\mu g/m^3$ respectively. The main sources of the pollutants are movements of large herds of cattle on loose surfaces and the busy Nairobi Highway. Strong wind action of loose surfaces was also another factor observed to be another source of fugitive dust at the two monitoring locations.

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).

An analysis on the particulate matter trends for the two measuring points was done and presented in the graphs below;

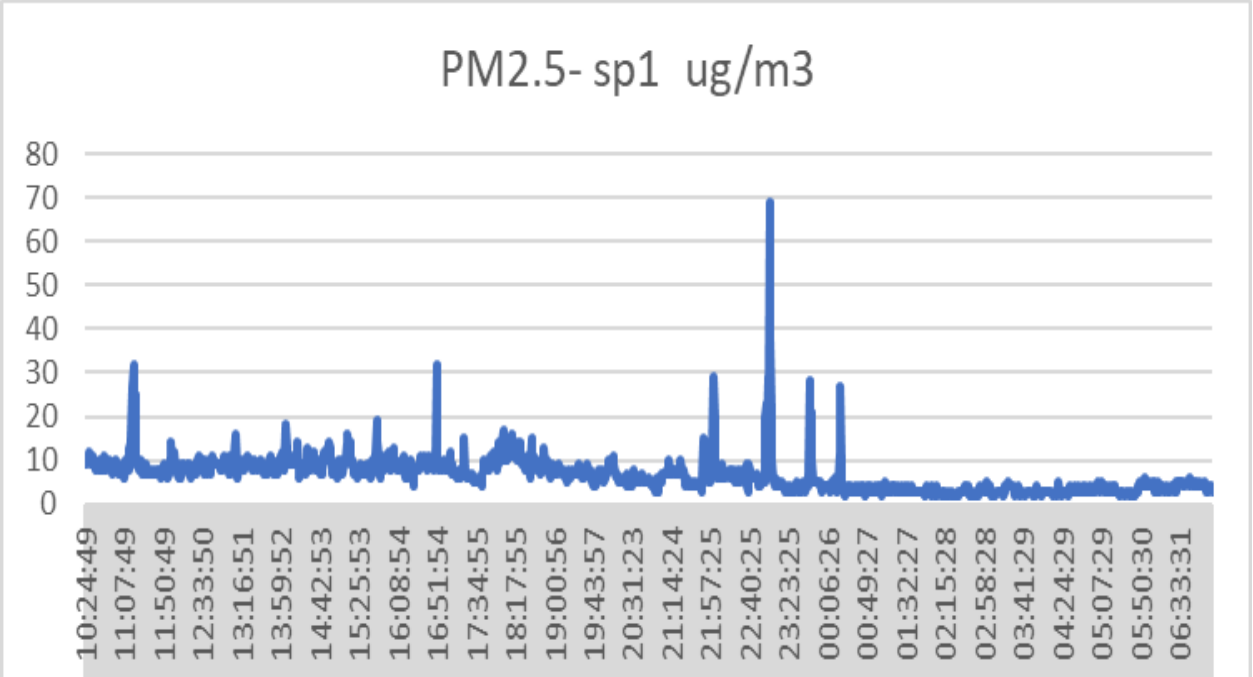


Figure 6-4: PM2.5 concentration trend- SP1

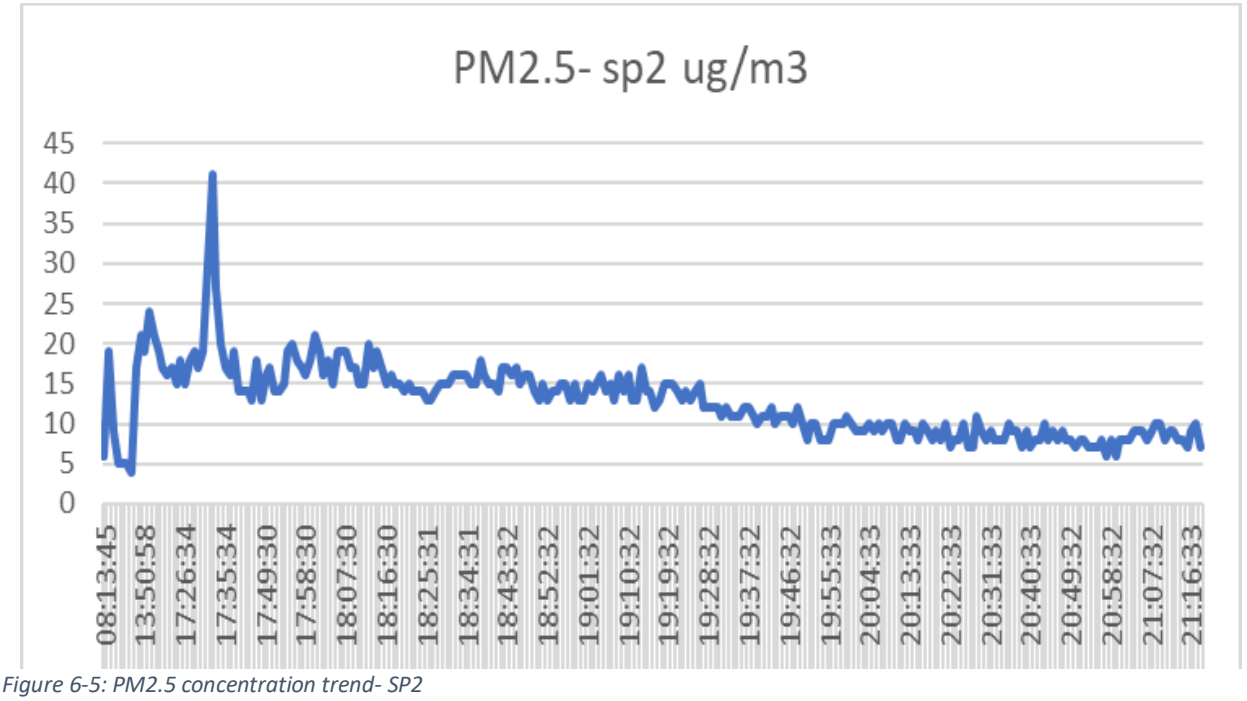


Figure 6-5: PM2.5 concentration trend- SP2

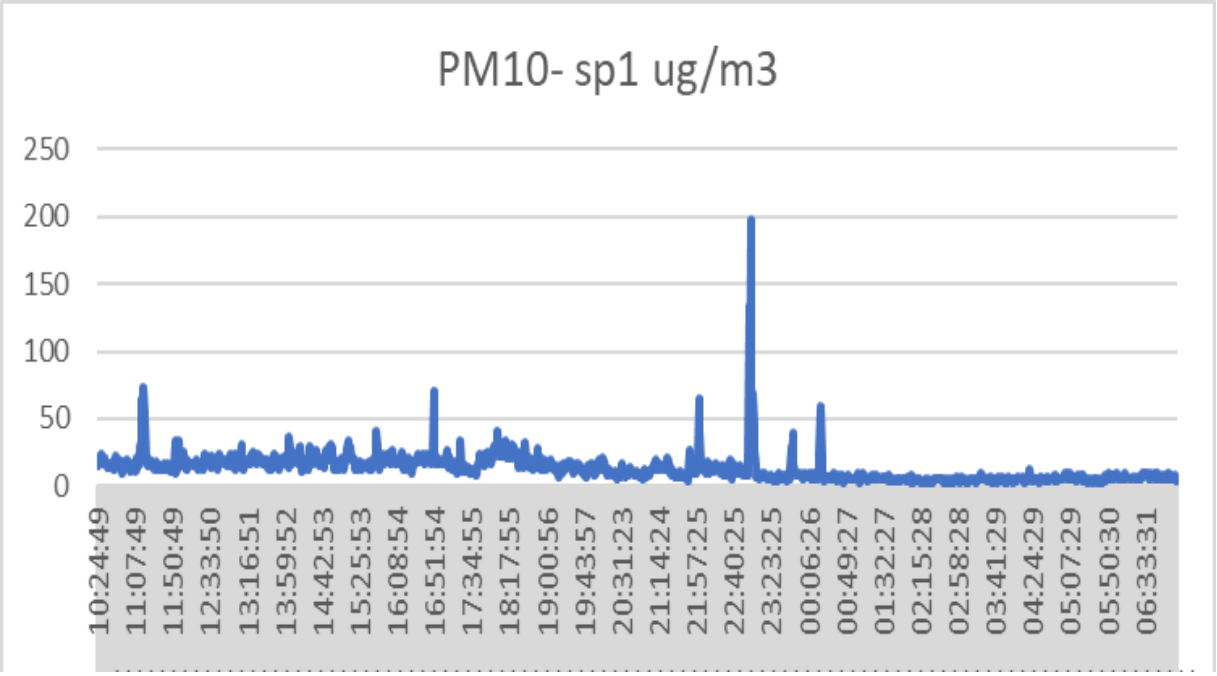


Figure 6-6: PM10 concentration trend- SP1

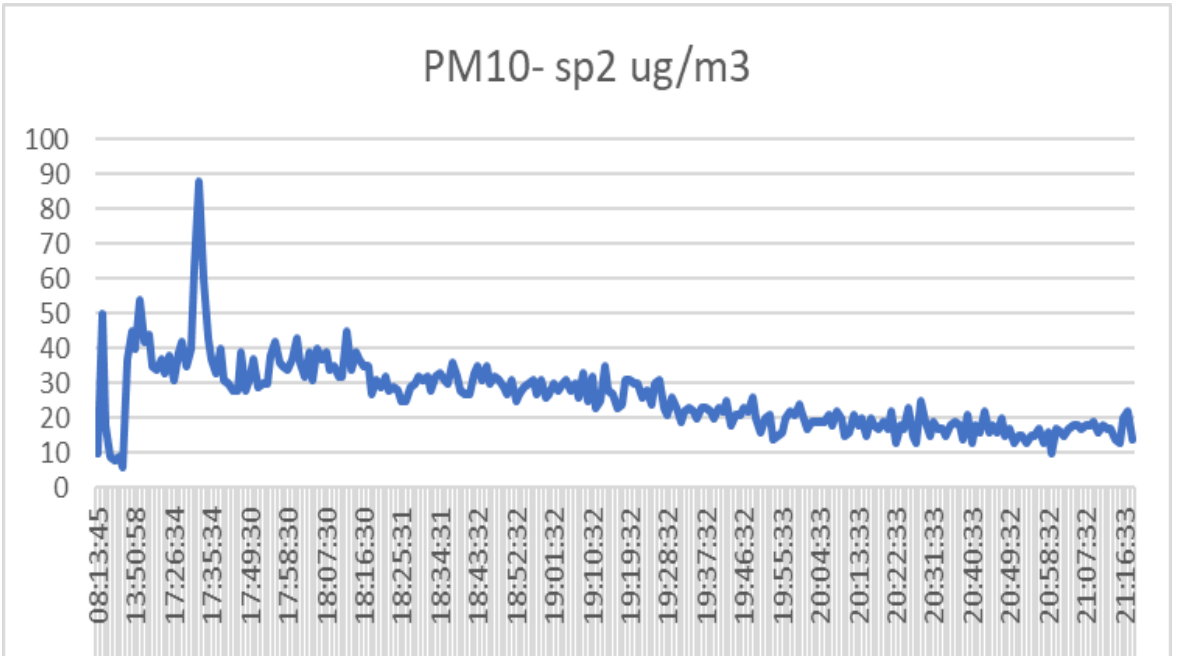


Figure 6-7: PM10 concentration trend- SP2

6.1.6.2 Gaseous Pollutants

The Gaseous Pollutants (VOCs, NO_2, O_3, SO_2) results are presented below:

Table 6-4:Results for gaseous pollutants at the proposed site

Sampling Location	Dates	NO_2 (ppm)	SO_2 (ppm)	O_3 (ppm)	TVOCs (ppm)	Comments
SP1	22nd – 23rd Aug 2021	0.045	0.02	0.05	7	Heavy traffic along the Nairobi Highway and homestead activities the main sources of pollutants
SP2	23rd – 24th Aug 2021	0.033	0.01	0.02	5	Heavy traffic along the Nairobi Highway the main source of pollutants
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 the table above. The values will serve as baseline of which future measurements can be compared with to assess impacts and compliance.

Although the activities taking place on 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. Another source of the gaseous pollutants can be attributed to activities at the nearest residential setups.

An analysis on the gaseous pollutants trends for the two measuring points was done and has been presented in the graphs below;

