

# Environmental Impact Assessment (EIA)

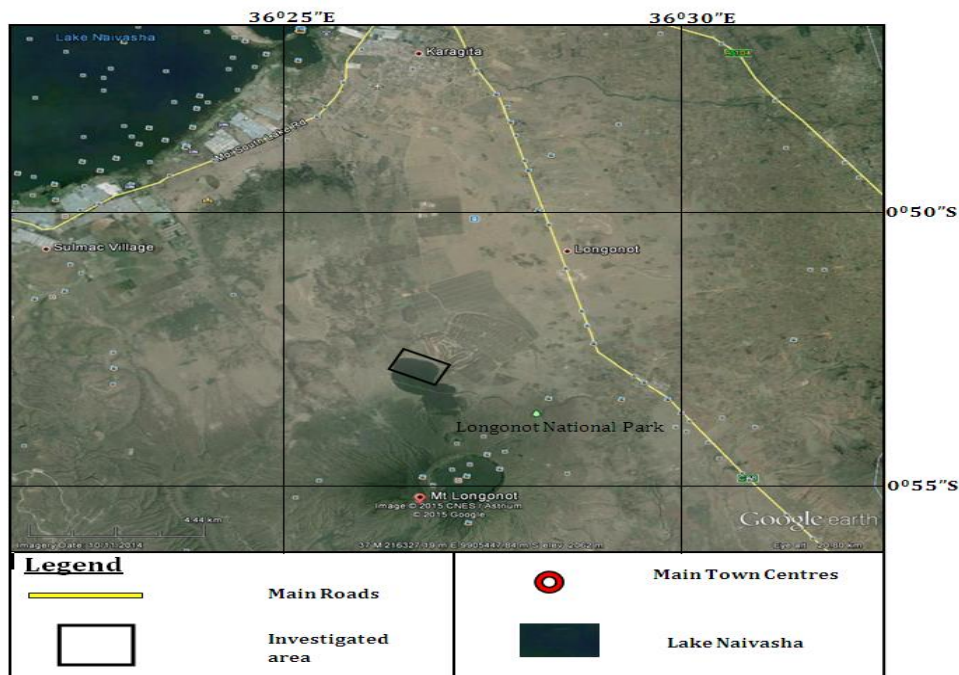
## Project Report

For

### THE PROPOSED QUARRY

By: Resorts and Cities LTD.

P. O. Box. 64553 – 00620 NAIROBI



GPS Coordinates: 0°52'30"S, 36°27'0"E

Conducted by  
Joseph M. Maitima, PhD  
Lead Expert – NEMA, Reg. No. 2815  
Ecodym Africa Ltd.  
P.O Box 50901- 00200, Nairobi, Kenya  
Tel: 020 233 1246 Or 0733 255 739

DECLARATION

This EIA Project report was prepared in accordance with Environmental Management and Coordination Act, 1999 and the Environmental Impact Assessment and Audit Regulations, 2003, for submission to National Environmental Management Authority (NEMA).

The undersigned, submit the following this report for the proposed Quarry adjacent to the Longonot Gate Golf Resort and Holiday Homes located in Munyo Sub-Location, Longonot Location, Naivasha Sub- County. All information contained in this report is accurate and truthful representation of all findings as relating to the project.

NAME.....

SIGNATURE.....

NEMA REGISTRATION No: 2815

DATE.....

-----  
**On behalf of the Proponent:**

**Resorts and Cities Ltd. P. O. Box. 64553 – 00620 Nairobi**

Signed by:

Name	Signature	Date

PROPONENT

I, .....on behalf of Resorts and Cities Limited submit this Environmental Impact Assessment project Report for the Proposed Quarry. To my knowledge all information contained in this report is accurate and truthful representation of all findings as relating to the project.

Designation: .....

Signature: .....

Date: .....

Disclaimer:

This Environmental Impact Assessment project report is strictly confidential to Resorts and Cities Ltd (the proponent) and any use of the materials thereof should be strictly in accordance with the agreement between the proponent and Dr. Joseph M. Maitima (the EIA Expert). It is, however, subject to conditions in the Environmental (Impact Assessment and Audit) Regulations, 2003 under the Kenya Gazette Supplement No. 56 of 13<sup>th</sup> June 2003.

## ACRONYMS

°C	Degrees Celsius
EIA	Environmental Impact Assessment
EMCA	Environmental Management Coordination Act
EMP	Environmental Management Plan
HWM	Household Waste Management
EA	Environmental Audit
ERP	Emergency Response Plan
GDP	Gross Domestic Product
KM	Kilometers
LPG	Liquefied Petroleum Gas
IAP	Consult with Interested and Affected Parties
ITC	Inter-Tropical Convergence Zone
MOH	Ministry of Health
NEAP	National Environmental Action Plan
NEC	National Environment Council
NEMA	National Environment Management Authority
NGOs	Non Governmental Organizations
NPEP	National Poverty Eradication Plan
PRSP	Poverty Reduction Strategy Paper
OHSO	Occupational Health and Safety Office
PCC	Public Complaints Committee
SSA	Systematic Sequential Approach
TOR	Terms of Reference
UNEP	United Nations Environmental Programme
WSSD	World Summit for Social Development
WRMA	Water Resources Management Authority