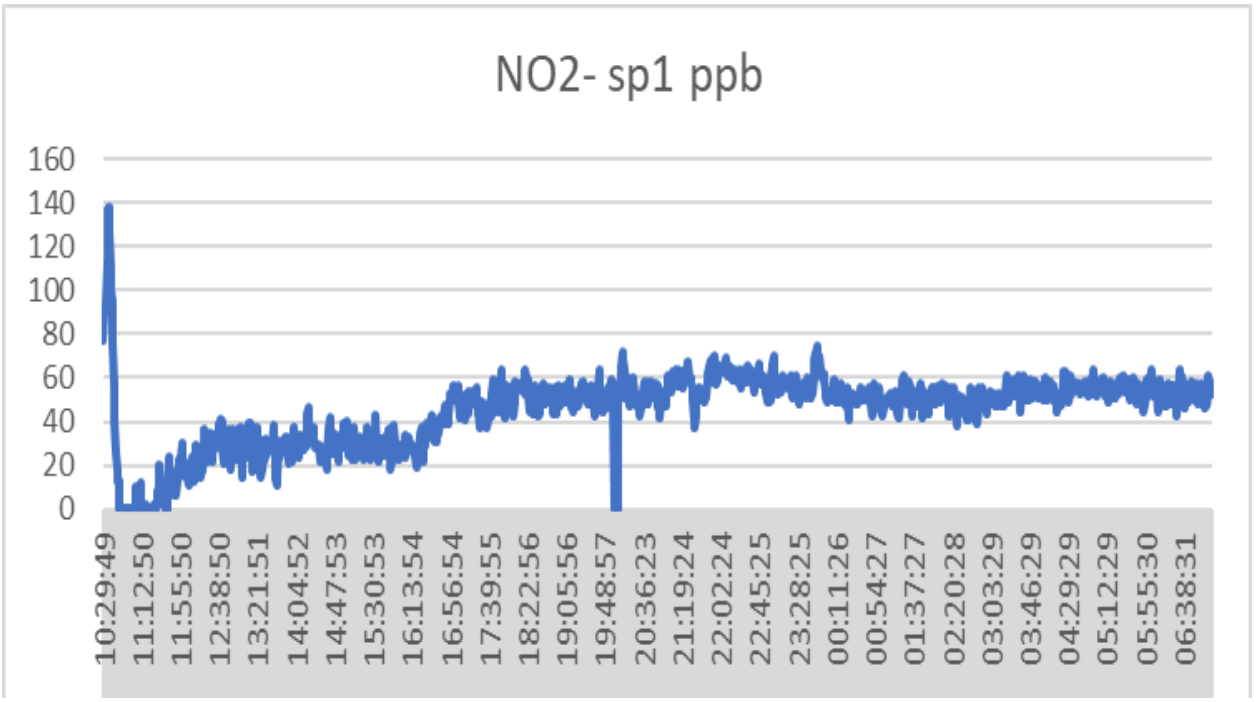


Figure 6-8: NO2 concentration trend- SP1

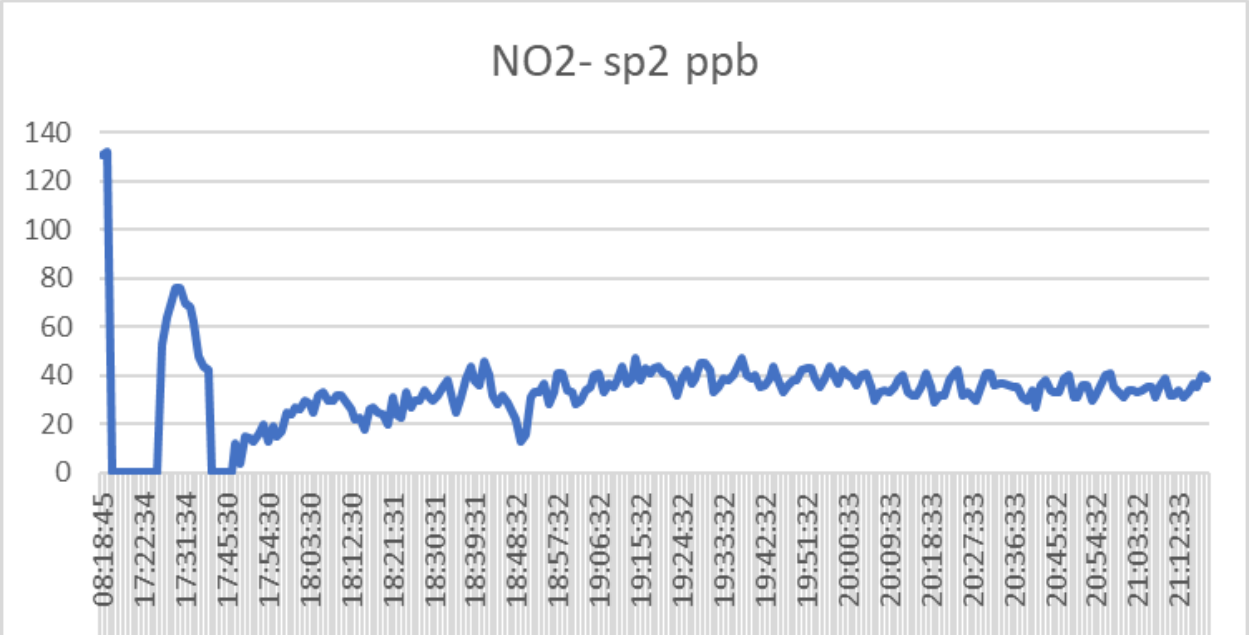


Figure 6-9: NO2 concentration trend- SP2

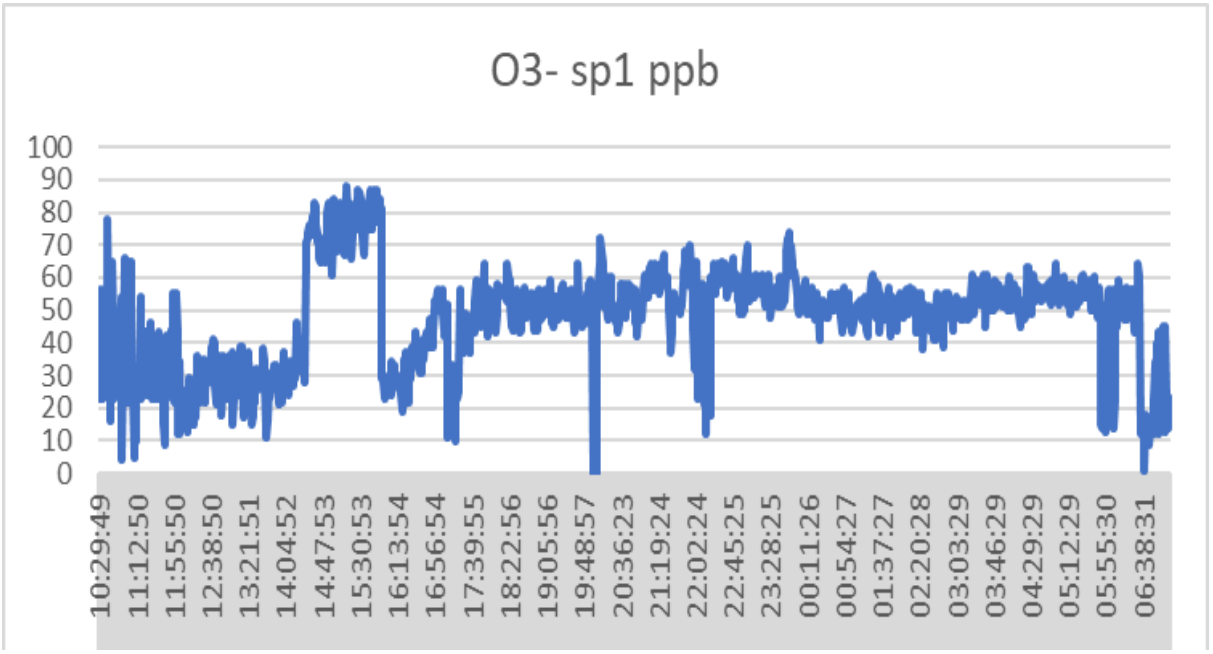


Figure 6-10: O3 concentration trend- SP1

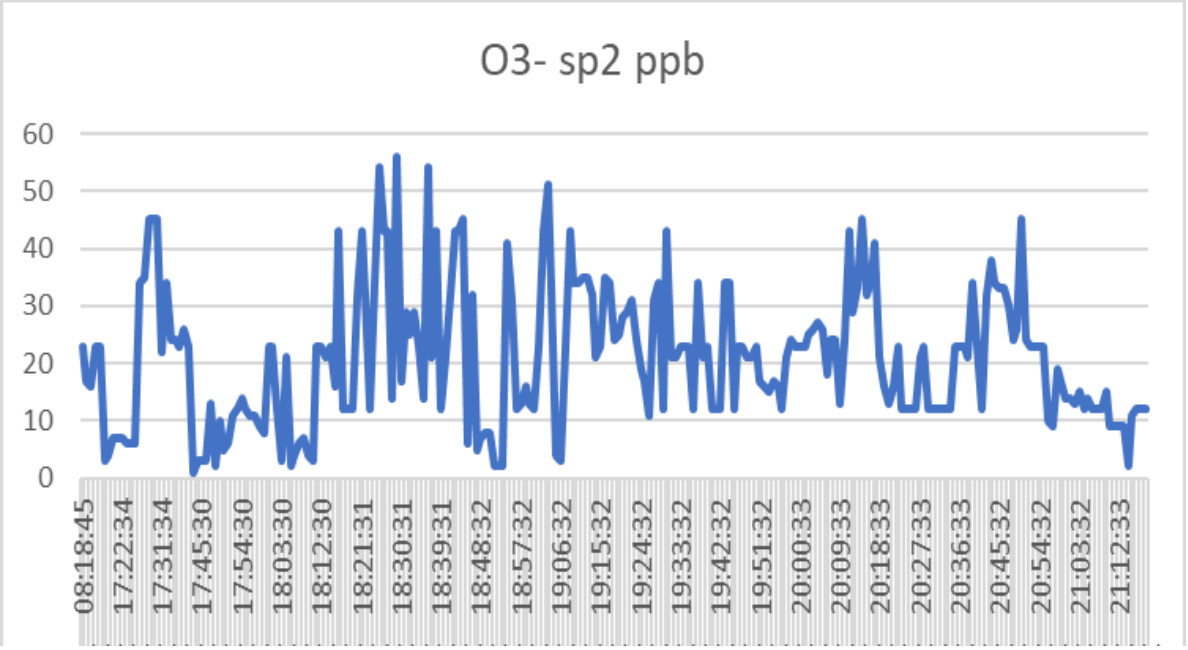


Figure 6-11: O3 concentration trend- SP2

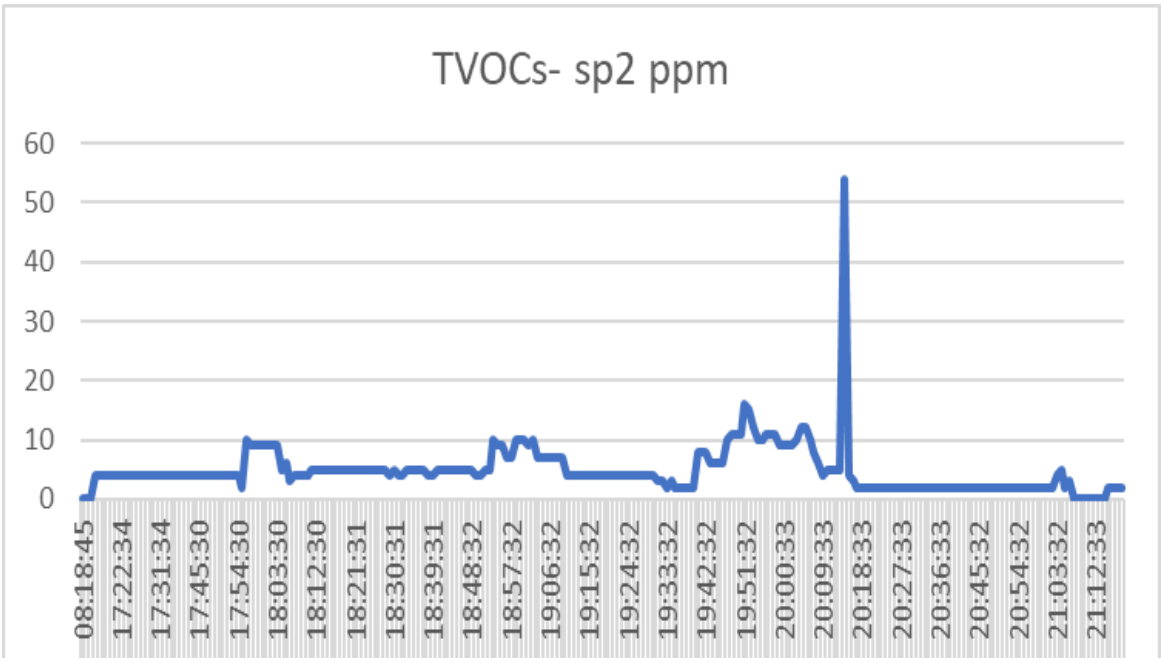


Figure 6-12: TVOCs concentration trend- SP2

6.1.7 Noise and Vibration

The current ambient noise pollution levels and vibration conditions is medium. The main source of noise is high traffic along A8 road, 200m east of the quarry site.

Baseline noise was measured at two points, both within the vicinity of the project area. The table below describes the measurement points for purposes of future monitoring.

Table 6-5: Noise measurement points

Site ID	GPS location	Description
SP1	0°24'28.65"S 36°15'21.66"E	Residential home - mainly affected by vehicular emission from the Highway, approximately 250 meters away. Homestead activities also contributed to the levels reported.
SP2	0°24'26.64"S 36°15'23.77"E	Within the project area - mainly affected by vehicular emission from the Highway, approximately 350 meters away. Dust levels also influenced by movement of large herds of cattle on loose surfaces.

Figure 6-13: Google earth screenshot of noise measurement points

The data obtained for each measurement location compared against the respective EMC set maximum limits are summarized in the table below.

Table 6-6: Noise measurement results – Nocturnal schedule

Site ID	Sampling Location	Date of measurement	Lmin	Lmax	Leq	EMC limits
SP1	Residential Home	22nd to 23rd Aug-21	32.4	73.9	**51.3**	*25*
SP2	Inside the proposed quarry site	23rd to 24th Aug-21	32.6	61.9	**44.3**	*25*

Table 6-7: Noise measurement results – Diurnal schedule

Site ID	Sampling Location	Date of measurement	Lmin	Lmax	Leq	EMC limits

SP1	Residential Home	22nd to 23rd Aug-21	39.6	91.2	**56.7**	*40*
SP2	Inside quarry site	23rd to 24th Aug-21	38.4	81.8	**48.5**	*50*

The obtained noise levels were compared against the EMC Excessive noise and vibration regulations maximum permissible limits for construction sites. Noise levels obtained during the nocturnal schedule are all above the respective regulatory limits. Noise on the diurnal schedule at the two points were also above the respective set limits. The busy Nairobi Highway was noted to be the main source of these reported levels. Dogs barking, birds chirping, movement of large herds of cattle and occasional alarms and ambulances form the highway were also noted to contribute to intermittent elevated noise levels. It is confirmed that background levels are sometimes higher than regulatory limits.

The main sensitive receptors are;

Table 6-8: Noise and vibration sensitive receptors

Receptor	Classification	Approx. distance from the site (m)
St. Mary's Mission Hospital	Silent Zone	690
St Joseph Rift Valley Hospital and medical school	Silent Zone	450
Sunbird resort	Mixed residential	800
Homesteads	Residential	550
Kariandusi Primary	Silent Zone	1000
Heavens Gate Prayer Mountain	Place of worship	1000

6.2 Biological Environment

6.2.1 Vegetation

Vegetation density within the proposed site varies based on the use from low to high density. Extraction of material will be on the hilly part of the site. Vegetation cover is generally of medium density with some mature trees but more shrubs. *Acacia xanthophloea* was the dominant tree species here. Other species

identified include *Euclea divinorum, Aloe capitata var. quartziticola*, Opuntia Species, *Euphorbia trigona* and *Calotropis procera*.

Plate 6-6: Section of area to be quarried with low vegetation cover of Calotropis procera and Acacia xanthophloea

Plate 6-7: medium density cover of area to be quarried with Acacia xanthophloea and shrubs Psiadia punctulata

Plate 6-8: Euclea divinorum and Psiadia punctulata within area to be quarried

Plate 6-9: Acacia xanthophloea and Psiadia punctulata

Another section of the site (0º24'49.49"S 36º15'22.12"E, 0º24"33.32"S 36º15'14.59"E) has a medium density cover of mature *Acacia xanthophloea and Psiadia punctulata. Psiadia punctulata* is used the Maasai's for medicinal purposes i.e. to cure flues.

Plate 6-10: Maize at the farmland

Section 0º 24'26"S 36º15'11"E, 0º24'24"S 36º15'16"S, 0º24'32"S 36º15'14"E and 0º24'32"S 36º15'18"E of the proposed site is used a farmland where maize and potatoes have been planted. The grazing area near the farm is mainly covered with grass and *Calotropis procera*.

6.2.2 Livestock

One of the main uses of the site is livestock grazing. There is a family living within the site with two cows and another individual who has about 200 cattle who has leased a portion of the land for livestock.

6.2.3 Wildlife

The site is largely used for grazing. However, there are monkeys, rock hyrax, guinea fowls and snakes. The neighbouring areas are wildlife dispersal area with Soysambu Conservancy about 2.4km from the site. Soysambu conservancy is a host to large populations of zebras, buffalo, eland, impala, Thompson's and Grant's gazelle, waterbuck, reedbuck, warthog, steenbok, klipspringer, and colobus monkey. It is also home to the introduced population of Rothschild's Giraffe (*Giraffa camelopardalis rothschildi)* which is listed in the IUCN red list as an endangered species and the Kenya Horned Viper (*Bitis worthingtoni)* listed as vulnerable in the IUCN red list.

6.2.4 Fish

At the southern end of the lake are the "Kekopey" hot springs, where the Lake Magadi tilapia (*Alcolapia graham)*, endemic to alkaline lakes was introduced and breeds. This fish is listed as vulnerable under the International Union for Conservation of Nature (IUCN red list).

6.2.5 Reptiles

According to National Museums of Kenya, Lake Elementaita and its environs is habitat to a rich mix of species of reptiles namely snakes, tortoise, lizards, chameleon and gecko.

6.2.6 Birds

The quarry site is about 1.2 km from Lake Elementaita which is home to more than 450 species of birds. The largest populations are the great white pelicans, lesser and greater flamingos travelling between Lake Elementaita, Nakuru and Bogoria. The area is known to be the only breeding colony in East Africa for great white pelicans with over 8000 breeding pairs.

About 100 species of the birds are migratory; coming in between October and March, utilizing the lake as a seasonal habitat. They include the African Spoonbill, Black-Necked Grebe, Yellow billed stork, Gull billed tern, Pied Avocet, Black Winged Stilt and Grey-Headed Gull.

At least 69 water bird species have also been recorded, including 29 Palearctic migrants. Other important bird species to note are; the marabou stork, Egyptian goose, secretary bird, Greater Spotted eagle, Grey-crested Helmet shrike, Grey-crowned Crane, and cape teals.

About 13 globally and 8 regionally threatened bird species have also been identified in the area as outlined in the table below (Birdlife International (2021)

Table 6-9: Threatened Species

Common Name	**Scientific Name**
Locally Threatened	
Ayres's hawk-eagle	*Hieraaetus ayresii*
Great crested crebe	*Podiceps cristatus*
Great egret	*Casmerodius albus*
Yellow-billed oxpecker	*Buphagus africanus*
Long-tailed widowbird	*Euplectes progne*
Red-throat tit	*Melaniparus fringillinus*
Globally Threatened	
White headed vulture	*Trigonoceps occipitalis*
Crowned eagle	*Stephanoaetus coronatus*
Martial eagle	*Polemaetus bellicosus*
Jackson's widowbird	*Euplectes jacksoni*
Maccoa duck	*Oxyura maccoa*
Greater spotted eagle	*Aquila clanga*
Secretary bird	*Sagittarius serpentarius*

Lake Elementaita is home to birds listed in the International Union for Conservation of Nature (IUCN red list). The table below lists the birds and their status.

Common Name	Scientific Name	Status
Greater spotted eagle	*Clanga clanga*	Vulnerable
Secretary bird	*Sagittarius serpentarius*	Endangered
Maccoa duck	*Oxyura maccoa*	Vulnerable
White headed vulture	*Trigonoceps occipitalis*	Critically Endangered
Crowned eagle	*Stephanoaetus coronatus*	Near Threatened
Martial eagle	*Polemaetus bellicosus*	Endangered
Jackson's widowbird	*Euplectes jacksoni*	Near Threatened

6.3 Environmentally sensitive areas

Lake Elementaita was announced as a wetland of international importance (5th Ramsar site in Rift Valley) on 5th October 2005. This shallow saline, alkaline lake provides a favorable environment for diatoms and the blue-green alga *Spirulina platensis*, which lie at the basis of the food chain of several bird species. An average of over 610,000 birds have been counted in the area during the annual census, belonging to more than 450 species of which 80 are waterfowl. The lake acts as an important dispersal area for Lesser Flamingo (*Phoenicopterus minor*), hosting an average of 28.5% of its world population and playing an especially important role when food is limited in other saline Rift Valley lakes like Nakuru and Bogoria. During the dry season, black lava islands situated in the western part of the lake provide the only suitable nesting and breeding grounds for Great White Pelicans (*Pelecanus onocrotalus*) in the Rift Valley region. Also a UNESCO world heritage site due to its birdlife fame.

6.4 Archaeological Resources

Examinations of this new quarry site revealed that it is not of archaeological significance. Although the underlying basement rock consists mainly of basalt and phonolite (Geological reports of Kenya No 31, 1968) presence of high-quality obsidian which was the preferred raw material for stone age tools points to a possibility of finding sub-surface archaeological materials.

A small number of stratified sediments were observed, usually located in rock shelters or caves in the area. It is therefore noted that there is a need to take caution of the subsurface and other areas when quarrying since in recent times archaeological human remains was reported at a quarrying site less than 2km away from the proposed site (Daily Nation 2017).

6.5 Social – Economic Environment

6.5.1 Project Administrative Location

Nakuru County is divided into 11 administrative Sub-Counties with a total of 31 divisions and 55 electoral wards. The table below shows the Sub-Counties and wards.

Table 6-10: Project Administrative data

Sub-County Code	Sub-County	Area (Km^2)	Wards
166	Molo	478.79	Molo, Turi, Elburgon, Marioshoni
167	Njoro	713.3	Mau Narok, Kihingo, Mauche, Nessuit, Lare, Njoro
168	Naivasha	1685.8	Biashara, Maiella, Maimahiu, Viwandani, Hells Gate, Olkaria, Naivasha East, Lake View
169	Gilgil	1348.4	Gilgil, Malewa West, Eburru/Mbaruk, Elementaita, Murindat
170	Kuresoi South	559.7	Amalo, Keringet, Kiptagich, Tinet
171	Kuresoi North	572.3	Kiptororo, Nyota, Sirikwa, Kamara
172	Subukia	390.71	Wasenges, Subukia, Kabazi
173	Rongai	1049.1	Mosop, Soin, Menengai West, Visoi, Solai
174	Bahati	375.4	Kabatini,Kiamaina, Lanet/Umoja, Dundori, Bahati
175	Nakuru Town West	251	Barut, London, Kaptembwo, Kapkures, Rhonda, Shaabab
176	Nakuru Town East	74.3	Biashara, Kivumbini, Menengai, Flamingo, Nakuru East

6.5.2 Population and Demography

The total population of Nakuru County as per the 2019 census is 2,162,202 where 1,077,272 are males, 1,084,835 are females and 95 are intersex. The table below shows the population distribution per Sub – County.

Table 6-11: Population distribution

Sub-County	Male	Female	Intersex	Total
Gilgil	92,955	92,247	7	185,209

Kuresoi North	87,472	87599	3	175,074
Kuresoi South	78,204	77,117	3	155,324
Molo	78,129	78,598	5	156,732
Naivasha	179,222	176,132	29	355,383
Nakuru East	92,956	100,960	10	193,926
Nakuru North	106,155	111,880	15	218,050
Nakuru West	101,797	96,854	10	198,661
Njoro	118,361	120,408	4	238,773
Rongai	99,976	99,922	8	199,906
Subukia	42,045	43,118	1	85,164

6.5.3 Land Use

The proposed site is located in a large piece of land that has been segmented and is used for different purposes. The main land use is grazing where a farmer with about 200 cattle has leased land to graze his cattle.

Crops planted at the time of assessment are maize and potatoes. The farm in about 6 acres of land.

The rest of land is covered with (about 40 acreas) natural vegetation dominated by *Acacia xanthophloea.* Other species identified in the other areas are; *Euclea divinorum, Aloe capitata var. quartziticola*, Opuntia Species, *Euphorbia trigona* and *Psiadia punctulata.*

Plate 6-11: Homestead and grazing field

Plate 6-12: Cow shed

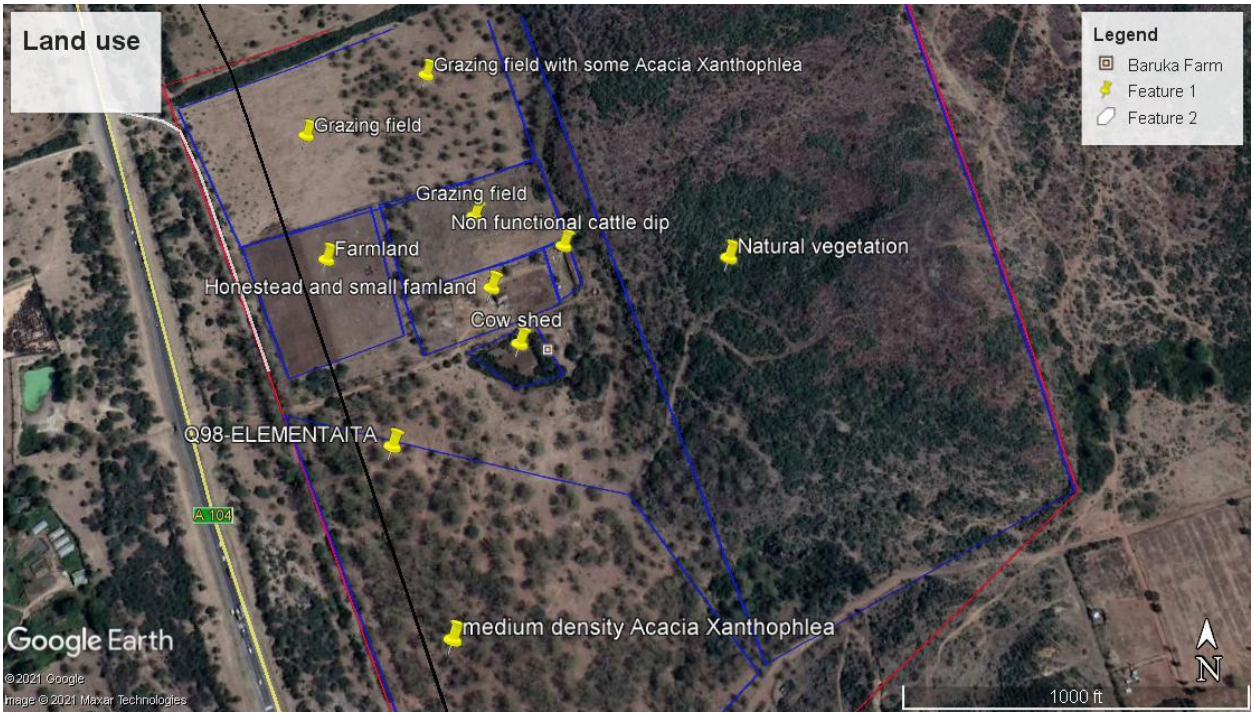


Figure 6-14: Google earth screenshot showing land use

6.5.4 Land tenure

Land tenure implies all rights provided by a legal system through which individuals and groups gain access to land including owning and disposing off. Most of the land in Gilgil is owned individually with owners possessing title deeds. Some however have leased land.

6.5.5 Ethnic Composition

Gilgil sub-county is a multi-cultural county with individuals originating from all the Kenya. According to the 2019 census, Gilgil Sub- County is said to have a population of 185,209 individuals with majority being male (50.2%) and female are said to be 49.8% of the population. The leading tribes are the Kalenjin and the Kikuyu making around 70% of the entire population. Other tribes for example Kamba, Meru, Luhyia, Luo, Kisii among others are present mostly in urban area. Majority of these people migrated here for business and employment.

The proposed quarry site is mainly occupied by Kikuyus and Maasais. The Maasai's are considered indigenous people.

6.5.6 Education

There are 1089 primary schools and 508 secondary schools in Nakuru County, serving 465,729 pupils and 146,073 students respectively. The county's Teacher to Pupil Ratio is 1: 49 for public primary schools

and 1:36 for public secondary schools. Some of the top high schools in Nakuru County include Moi High School Kabarak, Molo Academy, Nakuru High School, Bahati Girls Secondary School, Naivasha Girls Secondary School and Rongai Secondary School. Universities and other institutions of higher learning in the county include Egerton University, Mt Kenya University Campus, Kabarak University, Kenya Industrial Training Institute (KITI) and Kenya Institute of Management (KIM). The literacy level in the county is at 79.7%.

There is only one school about 800m from the proposed site, Kariandusi Primary.

6.5.7 Health

Gilgil Sub-County has a total of 40 health facilities; 18 public, 1 FBO and 21 private. The proposed site has two hospitals across the road, opposite the proposed quarry site. St. Mary's Mission Hospital Nakuru. It is a level 4 catholic faith-based healthcare facility located on the Gilgil - Nakuru road near Elementeita country Lodge. The hospital is a branch of the St Mary's Mission Hospital (STMMH) in Nairobi, Langata. Neighbouring St.Marys hospital is St. Josephs hospital.

The five most common diseases are; upper respiratory infections which has a prevalence rate of 438/1000, this is followed by skin diseases with a prevalence rate of 89/1000, diarrheal diseases with a prevalence rate of 63/1000, pneumonia with a prevalence rate of 41/1000 and arthritis with a prevalence rate of 30/1000 (KDHS 2014).

The HIV prevalence for the County stands at 4.1 percent with a total number of 66,295 PLHIV with 58,397 being adults and 7,898 being Children (NACC 2016). In 2014, the County recorder 4,127 new HIV infections with 199 HIV infections being among children. The outcome of these statistics reveals slow uptake of Prevention of Mother to Child Transmission (PMTCT).

6.5.8 Economic Activities

The main economic activities around the proposed quarry site are; farming, livestock keeping, salt and sand mining and hotelier/tourism. Hotels near the site include; Sunbird Lodge, Lake Elementaita Serena Camp, Eagles Point Camp and others.

6.5.9 Infrastructure

6.5.9.1 Roads

The entire road network in the Nakuru County is approximately 12,491km. Out of which paved roads are 993.7 Km and gravel roads are 4,500 Km and earth roads are 6998Km. The road infrastructure can be described as 20% good, 35% fair and 45% poor.

Some roads especially in agricultural rich areas including Kuresoi North and South, Molo, Njoro Subukia, Naivasha and Gilgil are still in deplorable condition hence leading to delays in transporting of agricultural produce to the market making farmers to incur losses for perishable goods. This situation is set to be improved in the plan period by opening up of more feeder roads.

The Nairobi – Uganda highway runs across the county thus promoting cross-border interconnections within the three East African countries.

6.5.9.2 Railway

The county has a railway line length of 192 Km connecting major urban areas of the county namely; Naivasha, Gilgil, Nakuru, Njoro, Molo and Rongai. It has ten railway stations serving as drop/ collecting points for agricultural and industrial good as well as providing public transport from Nakuru to the Mombasa via Nairobi and Nakuru to Uganda via Eldoret, Kisumu, Busia and Malaba.

The County also has a Standard Guage Railways from Nairobi to Suswa.

6.5.9.3 Communication

Estimates from the 2019 Population and Housing Census indicate that approximately 55.1 per cent of households in Gilgil Sub-county own a mobile phone. Mobile network coverage in the county is at 91 per cent. 28.2% of Gilgil population age 3 years and above use the internet while 12.6% use desktop computer/laptop/tablet.

6.5.9.4 Financial Services

Gilgil Sub- County is served by a network of major financial institutions. There are at least ten major banks which include Kenya Commercial Bank, Standard Chartered bank, Equity bank, National Bank, Commercial Bank of Africa, Family Bank, Co-Operative Bank, Barclays Bank, Post Bank and Trans-National Bank.

6.5.10 Energy

Electricity is the main source of energy for lighting in Gilgil Sub- County at 53.6 percent whereas firewood and gas (LPG) are the major sources of energy for cooking at 44.2 percent and 31.3 percent respectively. 19.4% of people living in Gilgil use charcoal as their cooking fuel. Other renewable sources like wind, solar and biogas account for less than 3 percent although there is potential of wind being used as a major source of energy, whereas most parts of the County receive enough sun shine throughout.

6.5.11 Housing Types

The majority of households in Gilgil have durable roofing materials with corrugated iron sheets being the major roofing material used at 93.7% percent. The main wall material is stone with lime/cement at 33.8

percent whereas the main floor material is cement and earth/sand which is at 52.4 percent and 33.3 percent.

The housing tenure is majorly rent/provided which is at 46.6 percent, however 53.4 percent of houses are occupied by owners. The number of houses owned in Gilgil are 26,371 of which 4.8 percent were purchased, 89.9 percent constructed and 5.4 percent inherited.

Ebburu/Mbaruk Ward has dispersed settlements because houses are spread over a wide area. The area is rural with few people living there.

6.5.12 Tourism and recreation

The town of Gilgil is located near Lake Elementaita. In the south-to-north sequence of Rift Valley lakes, Elmenteita is located between Lake Naivasha and Lake Nakuru. The major Nairobi-Nakuru highway runs along the nearby escarpment affording motorists a spectacular vista towards the lake. At the southern end of the lake lie the "Kekopey" hot springs, in which the Tilapia grahami breed. Very popular for bathing, the local Maasai claim that it can cure AIDS. The reed beds nearby are fishing grounds for night herons and pelicans. Gilgil sub- County has substantial number of tourist hotels and camping sites offering high class services. Some of the hotels around the proposed site include Sunbird lodge, Serena Camp, Eagles point camp and Elementaita Country Lodge among others

6.6 Similar Developments

About 1.3km from the project location is sand mine located at 0°24'58.02"S 36°15'50.84"E. It can be accessed through a road currently being upgraded to tarmac joining the A8 at 0°25'5.26"S 36°15'29.23"E.

Plate 6-13: Sand mine near Heaven Gates Prayer Centre

7 PUBLIC CONSULTATION

7.1 Introduction

Consultation and Public Participation Process is a policy requirement by the Government of Kenya and a mandatory procedure as stipulated by EMCA (Cap 387) section 58, on ESIA for achieving the fundamental principles of sustainable development. This chapter describes the process of the public consultation and public participation followed to identify the key issues and impacts of the proposed project.

Prior to commencement of the public consultation process, a Stakeholder Engagement Plan (SEP) was prepared which identified the projects key stakeholders. They were categorized into three as described below;

1. Are directly and/or indirectly affected by the project
2. Have “interests” in the project or parent company that determine them as stakeholders
3. Have the potential to influence project outcomes or company operations

Based on the above categorization, the table below shows the stakeholders engaged during the various methods of public consultation.

No.	Stakeholder Classification	Stakeholder Group	Stakeholders
1	Directly and/or indirectly affected by the project	Locals	• Land owners • Land lessee’s • Local business owners
2	Have the potential to influence project outcomes or company operations	Government Agencies	• County Government – Ministry of Environment, Energy and Natural Resources • Sub County Administrator • Ward Administrator • Chief and Assistant chief

Public consultation was conducted through key stakeholder interviews, public meetings and administration of questionnaires.

7.2 Administration of questionnaires

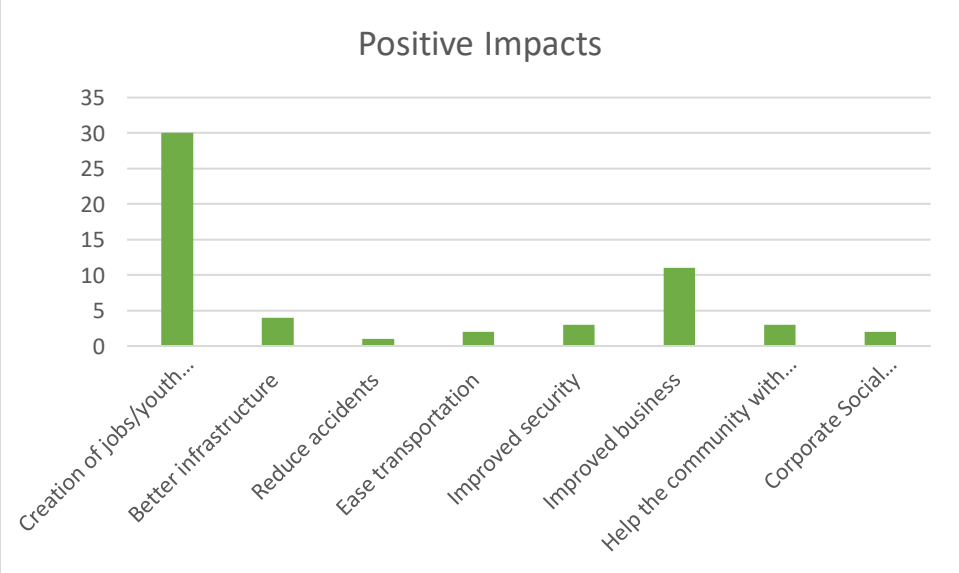
Questionnaires were administered to 3 categories of people; residents, key stakeholders and administrative/county officials. A total of 36 questionnaires were administered. The table below shows the number of responses from each category

Category	Number of responses
Local residents	25
Key Stakeholders	5
Administrative/county officials	6

The responses from the questionnaires have been analyzed as below;

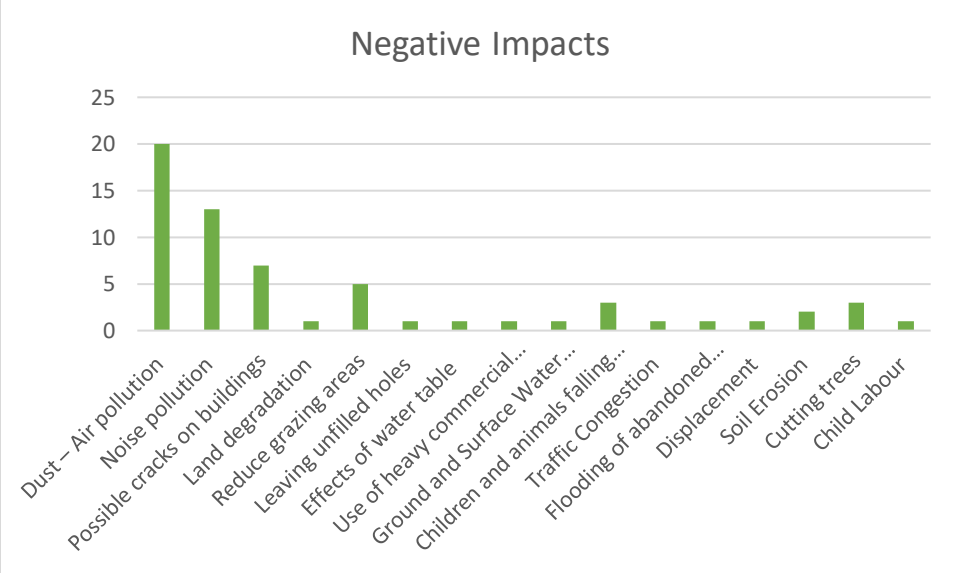
Anticipated positive impacts

- Creation of jobs/youth empowerment
- Better infrastructure - Build the dual carriage way (Long term)
- Reduce accidents
- Ease transportation
- Improved security
- Improved business around the area/Improve economy
- Help the community with building materials
- Corporate Social Responsibility (boreholes, classrooms)



Anticipated negative impacts

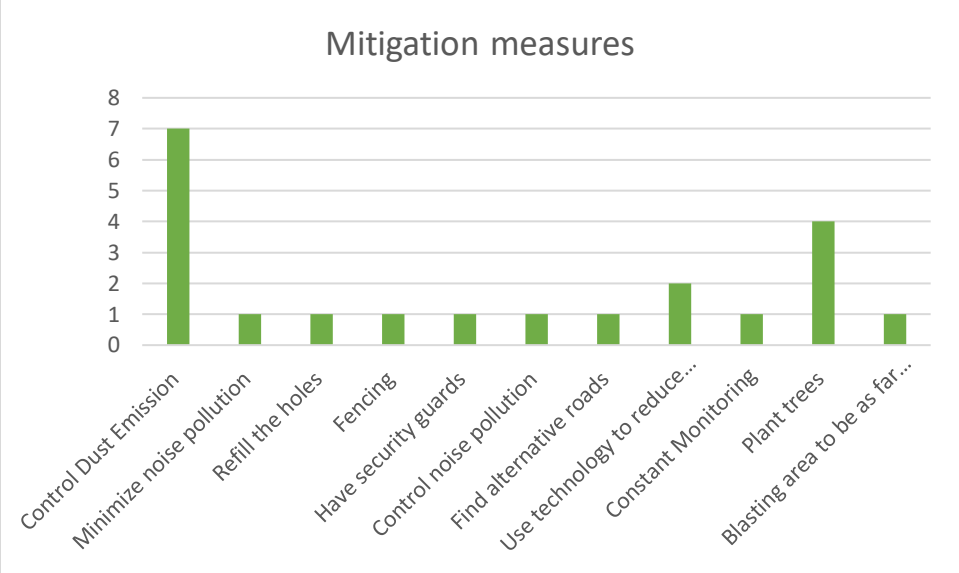
- Dust – Air pollution
- Noise pollution – blasting, drilling, crushing, asphalt plant
- Possible cracks on buildings/houses
- Degrade physical features/Land degradation
- Reduction of pasture/Reduce grazing areas
- Leaving unfilled pits
- Effects of water table - (Lowering the water table may affect 'Prayer Mountain')
- Use of heavy commercial trucks may affect the road under construction to Prayer Mountain
- Ground and Surface Water pollution – Asphalt plant
- Danger of children and animals falling in the quarry pit
- Traffic Congestion during quarry operation
- Flooding of abandoned quarry
- Displacement
- Soil Erosion
- Cutting trees/Deforestation
- Child Labour - children dropping out of school to work in the quarry



Mitigation measures

- Control Dust Emission – sprinkle water
- Minimize noise pollution
- Backfill the pits
- Fencing
- Have security guards

- Control noise pollution
- Blasting area to be as far away from Heaven's Gate Prayer Mountain as possible Find alternative roads
- Use technology to reduce pollution
- Constant Monitoring
- Plant trees



Unique or special considerations before the project commences

- Civic education of the people living in the area
- Set up sign boards
- Displacement plan
- Hold another public participation meeting / Chief Baraza
- Fence the quarry area
- CSR – Corporate Social Responsibility (Boreholes, schools)
- Avoid blasting during the night
- Employ locals

7.3 Public meeting

Two public meetings were held to share project details and also pick the public's opinion.

7.3.1 1st Public Meeting

A public meeting was held on 7th September 2021 at Karura, Eburru/Mbaruk Ward. The meeting was restricted to 53 people in attendance both male and female due to COVID 19 protocols and Government directive. The attendance list and minutes of the meeting have been attached.

Key issues raised

- Noise, vibrations and dust were a major concern for the residents and they wanted to know how these would be handled
- The community also requested that the youth in the area should be considered for employment for both skilled and non-skilled labour
- The area being a water scarce area, the community members suggested that a borehole is dug in public property as opposed to private property so that they will continue to benefit long after the project has been completed.

Plate 7-1: Engineer explaining the project

Plate 7-2: A resident making a comment on the project

Plate 7-3: Stakeholders filling questionnaires

7.3.2 2nd Public Meeting

A second public meeting was held on 8th October 2021 at Karura, Eburru/Mbaruk Ward. This meeting focused on the sensitive receptors identified and large businesses within the area. There were 18 people

in attendance although most were males. The attendance list and minutes of the meeting have been attached.

Key issues raised

- Noise and vibration affecting the sensitive receptors i.e. St. Marys Hospital, St. Josephs Hospital, Sunbird lodge, Heavens Gate Prayer Centre and Kariandusi Primary and Secondary.
- Blasting method may affect soil strata thereby impacting areas beyond project boundary by rocks falling or landslides.
- Depending on the blasting method, rocks flying in the area pose a hazard to locals and children in school
- Contamination of Lake Elementaita which is a Ramsar site. Fear of losing this Ramsar site and the biodiversity that is dependent on it due to any form of contamination from quarry activities. Many people may also lose jobs as a result.
- Health and safety of locals and wildlife from the neighboring Soysambu Ranch. Potential of falling into the quarry pit leading to injuries or even fatalities.
- Impact on aesthetics was a concern as it may hinders tourists from visiting the area. There was a request to locate the quarry on the face of the hill that does not face the road (A104)
- Depletion of ground water resources which most are dependent on especially those on higher grounds like Heavens Gate Prayer Mountain
- There was a concern about the proponent implementing the mitigation measures mentioned. The residents wanted an assurance on this and were requesting for a meeting with a NEMA representative.

Plate 7-4: Environmentalist explaining expected vibration and distance coverage

Plate 7-5: Community member giving their comments

Plate 7-6: Engineer responding to questions

8 GRIEVANCE REDRESS MECHANISM

It is important to have a proactive and credible local mechanism to systematically receive and resolve grievances that might arise from both real and perceived impacts in order that they do not escalate and present a risk to operations and to corporate reputation. In order to avoid, wherever possible, situations where some grievances occur, Sogea Satom shall ensure that proactive stakeholder engagement practices are established for example through regular communication with local community's representatives to update them on the project, its activities and associated impacts.

It is intended that all other environmental and social management plans, will work proactively towards identifying and addressing issues before they become grievances. However, when grievances are reported they need to be addressed in a consistent and verifiable manner. This will be done through the implementation of a grievance procedure. The process for responding to and dealing with feedback of grievances is outlined below:

1. Receipt of feedback or grievance
2. Recording of feedback or grievance
3. Acknowledgement of grievance
4. Eligibility assessment and decision making
5. Formal communication with stakeholder
6. Assessment of significance of feedback or grievance
7. Determination of actions to address feedback or grievance actions taken to resolve grievance
8. Completion of remedial actions
9. Ongoing monitoring and evaluation

8.1 Monitoring and reporting

Monitoring is an integral component of project management as it tracks and assesses progress towards achieving tangible development results associated with the project being implemented. It is an essential management tool which provides an opportunity to know whether results are being achieved as planned, what corrective action are needed to ensure delivery of the intended results and how they are making positive development contributions. This helps to detect problems earlier and coming up with appropriate measures to address them. Therefore, monitoring usually provides data used for analysis and synthesis prior to reporting for decision making.

All records of reported complaints, their nature and number of complainants, number of follow-ups by complainants either in person or via phone and other approved means and concluded resolutions or actions taken if unresolved and the average time taken to resolve grievances should be kept and made available to the project monitoring team. It shall be the mandate of Sogea Satom through the Community

Liason Officer, HSE supervisor and any other relevant office to keep records for annual reporting and for future use of the project. Below is a grievance register that can be implemented for monitoring purposes.

Table 8-1: Grievance Register

Date	Stakeholder	Grievance/Concerned Party	Solution/Agreement	Date Resolved

9 ANALYSIS OF ENVIRONMENTAL IMPACTS

The impact analysis were done using the Leopold matrix which 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 were done. The rating evaluation is as presented in the table below:

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

The following section describes the meaning of the terms used:

- **Sign /Nature of the impact:** Alludes to the beneficial nature, good(+), bad (-)
- **Intensity** It refers to the degree of impact on the factor, in the specific area in which it operates.

Ranked from 1 to 3. The three expressed an almost total destruction of the factor in the area in which the effect occurs.

- **Type:** Refers to the nature of the impact, direct (3) indirect (2) or cumulative (1)
- **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 (1). If, however, the effect does not support a precise location within the project environment, having a pervasive influence beyond the project footprint, the impact will be large (3). Intermediate situations are considered as partial (2).
- **Timing:** Refers to the moment of occurrence, the time lag between the onset of action and effect on the appearance of the corresponding factor. We consider three categories according to this time period is zero, up to 2 years, or more than two years, which are called respectively as immediately (3), medium term (2), and long term (1).
- **Reversibility:** It refers to the possibility of reconstructing the initial conditions once the effect has occurred. Can be characterized as short-term, easily reversible (1), medium term, partially reversible if mitigated (2) and impossible (3).
- **Duration/ Persistence:** Refers to the time that supposedly stays 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 this generic characterization because spaces are not discrete time course associated with these categories and because in any case, it is very difficult, in the limit, to discern on temporary or permanent effects.

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.

The above used technique is WB methodology (1995) and only two impact characterization parameters included in the matrix are not considered in the impact magnitude valuation formula, these are the “type” and “recoverability”.

Table 9-1: Impact scoring matrix

Topic	Element	Action	Impacts	NI	TI	EX	IT	R	TM	PI	Phase	MG
Water Resources	*Water Quality*	*Drilling of borehole*	Pressure on existing resources	-	3	1	2	2	2	1	C/0	13
		Civil works	Sedimentation of seasonal stream and dam	-	3	2	1	1	2	1	C/O/D	11
			Contamination of ground and surface water	-	2	3	2	2	2	3	C/0	19
	Water flow	*Civil works*	Increased surface runoff	-	2	1	2	1	1	1	C/0	11
Flora	*Natural vegetation*	*Civil works & quarrying*	Clearance of vegetation	-	3	1	2	2	1	1	C/O	12
Fauna	*Wildlife*	*Civil works and quarrying*	Loss of habitat	-	3	1	2	2	1	1	C/O	12
	Livestock		Loss of grazing field	-	3	1	1	2	1	1	C/O	9
	Wildlife & Livestock		Impact on wildlife safety	-	3	1	2	2	1	1	C/O/D	12
Soil	*Soil contamination*	*Civil works & quarrying*	Fuel and oil leaks/spills	-	3	1	1	1	1	1	C/O/D	8
	Soil erosion		Exposure to erosion agents	-	3	1	2	1	2	1	C/O	12
	Soil fertility	*Quarrying*	Impact on soil profile and fertility	-	2	1	2	2	2	3	O	15
Air Quality	*Air pollution*	*Civil Works & quarrying*	Particulate matter emissions	-	3	1	3	1	1	1	C/O/D	14
			Exhaust fumes from vehicles	-	3	1	2	1	1	1	C/O/D	11
Noise and Vibration	*Excessive noise and vibration*	*Civil works & quarrying*	Excessive noise and vibration	-	3	1	3	1	1	1	C/O/D	14

Occupational Health & Safety	*Accidents & Incidences*	*Civil works & quarrying*	Risk of accidents and incidence	-	3	1	3	2	1	1	C/O/D	15
	Diseases	*Civil works & quarrying*	Risk of respiratory diseases	-	1	1	3	1	1	1	C/O/D	14
		Civil works & quarrying	Spread COVID 19	-	2	1	2	1	1	1	C/O/D	11
		Civil works & quarrying	Spread of HIV/AIDS	-	2	1	1	2	2	2	C/O/D	11
		Quarrying works	Spread of water borne diseases	-	2	1	1	1	2	1	O	9
Land use	*Farmland and Grazing area*	*Civil works & quarrying*	Change of use from farmlands and grazing fields to quarrying site	-	3	1	2	1	3	3	C/O	15
Social	*Displacement of people*	*Civil and General works*	Possible displacement of the family living on the site	-	3	1	2	1	2	1	C	12
Land degradation and aesthetics	*Impact on landscape*	*Quarrying works*	Change of visual impacts (features, vegetation removal) and slope alteration	-	3	1	3	2	3	3	O	19

From the analysis above, the impacts can be rated as high, medium, low and insignificant depending on the impact scoring.

Where: High>15, Medium: 12 – 15, Low<12

The table below shows the impact ranking;

High Impacts	Medium Impacts	Low Impacts

Contamination of ground and surface water Land degradation Occupational and Public Safety Excessive noise and vibrations Air Quality	Pressure on existing water resources Change in land use Clearance of vegetation Risk of respiratory diseases Impact on wildlife safety Impact on soil profile and fertility Exposure to soil erosion Possible displacement of family on site Loss of habitat	Spread of water borne diseases Increased surface run-off Loss of grazing field Fuel and oil leaks Exhaust fumes from vehicles Spread of COVID-19 Spread of HIV and AIDS

10 POTENTIAL POSITIVE IMPACTS

10.1 Construction / Installation Phase

10.1.1 Creation of employment and business opportunities

Establishment of the quarry will create short term employment to the local community who will be contracted to take part in the various aspects of the project. It will also contract local business owners to supply some of the materials needed in the set-up of auxiliary facilities or daily operations within the quarry.

Land leased for the quarrying operation will be a source of income to the owner.

10.1.2 Improved water supply

The proponent intends to sink one borehole that will be used to meet the water needs during operation. These will not only supply water to the project but also to the landowner during and after the project.

Having an alternative source of water as a project will also reduce pressure on the currently available water resources within the sub county.

10.1.3 Source of revenue to the government

Both the County and National government will generate income in form of taxed generated during the acquisition of licenses and operations of the facility and also PAYE remitted from the employee's salaries.

10.1.4 Acquisition of new skills

Locals hired in the project may be required to undergo brief training in order to operate the machines used in aggregate processing; giving them an upper hand against other unskilled candidates when similar projects come up.

10.2 Operation Phase

10.2.1 Creation of employment and business opportunities

Some locals will benefit from the quarry project through employment opportunities. Employment will empower the people in a big way because money will circulate the area and that will positively impact businesses in the area.

10.2.2 Improvement of transport system

Materials taken from the quarry are salient for construction of the new Rironi-Mau Summit Road. The highway passes through Elementaita area and therefore will greatly benefit local road users and others.

10.2.3 Source of revenue to the government

There will be unfaltering revenue collection by the county government and this ubiquitously impacts the county positively. The education sector, the health sector and many disparate sectors will all be ameliorated because of the revenue arrogated from the quarry project.

10.2.4 New Skills for the Employed

The locals that will get jobs will learn new skills from trainings or apprenticeship that may help them in the future when they will look for other job opportunities.

11 Potential Negative Impacts during Construction and Installations Phase

11.1 Clearance of vegetation

The site has mature species that will need to be cleared for the installation of plants and other quarry components. The site has a variety of mature tree species especially *Acacia xanthophloea* and shrubs some of which are used for medicinal purposes such as *Psiadia punctulata.* Crops in the farmland will also be cleared. This impact is rated as medium.

Mitigation measures

- Utilize the area without large vegetation cover
- Clear only those trees that are within the area to be developed
- Compensatory tree planting

11.2 Contamination of surface water

The proposed site has a seasonal stream crossing it. The water drains into a private dam and when in excess, drains into Lake Elementaita. Poor management of waste and oil/fuel spills may result into contamination of these water bodies. Heaping of excavated soil that may be carried by surface run off into the stream will lead to sedimentation of the stream and eventually the dam and lake. The stream and dam serve as water sources for cattle hence contamination may impact livestock. Lake Elementaita is a Ramsar site and home to various birds and wildlife. Contamination of the seasonal stream may also affect the lake and impact negatively on the fauna dependent on this water body.

Mitigation measures

- Ensure proper waste management so that no waste reaches the seasonal stream and eventually into the dam and lake
- Cover heaps of excavated material and place them on flat surfaces away from water channels
- Regular servicing of construction vehicles to ensure there are no leaks

- Servicing of 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

11.3 Pressure on existing water resources

Installation of the various quarry components will require water such as for wetting dusty areas, mixing concrete, curing, for use by workers etc. The area usually has water shortage, unless one drills a borehole which the proponent intends on doing. The construction works may therefore increase pressure on the existing water resources including ground water. The impact is short term and its intensity is rated as medium.

Mitigation measures

- Use the existing productive borehole and only supplement with water from the seasonal river or develop another borehole.
- Practice rain water harvesting during the raining season to reduce pressure on existing resources
- Sensitize workers on water conservation

11.4 Fauna

The proposed site has some wildlife including monkeys, rock hyrax, guinea fowls and snakes. Construction works will result to part of their habitats being destroyed and construction activities such as excessive noise and vibrations may cause disturbance forcing some of them to leave in search of new habitats. Construction activities can also injure or even kill some wildlife

Mitigation measures

- Stage clearance so as to avoid vegetation clearance of areas that will not be used.
- Report any injuries to wildlife to the nearest Kenya Wildlife Service Office

11.5 Change in land use

The proposed site is currently used as a farmland, grazing land and cow shed (for about 200 cattle). However, once the installations and construction of quarry components begins, this will change leading to loss in farmland and grazing land.

Mitigation measures

- Avoid disturbing areas that won't be used for installations so their original state is maintained

11.6 Relocation and Resettlement

There is a family living on the proposed site and a herder with 200 cattle. Quarrying activities will result in the relocation and resettlement of these people.

Mitigation measures

- The land owner should ensure the single family living on the land is properly relocated before commencement.

11.7 Impact on soil

There was no evidence of any soil erosion at the time of baseline study. During the construction phase, there will be some excavation that may expose soil to erosion agents such as wind and water. The construction process may also result to soil contamination or pollution through fuel or oil spills from construction vehicles and maintenance activities.

Mitigation measures

- Excavated soil should be placed on flat surfaces and away from water ways
- Ensure proper maintenance of construction vehicles to minimize spills and leaks
- Avail a spill kit on site in case any unavoidable spills/leaks occur
- Servicing of vehicles in a bunded area so that any spills are contained

11.8 Reduced air quality

Activities such as excavation, mixing of aggregates and trucks will result to generation of fugitive dust thus reducing the air quality in the area. If in an excess of100 µg/m^3, it may potentially affect workers, visitors and neighbors. Dust may present a respiratory hazard, cause eye irritation and visual intrusion. Exhaust fumes from the construction vehicles will also result to air pollution. Impact on air quality will only affect sensitive receptors located South East as the wind mainly blows North West to South East. The major receptors are homesteads SE to the site and Kariandusi Primary and Heavens Gate Prayer Mountain. However since they are located about 1km from the site, they are not expected to be adversely affected. This impact will be short term and temporal.

Mitigation measures

- Restrict construction vehicle speed to a set maximum after careful site safety assessment
- Sprinkling of water along the access road and excavation areas as need be
- 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

11.9 Excessive noise and vibration

Construction activities such as excavation, movement of construction vehicles, demolition and machinery operations are expected to produce excessive noise and vibration. This impact will add to the already high levels of noise produced by traffic using the A8 road. Sensitive receptors to noise and excessive vibrations are; St. Marys Mission Hospital, St Joseph Rift Valley Hospital, Sunbird resort, the homesteads around, Kariandusi Primary and Heavens Gate Prayer Mountain. However noise assessment indicates that these receptors will not be adversely affected by construction noise due to distances from the quarry. Workers operating machinery or working around the machinery may have their hearing affected by the excessive noise produced. This impact is temporal and unavoidable but its effects can be mitigated in the following ways;

Mitigation measures

- Provision and enforcement of PPE to workers such as ear plugs/ear muffs
- Construction vehicles and machinery should be regularly serviced to reduce the amount of noise produced
- Sensitize construction vehicle drivers to avoid unnecessary hooting and running of engines
- In case high noise generating activity whose sound pressure can reach the sensitive receptors is planned then it is recommended that the potentially affected receptors be informed in advance
- Ensure compliance to EMCA, Noise and Excessive Vibration Pollution (Control) Regulations, 2009

11.10 Waste Generation

The workforce at the site and activities undertaken during construction are expected to generate both liquid and solid waste. The site currently does not have any liquid waste management infrastructure meaning the proponent will be required to provide appropriate facilities such as septic tanks.

Some of the solid waste anticipated includes; paper, plastics, timber, concrete waste, plastic material, rejected material among other waste. Hazardous waste is also anticipated such as used oil, concrete additives, paint containers and medical waste from the clinic

Mitigation measures

- Construct a septic/soak pit for liquid waste management
- Provide for bins at various locations within the site. Practice waste segregation
- Avail a skip on site for disposal of all solid waste.
- Contract a licensed waste disposal company to collect and dispose solid waste

- Create awareness among workers on proper waste management practices such as collection, segregation and disposal
- Put in place a waste management and monitoring plan for proper management of solid waste

11.10.1.1 Occupational Health and Safety

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

11.10.1.2 Spread of 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

12 Potential Negative Impacts during Operation Phase

12.1 Impact on air quality

Quarrying activities such as blasting, excavation of aggregates, transportation, concrete mixing, crushing, wind blowing over soil heaps among others are expected to generate fugitive dust into the air. Exposure to PM_{10} and $PM_{2.5}$ can be detrimental to the people working in the quarry and neighbours. The sensitive receptors that will feel this impact are those who are South East of the site as the main wind direction is North West to South East. The major receptors are homesteads SE to the site. Kariandusi Primary and Heavens Gate Prayer Mountain: all are about 1km from the site therefore particulate matter and fumes will be completely dissipated before reaching the receptors. Vulnerable people will therefore be those working within the site including the offices.

Health effects ranging from eye irritation, respiratory and cardiovascular problems to mental disorders are some of the effects of air pollution. The table below shows the possible health effects of short term and long term exposure to particulate matter.

Table 12-1: Health effects of short term and long term exposure to particulate matter

Pollutant	Short-term exposure	Long-term exposure
Particulate matter	• Lung inflammatory reactions • Respiratory symptoms • Adverse effects on the cardiovascular system • Increase in medication usage • Increase in hospital admissions • Increase in mortality	• Increase in lower respiratory symptoms • Reduction in lung function in children • Increase in chronic obstructive pulmonary disease • Reduction in lung function in adults • Reduction in life expectancy • Reduction in lung function development

(Source: WHO, 2004)

Other than particulate matter, it is also anticipated that other air pollutants such as Volatile Organic Compounds (VOCs), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Ozone (O_3) will be released during operations. Main sources will be vehicular emissions, generator or equipment burning fuel containing sulfur except for ozone which occurs as a result of chemical reaction between oxides of nitrogen and volatile organic compounds. Exposure to these gases may result to respiratory problems, eye, nose and throat infection, headaches, nausea/vomiting, dizziness, worsening asthma symptoms,

skin and sensory irritation, loss of coordination or harm sensitive vegetation during the growing season among others. Some of them are also Greenhouse Gases.

Plant physiology may also be affected by dust generated i.e. photosynthesis, respiration, transpiration and allow the penetration of phytotoxic gaseous pollutants. Dust can have physical effects on the surrounding plants, such as blocking and damaging their internal structures and abrasion of leaves and cuticles, as well as chemical effects which may affect long-term survival. Visible injury symptoms may occur and generally there is decreased productivity.

The impacts on air quality are anticipated to be short term if further exploration of the quarry will not continue once road construction is complete.

Mitigation measures

- Retaining existing trees in areas which are not earmarked for quarrying to act as a buffer zone between quarrying area and neighbours
- Apply dust suppression measures such as regular water sprinkling in dusty areas
- Restrict construction vehicle speed in the site to a safe maximum after a careful safety analysis
- Proper and frequent maintenance of construction vehicles and machinery to minimize exhaust fume emissions
- Standard Operating Procedure at the site that includes turning off engines when not in use should be implemented
- Workers should be provided with dust masks or respirators depending on the area they are working to protect them against inhalation of dust particles that can cause respiratory illnesses.
- 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

12.2 Excessive noise

Blasting, material extraction process and breaking rocks into aggregates and other forms is expected to generate excessive noise and vibration. Other operations that generate excessive noise and vibration include; blasting, extraction of aggregates using excavators, use of plants and machinery such as the crusher, concrete mixer etc. Depending on the sound pressure generated excessive noise and vibration may impact on those within a specific radius including workers. Sensitive receptors to excessive noise and vibration that are closest to the site are presented in Table 9-2 below.

Table 12-2: List of sensitive receptors

Receptor	Classification	Approx. distance from the site (m)

St. Marys Mission Hospital	Silent Zone	690
St Joseph Rift Valley Hospital and medical school	Silent Zone	450
Sunbird resort	Mixed residential	800
Homesteads	Residential	550
Kariandusi Primary	Silent Zone	1000
Heavens Gate Prayer Mountain	Place of worship	1000

To assess vulnerability of these receptors, an online sound level dumping calculator model developed by Eberhard Sengpiel (http://www.sengpielaudio.com/calculator-distance.html) 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 and blasting. An example of the calculation is shown in the figure below.

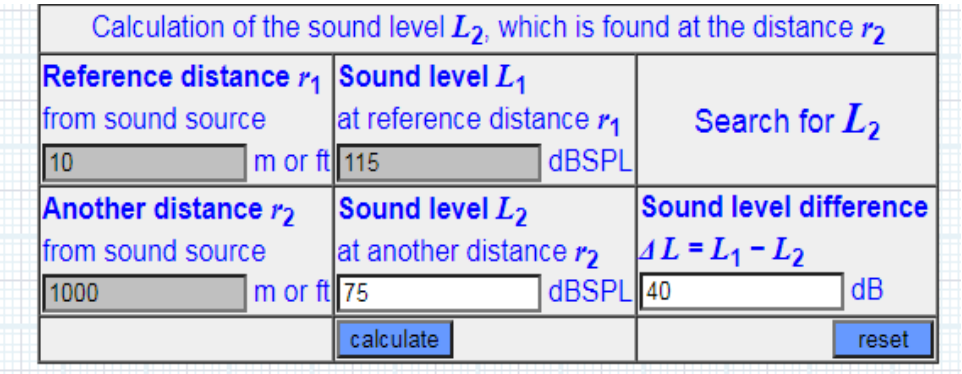


Figure 12-1: Blasting noise levels at 1000meters from source to heaven's gate prayer mountain

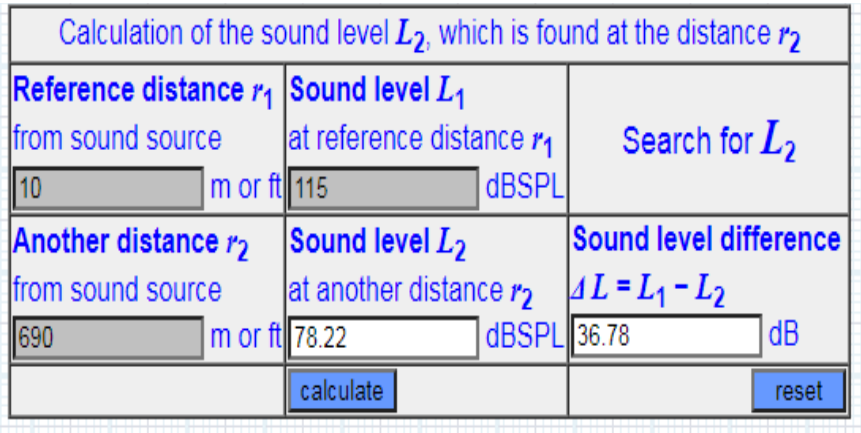


Figure 12-2: Noise from blasting at 690 meter to St. Mary's mission hospital

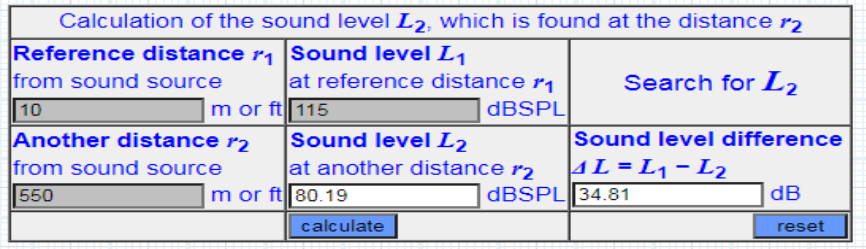


Figure 12-3: Noise from blasting to the nearest residential areas

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 and excavators as shown in the tables below;

Table 12-3: Noise produced from blasting activity

Receptor	Classification	Approx. distance from the site (m)	Noise Pressure levels produced at source (dBA)	NEMA recommended limits (dBA)	Noise pressure level calculated at respective distance (dBA)
St. Marys Mission Hospital	Silent Zone	690	115	109	78.22
St Joseph Rift Valley Hospital and medical school	Silent Zone	450	115	109	81.94
Sunbird resort	Mixed residential	800	115	114	76.94

Homesteads	Residential	550	115	114	80.19
Kariandusi Primary	Silent Zone	1000	115	109	75
Heaven's Gate Prayer Mountain	Place of worship	1000	115	109	75

Table 12-4: Noise produced from crusher plant

Receptor	Classification	Approx. distance from the site (m)	Noise Pressure levels produced at source (dBA)	NEMA recommended maximum levels (dBA)	Noise pressure level calculated at distance (dBA)
St. Marys Mission Hospital	Silent Zone	690	85	109	48.22
St Joseph Rift Valley Hospital and medical school	Silent Zone	450	85	109	51.94
Sunbird resort	Mixed residential	800	85	114	46.94
Homesteads	Residential	550	85	114	50.19
Kariandusi Primary	Silent Zone	1000	85	109	45
Heaven's Gate Prayer Mountain	Place of worship	1000	85	109	45

Table 12-5: Noise produced by excavators

Receptor	Classification	Approx. distance from the site (m)	Noise Pressure levels produced at source (dBA)	NEMA recommended maximum levels (dBA)	Noise pressure level calculated at distance (dBA)
St. Marys	Silent Zone	690	74	109	37.22

Mission Hospital					
St Joseph Rift Valley Hospital and medical school	Silent Zone	450	74	109	40.94
Sunbird resort	Mixed residential	800	74	114	35.94
Homesteads	Residential	550	74	114	39.19
Kariandusi Primary	Silent Zone	1000	74	109	34
Heaven's Gate Prayer Mountain	Place of worship	1000	74	109	34

From the findings above, noise generated by all quarrying activities reaching the sensitive receptors are expected to be below the permissible noise levels as recommended by NEMA's Excessive Noise and Vibrations Regulations.

Mitigation measures

- 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.
- Noise associated with the other operations such as crushing and asphalt plant operations, truck movements, etc are not expected to affect the nearby sensitive receptors, however it could affect those working within the camp. These people should be provided with the right PPEs than includes ear muffs.

12.3 Excessive Vibrations

Excessive vibrations will be caused by blasting can lead to airborne hazards from naturally occurring gases, chemical vapors and principal hazards such as noise, segmental vibration and heat. According to a study on the Environmental And Land Use Impacts of Quarrying along Ngong River in Embakasi, incidents of miscarriage attributed to shocks from explosions were reported (Samwel Kindiga 2017: Environmental and Land Use Impacts of Quarrying Along Ngong River In Embakasi. MSc thesis, University of Nairobi) implying that blasting also has the potential of causing miscarriage

Furthermore ground vibrations caused by blasting and use of heavy machinery can cause disturbance to neighbors and may also lead to cracking of susceptible structures. Depending on the blasting intensity, the resultant vibrations may affect patients in St. Mary's Mission and St Joseph Rift Valley Hospitals and can also scare pupils in Kariandusi Primary.

Vibration signals monitored at a blasting site with different rock masses were used to investigate the attenuation characteristics of blasting vibration through the peak particle velocity (PPV), frequency characteristics, and energy distribution of the blasting vibration signals

To assess the impacts of blasting Unconfined Compression Test (UCS) was done to help derive the maximum axial compressive stress that a specimen can bear under zero confining stress. It is used to investigate the attenuation characteristics of blasting vibration through the peak particle velocity (PPV), frequency characteristics and energy distribution of the blasting vibration. On a large scale, the rockmass properties are highly affected by other factors including discontinuities, faults and weathering. The Table below shows the laboratory results of analysis of UCS and density for rock samples from the site which was input in the regression analysis and subsequent models generated.

Table 12-6: Laboratory results

Sample #	Compressive strength (N/mm^2)	Unit weight (kg/m^3)	Load at failure (KN)
Sample A	73.9	2232	169.3
Sample B	30.8	2238	70.6
Sample C	13.4	2322	30.7

Data from the regression analysis is presented in the table below and the predicted radii of allowable impact presented in the Figure 10-4.

Table 12-7: Regression modelling results

Explosive weight, kg	Distance from blast source, m										
	50	75	100	125	150	175	200	225	250	275	
50	1.93	1.1	0.74	0.55	**0.43**						**PPV, cm/s**
100		1.78	1.2	0.88	0.69	0.55	**0.46**				
150			1.58	1.16	0.91	0.73	0.61	0.52	**0.45**		
200					1.1	0.89	0.74	0.63	0.55	**0.48**	

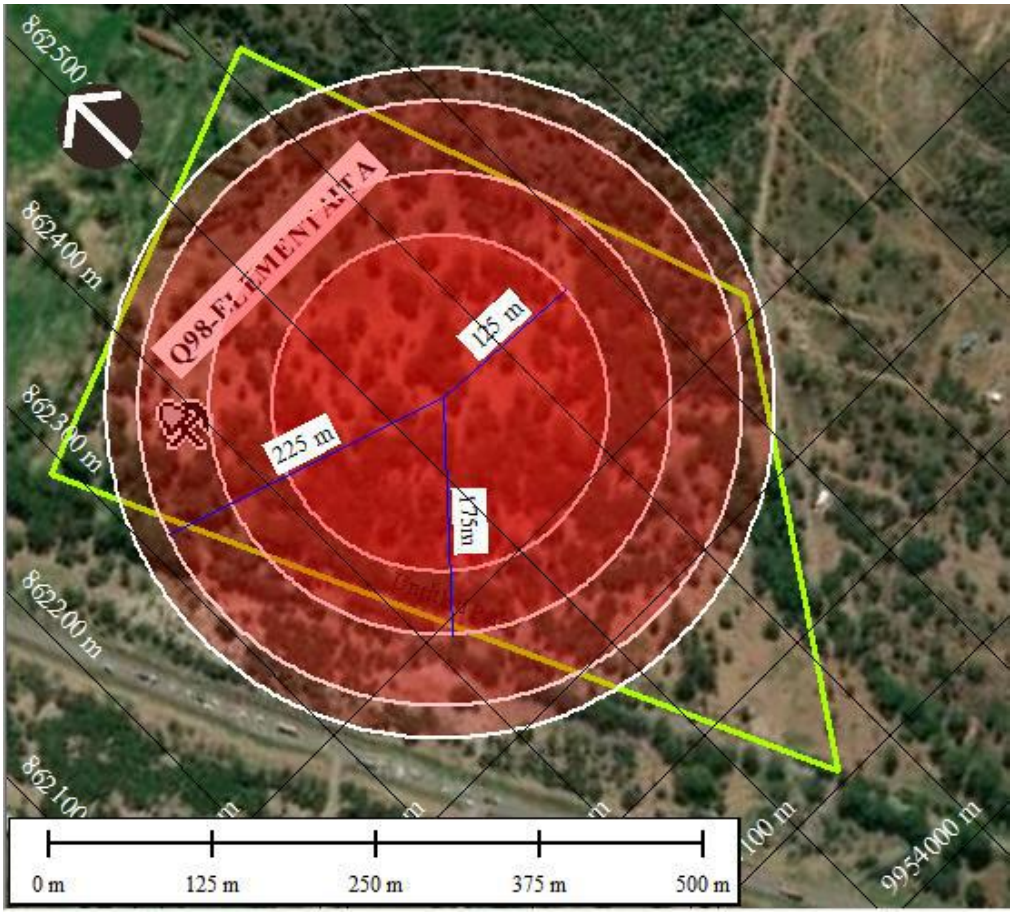


Figure 12-4: Distribution of distances at which ppv of <0.5 cm/s is attained for different charge weights across Elementaita quarry

The model shows that working the quarry blasting plan with between 50 and 100kg charge weight will keep the vibratory blast velocities within the NEMA limits which are 0.5cm/s within the site boundary. Depending on the payload required per cycle during quarrying operations, all three methods – explosive blasting, non-explosive hydraulic splitting or expansive chemical agents can be used while maintaining vibrations within limits outside the quarry boundary.

Mitigation measures

- 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
- Rock breaking methods adopted at each quarry site should be based on a balance between suitability, the required payload, cost and the impact on the receptors.
- Give a minimum 1 week notice indicating day and time of blasting to people within 1km radius
- Explain the expected effects/experience of blasting to the those within 1 Km radius prior to blasting

- 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
- 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
- Adhere to the provisions of the Explosives Act, 2012

12.4 Contamination of surface and ground water resources

Quarrying activities could potentially pollute ground and surface water bodies. The hydrogeology regime at the site will be altered by the distinct aspects of surface material extraction and associated activities which could result in groundwater pollution. Removal of the rock strata can cause the floor to heave and allow for water seepage. Quarry depth might puncture the overlying rocks of the water hence toxic materials could seep into the ground water.

The activities of the quarry and operation of machinery such as crusher, mixing plant, batching plant etc. will have potential to pollute the seasonal stream crossing the site, the dam and Lake Elementaita where the seasonal stream drains. Surface water pollution can be caused by run-off across active asphalt plant and concrete batching plant areas thereby loading sediment, debris, solid waste, oil/fuel spills and impurities into the adjacent stream.

Mitigation measures

- Ensure runoff from asphalt plant and concrete batching plant areas are contained or directed into a sedimentation tank or pond for retention and treatment of 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
- Maintain maximum existing vegetation coverage and plant more trees along the boundary wall to act as buffers
- 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

12.5 Land degradation and aesthetics

Quarrying activities usually destroy the original landscape of the site leaving behind huge depressions and potential point of collecting water forming artificial ponds. Stockpiles and quarry waste piling also have a negative feeling of the landscape.

Mitigation measures

- Rehabilitate the quarry pits by cutting back quarry faces and backfilling to the extent possible and planting indigenous vegetation
- Create drainage channels so water does not accumulate in the pit

12.6 Pressure on existing water resources

Once operational, quarrying and related activities will require substantial quantities of water. This includes use in dust suppression, concrete mixing, and curing pre-cast concrete among others. All this water needs will have to be met thus increasing the pressure on existing water resources in an already water scarce area. The proponent intends to sink a borehole to meet the water needs but this will also create pressure on ground water as there are other existing boreholes within the area. If the abstraction rate is higher than the recharge rate, it may undermine the aquifer capacity to support all nearby boreholes.

Mitigation measures

- Ensure proper use of water e.g. by installing automated taps and recycling and re-use where possible
- Practice rain water harvesting during the raining season to reduce pressure on existing resources
- Sensitize workers on water conservation

12.7 Increased surface runoff

Once offices, parking spaces and other auxiliary facilities have been installed and operational, there will be an increase in paved surfaces that will lead to enhanced run-off. Surface run off may result to soil erosion which will in turn cause sedimentation of the seasonal stream and the dam downstream. The magnitude of this impact is, however, adjudged low.

Mitigation measures

- Create proper storm water drainage channels to reduce soil erosion
- Minimize paved surfaces and use porous material, such as cabro, for the parking spaces where possible

- Minimize vegetation clearance to reduce storm water velocity and increase water infiltration

12.8 Impact on Fauna

The area to be quarried is home to rock hyrax and snakes. As soon as quarrying begins, the habitat of these animals may be disturbed causing some of them to alter their feeding and breeding patterns. However, the area adjoins the expansive Soysambu Conservancy and other open ranges where the wildlife can migrate to.

Upon completion of quarrying and other operations at the site, the pit, if left un-rehabilitated may be a safety risk to larger animals within the area. They may fall into the pit resulting into broken limbs or even death.

Mitigation measures

- Stage vegetation clearance to reduce the impacts on habitat
- Restrict vegetation clearance to the footprints of the developments
- Workers should be sensitized against injuring or killing of any wildlife

12.9 Waste Generation

Quarrying activities are expected to generate liquid and solid waste. Both grey and black water are some of the liquid waste expected. The proponent intends to construct a septic/soak pit to handle this waste as there is no existing waste water infrastructure.

Quarry wastes per se have limited economic value apart from value on the quarry site as material for uses such as void fill, embankments and roadway base. Some of other solid waste expected includes; top soil and overburden, explosive packaging, paper, plastics, steel/metal and material discarded after crushing.

Hazardous waste is also anticipated including; used oil, spilt bitumen, concrete additives, and medical waste from the clinic.

Mitigation measures

- 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 where possible
- Construct a septic/soak pit for liquid waste management
- Provide for bins at various locations within the site. Practice waste segregation
- Avail a skip on site for temporary holding of all solid waste.

- Create awareness among workers on proper waste management practices such as collection, segregation and disposal
- Put in place a waste management and monitoring plan for proper management of solid waste

12.9.1.1 Occupational Health and Safety

Quarrying and associated works and operations of the other installations are high risk activities which can be injurious to humans that sometimes can be fatal. Injuries to workers can be caused by slips and trips, cuts, flying objects hitting people, fall from height, moving machinery/vehicles and falling objects. In some cases, death can occur. This can be mitigated by applying the following measures;

Mitigation measures

- 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
- Ensure relevant safety signs are erected at the required areas
- High risk activities should only be conducted by persons well trained and experienced in the relevant field
- Control access to the site by fencing off high risk areas to keep out the general public 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 and provide well stocked first aid kits at the quarry, asphalt plant, crusher plant, pre-cast yard and offices
- Have a health and safety officer, first aider and fire marshals on site during operations
- Ensure workers sign a code of conduct that binds them to safe work practices while on site.

12.10 Archeological and Heritage Resources

Whereas Kariandusi Pre-historic site is not very far from the quarry site, archaeological and cultural assessment established that the site is of low archaeological significance and historical materials. However, the presence of the small rock shelters is a possible indication of subsurface archaeological occupation. Sub-surface archaeological resources can be damaged during quarrying and when setting up other supporting infrastructure such as crusher, mixing plant, workshops and site offices. Other activities that are likely to damage potential subsurface archaeological remains include grading access roads and general ground levelling.

Mitigation measures

- A Chance Finds Procedure (CFP) should be developed and provided during the crew induction for the three sites. The CFP is a project-specific document that aims to minimize damage to objects accidentally uncovered during the construction phase.
- It is recommended that a construction crew induction be undertaken on the significance of archaeological and cultural heritage resources and how to identify such sites and features including; stone tools, pottery, human fossil bones.
- It is recommended that an archaeologist from the National Museums of Kenya be present during the initial ground breaking and clearance activities, to assess and protect any cultural material that might be exposed.
- Caution be taken especially when collecting/moving stones, rocks and boulders as some could be burial material or have rock art on them

12.11 Public Health

The operation phase is predicted to have between 200 - 300 workers at the site. Presence of many people within an area increases the chances of the spread of the Covid-19 virus if proper precaution is not taken. The increased spread of the virus is anticipated to be short term and reversible or irreversible in cases where one succumbs to the virus.

Workers employed at the site without their partners might be tempted to engage in improper sexual relations with the community members possibly leading to spread of HIV and AIDS. The impacts associated with the virus are long term and often permanent.

Mitigation measures

- 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 health measures put in by the government to control spread of the virus.
- Contract a health practitioner to train and sensitize employees and the immediate community on HIV and AIDS control and prevention.
- Place relevant Information, Education and Communication (IEC) posters on HIV AIDS and COVID 19.

13 Potential Impacts at Decommissioning Phase

Decommissioning approach and timing will largely depend on the post-use land lease agreement that the proponent shall enter into with the land owner. If the land owner desires to retain the quarry as a

commercial quarry and associated infrastructure then decommissioning will not be immediate and the current proponent will not be responsible. Regardless of the operator at the time of decommissioning, it will be expected that the party prepares a detailed decommissioning plan to be submitted to NEMA for approval.

In all cases, however, the following potential impacts, at a minimum will need to be addressed.

13.1 Risk of accidents and incidents

The proposed quarrying area is within private land but there is a path crossing the property that is used by the locals. If left open and unguarded, the pit may lead to safety incidents such as falls. This can also happen to livestock and wildlife.

Minor, major accidents and near misses may also result from demolition of auxiliary structures and decommissioning of site installations. Some of the risks and hazards includes, fall from heights, slips and trips, falling objects, collision with moving vehicles or machinery, cuts, electrocution, among others.

Both potential impacts are expected to be short term and are partly reversible in the case of minor accidents but irreversible in extreme cases such as loss of lives or limbs.

Mitigation measures

- Undertake a detailed risk assessment before decommissioning
- Develop and implement a health and safety management plan based on the outcome of the risk assessment.
- Rehabilitate the quarry to reduce or eliminate risks posed by deep pits. This may involve cutting back quarry faces, backfilling with spoil materials and soil excavated on site or from road works, fencing off the site if acceptable rehabilitation is not achievable in the short term.
- Ensure there are sufficient, visible danger-sign posts put up at the site to warn passers-by or workers of potential accidents or incidents.
- Limit high risk activities to those who are well trained and experienced in the area
- Adopt a comprehensive health and safety plan as outlined in the Occupational Health and Safety Act (2007). Plan to cater for accidental injuries among employees. This will include; periodic health and safety audits, risk assessments, provision of sufficient personal protective equipment, trained first aider and an accessible first aid kits, health cover, refresher training of employees on health and safety among other needs.

13.2 Health risks

Rain water may collect into the quarry pit if left open, providing a breeding ground for mosquitoes and other disease causing organisms. Mosquitos in the project area are not carriers of the parasite that

causes malaria but can be a nuisance none the less. This impact will be short term and reversible if the quarry is backfilled after project completion, if not, the impact will be long term.

Decommissioning activities will require some human work force. Presence of several people within an area increases the chances of the spread of the Covid-19 virus if proper precaution is not taken. The increased spread of the virus is anticipated to be short term and reversible or irreversible in cases where one succumbs to the virus.

Workers employed to decommission the project site might engage in improper sexual relations with the community members possibly leading to spread of HIV and AIDS. The impacts associated with the virus are long term and permanent.

Mitigation measures

- If further exploration is anticipated, create a drainage channel to ensure no water stagnates in the pit
- 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 health measures put in by the government to control spread of the virus.
- Contract a health practitioner to train and sensitize employees and the immediate community on HIV and AIDS control and prevention.
- Place relevant Information, Education and Communication (IEC) posters on HIV AIDS and COVID 19.

13.3 Excessive noise and vibration

Noise and vibration will be generated by machines and equipment used in the demolition of auxiliary facilities if not handed over to land owner. Movement of tracks and machines out of the project site are also expected to generate noise.

Excessive noise and vibration will affect employees working at the site and sensitive receptors including; St. Marys Mission Hospital, St Joseph Rift Valley Hospital, Sunbird resort, the homesteads around, Kariandusi Primary and Heavens Gate Prayer Mountain. Workers are likely to suffer from hearing complications or white finger disease for those exposed to excessive vibration. Though the impacts will be short term and unavoidable, the following mitigation measures can be applied to reduce the effects;

Mitigation measures

- Regularly service vehicles and construction machinery per the manufacturer's manual to minimize noise/vibration. If possible, turn off machines when not in use.
- Where possible restrict the number of machines in use at any one time.

- Avoid unnecessary hooting by project vehicles within 200 m of sensitive receptors.
- Provide sufficient protective gear such as ear muffs/ear plugs to construction workers operating equipment with noise levels greater than 70dBA continuously for 8 hours and those workers near noisy areas.

13.4 Waste Generation and Management

Both liquid and solid wastes are expected during the decommissioning phase. Grey and black water are the anticipated liquid waste. Solid waste anticipated includes; paper, plastics, wood, rubble, aggregates, ceramics, metals, glass among others. Hazardous waste is also anticipated including medical waste from the clinic. The impacts associated with generation of waste are predicted to be short-term and may or may not be reversible if not well mitigated as in the case of plastic waste.

Mitigation measures

- Take inventory of expected waste streams and quantities.
- Prepare a site waste management plan which outlines and modes of collection, transportation and final disposal.
- Contract a licensed waste handler to collect and dispose the waste as per EMCA, waste management regulations, 2006. This must include a hazardous materials waste handler.
- Use inert demolition waste e.g. aggregates; overburded; top soil or any other form in backfilling the quarry pits
- Apply principles of circular economy which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible that aims at minimizing waste, and pollution. Some of the materials, if not needed by the proponent, can be donated to nearby public institutions and even individual neighbours.

14 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

14.1 Introduction

The Environmental and Social Management Plan (ESMP) is prepared to show how site specific concerns and mitigation measures are addressed through the construction and operation phases of the project.

14.2 Objectives of the ESMP

The 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 impacts. The ESMP 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 work does not adversely affect the environment and social community resources. The proponent's Environmental officer may revise the ESMP as need be. Revisions may be made to accommodate changes in work, weather and site conditions. The ESMP should be made available to all project staff.

The objectives of the ESMP are:

- To bring the project into compliance with applicable national environmental and social legal requirements;
- 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;

14.3 Responsibilities

14.3.1 Sogea Satom EHS Officer

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 periodic environmental and social progress or "audits" reports on the status of implementation of measures and management of work sites.

14.3.2 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.

14.3.3 Local Authorities

The relevant departmental officers in the local authorities 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 local health providers to assist in the sensitization campaigns for HIV/ AIDS and other public health issues 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.

14.4 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. Mobilization / Construction;
2. Operation.
3. Decommissioning

The following issues require special attention:

1. Site layout 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.

14.4.1 Mobilization and Site Establishment

Requirements for environmental management and mitigation measures will be included in contracts of the construction sub-contractors. However, the oversight and responsibility for implementation during the construction period will remain with the proponent.

The ESMP has put in place measures to avoid and mitigate impacts and optimize benefits arising from activities during the establishment phase. The principal focus of project management for the establishment phase will include:

- Personnel and contractor management and training;
- Conduct and site management;
- Maintenance of complaints register;
- Emergency preparedness; and,
- Mitigation of impacts such as noise, dust, safety and pollution.

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.

14.4.2 Operation phase

The proponent 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 safety and health management roles.

14.4.3 Decommissioning phase

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

14.5 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.

14.5.1 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).

14.5.2 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.

14.5.3 Management review

The final component of the EMP management cycle is a formal management review that takes place at defined intervals, both during the establishment 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.

14.6 Competence, Training and Awareness

To ensure that this ESMP is effectively implemented, each level of management is responsible for ensuring that all personnel reporting to them are aware of the requirements of this CEMP. The site EHS officer will coordinate environmental training in conjunction with other training and development activities.

14.6.1 Environmental induction

All personnel, including sub-contractors, are required to attend a compulsory site induction that includes an environmental component prior to commencement on-site. The EHS officer will conduct the the site induction which should include an overview of:

- Relevant details of the ESMP including purpose and objectives
- Key environmental issues, such as dust and noise management, waste, blast control.
- Conditions of environmental licences, permits and approvals
- Specific environmental management requirements and responsibilities
- Mitigation measures for the control of environmental issues
- Incident response and reporting requirements, and
- Information relating to the location of environmental constraints.

A record of all environment inductions will be maintained and kept on-site.

The The site EHS officer may authorize amendments to the induction where required to address Project modifications, legislative changes or amendments to this ESMP or related documentation.

14.6.2 Toolbox talks, training and awareness

Toolbox talks will be used to raise awareness and educate personnel on operation related environmental and safety issues. The toolbox talks will be used to ensure EHS awareness continues during construction.

Toolbox talks will be tailored to specific environmental issues including:

- Requisite safety measures while on site
- erosion and sedimentation control
- hours of work
- emergency response and reporting
- noise
- Air quality
- housekeeping and waste
- concrete washout
- dewatering

- project and clearing limits
- dust control.

Toolbox attendance is mandatory and attendees of toolbox talks are required to sign an attendance form and the records maintained.

14.6.3 Daily pre-start meetings

The pre-start meeting is a tool for informing the workforce of the day's activities, safe work practices, environmental protection practices, work area restrictions, activities that may affect the works, coordination issues with other trades, hazards and other information that may be relevant to the day's work.

The Foreman, or other appropriate site staff member, conducts a daily pre-start meeting for the site workforce before the commencement of work each day (or shift) or where changes occur during a shift. Pre-start meetings may be project-wide and/or held for specific work areas.

The environmental component of pre-starts will include any environmental issues that could potentially be impacted by, or impact on, the day's activities. All attendees will be required to sign on to the pre-start and acknowledge their understanding of the issues explained.

Pre-start topics, dates delivered and a register of attendees will be recorded and the records maintained.

14.6.4 Communication

14.6.4.1 Internal communication

Clear lines of communication throughout all levels and functions (e.g. management, staff and sub-contracted service providers), is key to minimizing environmental impacts and achieving continual improvements in environmental performance.

14.6.4.2 External and government authority consultation

The site EHS officer will be the main point of contact regarding specific environmental issues. Upon consultation with the site manager, each relevant authority will be notified immediately via the appropriate telephone number should a pollution incident occur that causes or threatens material harm to the environment.

The relevant authorities to be notified are:

- NEMA
- The Ministry of Health via the local Public Health Unit
- County Environment Secretary

14.6.4.3 Stakeholder and community communication

A Community Engagement Strategy will need to be prepared by the contractor that describes the processes to follow for all community and stakeholder consultation in relation to the works.

14.6.4.4 Complaints and enquires protocol

A suggestion box, a phone number and email address should be provided for receipt of complaints and enquiries. The suggestion box should be located outside the main offices and accessible to the public while telephone number and email addresses shall be posted at all work sites.

14.6.5 Incidents and emergencies

All incidents and emergencies resulting from the Works at the site will be managed in accordance with the Emergency Preparedness and Response Plan that the contractor must prepare as part of the preliminaries. Typically the EPRP should provide the following:

- types of incidents
- criteria for classification of environmental incidents
- processes for systematically responding to and managing emergency situations, and
- processes and legal requirements (e.g. OSHA, NEMA Regulations) for the reporting and notification of an environmental incident.

Environmental emergency requires various authorities to address the prevention of, preparedness for, response to and recovery from environmental emergencies caused by uncontrolled, unplanned or accidental releases and to reduce any foreseeable likelihood of releases of toxic or other hazardous substances into the environment.

In the event of environmental emergency or environmental incident occurring, NEMA requires that the person reporting the incident must (i) give accurate reporting of exact occurrence of incident(s), (ii) provide necessary details to assist in locating and addressing the incident and finally (iii) provide feedback on the effectiveness of incidence response.

When providing these details, NEMA requires that *High-Risk Incidents* to be addressed within 24 hours, *Medium Risk Incidents* within 48 hours, and *Low Risk Incidents* addressed with 14 days. Acknowledged and forwarded to relevant lead agency and finally giving regular feedback to customers.

14.7 Matrix of Environmental and Social Impacts and Mitigation Measures

Table 14-1: Environmental and Social 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 dam and lake	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

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
	Servicing of vehicles in a bunded area so that any spills are contained	Throughout	-	Contractor
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
	Contract a licensed waste disposal company to collect and dispose general and hazardous waste	One off		Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
	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
	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

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
Operation Phase				
Impact on air quality	Retaining existing vegetation in areas which are not earmarked for quarrying to act as dust screens and a buffer zone between quarrying area and neighbours	Throughout		Contractor
	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
	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

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
	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 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
	The proponent should map out all susceptible structures within 500m 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	Proper waste management to ensure no waste gets to the stream, dam, lake or seeps into the ground water reservoir.	Throughout		Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
resources	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
	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

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
	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
Occupational Health and Safety	Prepare and implement an Occupational Health and Safety Management Plan	Throughout		Contractor
	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 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 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

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
	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
	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
	Contract a health practitioner to train and sensitize employees and the 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	Ensure there are sufficient, visible danger-sign posts at the site to warn passers-by	One off	BEP	Contractor

Impact	Mitigation	Implementation Frequency	Cost (KSH)	Responsibility
accidents	or workers as they approach high risk areas.			
	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
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 structures demolition waste	One off		Contractor
	Re-use overburden and topsoil in quarry backfilling	One off		Contractor
Increased insecurity	Fence off the area and restrict use of any pathways passing through the project site	One off	Contractual	Contractor
	If possible, demolish buildings or advice landowner to put them into appropriate use after project completion to limit idling.	One off		Contractor/land owner

14.8 Proposed Quarry Rehabilitation Plan

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

Quarrying substantially affects the local environment both during operations and following closure. The extraction of material, soil removal and subsoil digging may greatly affect a site's topography and the local watershed and ecosystem.

Quarry rehabilitation plans aim to restore the environment to a sustainable level, taking into account the unique requirements of the local ecosystem and its stakeholders. Proactive planning can even contribute towards the creation of new micro ecosystems in which fauna and flora and the local inhabitants find additional benefits. Below is a description of how rehabilitation can be done.

14.8.1 Re-profiling

The objective of re-profiling is to reinstate soils to a more stable landform, which includes:

1. Re-establishing surface drainage lines

2. Reinstating the land surface that is visually consistent with surrounding land

3. Features re-profiling to original contours and established drainage lines

4. Minimizing the potential for subsidence/ erosion gullies to occur

5. Replacing top soil over subsoil

14.8.2 Contouring the site

Land form reinstatement involves surface contouring to create a stable land formation consistent with the surrounding land form. This ensures water flow over the surface is in cohesion with the surrounding landscape and minimizes the risk of potential erosion. It also ensures that the final landform is consistent with the surrounding land features. Surface contouring should be completed prior to re-spreading of topsoil.

14.8.3 Ripping and scarification

This will be undertaken along contours to assist with binding of the soil layers, increase retention time of water on the slope, aid water infiltration into the soil increasing the opportunity of seed germination success while reducing the volume and velocity of runoff generated from the slope. Ripping will be excluded from under the drip lines of retained vegetation to avoid impacts on the root systems of adjacent vegetation. Scarification can be achieved by ploughing of the sub-surface material prior to topsoil reinstatement

14.8.4 Top soil re-spreading

This involves the reapplication of topsoil accumulated from the original clearing. Top soil will be re-spread to the following specifications:

1. Re-spread over watered and scarified or ripped sub soils in even layers at a thickness appropriate for the intended land use of the area to be rehabilitated

2. Spread back over in an even layer and left “rough” (rather than smooth and compacted) to minimize potential erosion, increase water infiltration and to trap seed.

3. Topsoil will cover the entire width of the disturbed area so that there is no exposed subsurface material. This ensures seeding and germination has the best opportunity to take, enabling establishment of groundcover

4. Topsoil application will only take place following initial reinstatement of the subsoil, construction of contour banks on steep slopes and compaction of sub soils to account for subsidence

5. Topsoil stockpiled for extended periods will be turned over and mixed prior to replacement.

6. Vehicle movement will be restricted following topsoil re-spreading

14.8.5 Re-vegetation

The re-vegetation of the site will involve direct seeding of native species such as *Euclea divinorum, Aloe capitata var. quartziticola*, Opuntia Species, *Euphorbia trigona* and *Calotropis procera*. This species selection is guided by soil conditions, micro-climate and aspect of the new land form. The ground cover will consist of native grasses or sterile exotic grasses to ensure exotic grasses do not become established. Initial re-vegetation with suitable sediment binding ground cover is essential to provide soil stability. Final slopes and surface contours will approximate native gradients and will blend with adjacent topography. Consequently, subsidence and erosion from areas re-profiled and rehabilitated will be monitored.

14.8.6 Demolition of infrastructure and buildings

All infrastructure, including site offices/workshop, parking areas, crushing plant, mixing plant, batching plant, emulsion plant and storage areas will be demolished and removed from the site. Where possible assets will be reused at the proponents other quarries or sold to other operators.

The remaining items will be demolished, removed and transported from site as required. All recoverable scrap steel will be sold and recycled with the remaining non- recyclable waste being collected and disposed by a licensed solid waste handler.

All concrete footings and pads will be broken up to at least 1.5m below the surface. The waste concrete will be crushed to produce an aggregate that can either be used on the site or for some other beneficial use. All remaining areas will then be reshaped, deep ripped, top soiled and seeded.

14.8.7 Rehabilitation success criteria

Performance indicators will be utilized to demonstrate achievement of rehabilitation objectives. The closure and rehabilitation performance criteria for the project are outlined in the table below;

Aspect	Performance Indicator	Rehabilitation Performance
Safety	• Access and public safety to be managed during operations and at the closure of the quarry.	• Access to the site post closure will be restricted via fencing and access gates.
Vegetation	• Rehabilitated quarry areas contain flora species characteristic of the desired native vegetation communities in the landscape; • Monitoring indicates that natural regeneration is occurring. • The majority of trees are healthy and growing in rehabilitated areas. • There is no significant weed infestation.	• More than 75 per cent of trees are healthy and growing. • Second generation tree seedlings are present or likely to be, based on monitoring in comparable older rehabilitation sites (i.e. evidence of fruiting of native species observed). • There is no significant weed infestation such that weeds do not comprise a significant proportion of species in any stratum. • Cut trees are compensated at a ratio of 1:2 as per KFS policy of panting two times the area of trees cut.
Landform	• No significant erosion or runoff impacts are present. • Rehabilitation activities are undertaken as soon as reasonably possible to minimize unnecessary dust generation from cleared areas. • No significant visual impacts from the quarry.	• Final void areas have been backfilled and stabilized to achieve a an outcome that is satisfactory to NEMA • Rehabilitated slopes on overburden dumps are stabilized. • No significant erosion is present that would constitute a safety hazard or compromise the capability of supporting the end land use. • Contour banks are stable and there is no evidence of overtopping or significant scouring as a result of runoff. • Visually prominent locations are rehabilitated to the extent possible.

Infrastructure	• All surface infrastructure to be decommissioned and removed, including the removal of services (roads, power, water and communications).	• All surface infrastructure which does not have a potential future use associated with the post quarrying land use will be removed, unless such removal has a greater environmental impact than rehabilitating the area with the infrastructure remaining in place. • Removal of all services (power, water, communications) that are not needed as part of the future development of the land. • All infrastructure that is to remain as part of the future land use have been assessed by an appropriately qualified person and determined to be suitable for the intended use and do not pose any hazard to the community.
Soil	• Re-vegetated areas to be top dressed with topsoil. • Soils pH to be within an appropriate pH range. • The land is to be free of land contamination or hazardous materials.	• Topsoil or a suitable alternative has been spread uniformly over the rehabilitation surface. • Soil pH to be within acceptable range of 5-9. • Monitoring demonstrates soil profile development in rehabilitated areas (e.g. development of organic layer, litter layer). • Surface layer is free of any hazardous materials. • Any contamination will be appropriately remediated so that appropriate guidelines for land use are met.
Water	• No evidence of excessive run-off or contamination (namely silt) into downstream waterways. • Cut off drains to be removed and/or retained for water quality control.	• Inspection of downstream waterways to ensure that the development site is not causing excessive run-off. • Water control measures (where remaining) are stabilized and working effectively.

15 ENVIRONMENTAL MONITORING PLAN

15.1 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 proposed 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

15.2 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.

15.2.1 Monitoring frequency

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

15.2.2 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.

15.3 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.

15.3.1 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.

15.3.2 Monitoring location

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

15.3.3 Monitoring frequency

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

15.3.4 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.

15.4 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 proposed project 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 15-1: 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)

15.4.1 Monitoring location

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

15.4.2 Monitoring frequency

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

15.4.3 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.

15.5 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 Lake Elementaita which is a Ramsar site.

15.5.1 Monitoring parameters

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

Table 15-2: 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

15.5.2 Monitoring frequency

The frequency of monitoring will be annually. This will be implemented in collaboration with NEMA or by a NEMA accredited laboratory.

15.6 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.

15.6.1 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 quantities and types generated.

Table 15-3: Sample outline for solid waste monitoring plan

Parameter	Frequency	Critical level (Tons)	Target	Responsibility
Storage	Weekly			
Management	Monthly			
Collection	Weekly			
Disposal	Weekly			

15.6.2 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.

15.7 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.

15.7.1 Monitoring frequency

The proponent will ensure monitoring is carried out annually.

15.7.2 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.

15.8 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.

16 CONCLUSIONS AND RECOMMENDATIONS

Quarry and camp establishment and operation phases have significant multifaceted environmental and social impacts that must be addressed. The ESIA has identified potential for water contamination, land degradation, health and safety, excessive noise and vibrations and particulate matter emissions as the anticipated high impacts. All these impacts can be mitigated to ensure that there are no adverse environmental and social effects during use and after decommissioning. If the quarry is not explored further after the road is completed and mitigation measures proposed in this report are implemented, then the residual effects of the above impacts will be sufficiently dampened.

The other impacts identified were of medium and low intensity all of which are mitigatable if the contractor implements the ESMP provided and also conducts monitoring for all aspects listed.

It is our recommendation that the project be allowed to go on provided the mitigation measures outlined in the report are adhered to, Environmental and Social Management Plan (ESMP) is implemented and the proponent adhere to the conditions of NEMA EIA license that will be issued.

17 REFERENCES

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18 APPENDICES

Appendix I: Certificate of Incorporation

Appendix II: Land Agreement

Appendix III: Approved Terms of Reference

Appendix IV: Minutes of the Public meeting

Appendix V: Attendance Register

Appendix VI: Sample Questionnaires

Appendix VII: Vibration velocity Test Report

Appendix VIII: Noise Test Results

Appendix IX: Air Quality Test Results

Appendix X Archeological and Cultural Heritage Assessment Report

Appendix XI: Lead Experts NEMA License