## Table of Contents

DECLARATION .....	2
Executive Summary .....	12
• Adapt an effective Accident prevention and Emergency Response Plan (ERP) .....	13
1. Introduction .....	14
1.1 Objectives of the EIA .....	15
1.1.1 Specific Aims and Objectives of the impacts study .....	15
1.2 Terms of Reference .....	15
1.3 Responsibilities .....	16
1.4 Scope of the study .....	17
1.5 Methodology .....	18
2.1 Project Objectives .....	19
2.2 Project Designers .....	19
2.3 Site Location .....	19
2.4 Other existing quarries close to the proposed site .....	20
2.5 Infrastructure and services .....	20
2.5.1 Roads and Accessibility .....	20
2.5.2 Water supply .....	21
2.5.3 Waste Management .....	21
2.5.4 Surface Water Drainage .....	21
2.5.5 Solid Waste Management .....	21
2.5.6 Energy supply and use .....	22
2.5.7 Communication .....	22
2.5.8 Security .....	22
2.6 Data collection and recording .....	23
2.6.1 Site surveys .....	23
2.6.2 Photographic recording .....	23

2.6.3	Desktop study .....	23
3.	<b>PROJECT DESCRIPTION AND ACTIVITIES .....</b>	<b>24</b>
3.1	<b>Introduction .....</b>	<b>24</b>
3.1.1	<b>Nature and description of the proposed project .....</b>	<b>24</b>
3.1.2	<b>Preparatory work .....</b>	<b>24</b>
3.1.3	<b>Transportation to road construction sites .....</b>	<b>24</b>
3.1.4	<b>Project Budget and duration. ....</b>	<b>24</b>
3.2	<b>Project Description and (stone excavation and crusher site) Activity .....</b>	<b>25</b>
3.2.1	<b>Site Preparation .....</b>	<b>25</b>
3.2.2	<b>Rock and Stone Mining .....</b>	<b>25</b>
3.2.3	<b>Transportation of rock materials .....</b>	<b>25</b>
3.2.4	<b>Crushing of Rock and Storage Materials .....</b>	<b>25</b>
4.	<b>BASELINE INFORMATION OF THE STUDY AREA .....</b>	<b>26</b>
4.2	<b>Environmental Profile of the Project Site and the Surroundings .....</b>	<b>26</b>
4.2.1	<b>Climate .....</b>	<b>27</b>
4.2.2	<b>Biological Environment .....</b>	<b>28</b>
4.2.2.1	<b>Biodiversity .....</b>	<b>28</b>
4.2.2.1.1	<b>Flora .....</b>	<b>28</b>
4.2.2.1.2	<b>Fauna .....</b>	<b>29</b>
4.2.3	<b>Land Use .....</b>	<b>31</b>
4.2.4	<b>Hydrology .....</b>	<b>32</b>
4.2.5	<b>Drainage .....</b>	<b>32</b>
4.2.6	<b>Geology .....</b>	<b>33</b>
	The proposed project site has two types of rocks: - .....	33
4.2.7	Availability of rocks for Quarrying .....	34
4.2.8	<b>Water resources .....</b>	<b>37</b>
4.2.9	<b>Demography and Population profile .....</b>	<b>37</b>

4.2.10	Archaeology of Naivasha Basin .....	37
4.2.11	Socio-Economic Environment .....	38
4.2.11.1	Health .....	38
4.2.11.2	Socio-Economic Profile .....	38
4.2.12	Soils .....	39
4.2.13	Infrastructure .....	40
4.2.14	Structures in the site area .....	40
5	RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORK .....	41
5.1	Mining policy and Environmental legislation .....	41
5.1.1	The Mining and Minerals Act, Cap 306 .....	41
5.1.2	Environmental Policy Framework .....	41
5.1.3	Institutional Framework .....	42
5.1.3.1	National Environment Management Authority (NEMA) .....	42
5.1.3.2	National Environment Council (NEC) .....	42
5.1.3.2	National Shelter Strategy to the Year 2000 .....	42
5.1.3.3	The National Poverty Eradication Plan (NPEP) .....	42
5.1.4	Environmental Legal Framework .....	42
5.1.5	Public Health Act (Cap. 242) .....	43
5.1.6	Local Authority Act (Cap. 265) .....	43
5.1.7	Physical Planning Act, 1999 .....	43
5.1.8	Electricity Power Act No. 11 of 1997 .....	43
5.1.9	Penal Code Act (Cap.63) .....	44
5.1.10	Way leaves Act Cap 292 .....	44
5.1.11	The Land Registration Act, 2012 .....	44
5.1.12	The Environment and Land Court Act, 2011 .....	45
5.1.14	The Land Act, 2012 .....	45
5.1.15	The Environment Management and Coordination Act (1999) .....	46

5.1.16	The Environment (Impact Assessment And Audit) Regulations, 2003 .....	46
5.1.17	The Environmental Management and Co-ordination (Water Quality) Regulations, 2006	46
5.1.18	Environmental Management and Co-ordination (Waste Management) Regulations 2006	46
5.1.19	The Explosives Act (Cap 115).....	46
5.1.20	Public Health Act – (Revised 1986).....	47
5.1.21	Water Act, 2002.....	47
5.1.22	The Traffic Act.....	47
5.1.23	The Workman’s Compensation Act, Cap 236.....	47
6	<b>PUBLIC PARTICIPATION AND CONSULTATION .....</b>	<b>47</b>
6.1	<b>Introduction .....</b>	<b>47</b>
6.2	<b>Methodology used in Public consultation .....</b>	<b>48</b>
4.3	<b>Sources of information .....</b>	<b>48</b>
7	<b>POTENTIAL ENVIRONMENTAL IMPACTS .....</b>	<b>53</b>
7.1	<b>INTRODUCTION .....</b>	<b>53</b>
7.2	<b>OPERATIONAL PHASE.....</b>	<b>53</b>
7.2.1	<b>Positive Impacts .....</b>	<b>53</b>
7.2.1.1	<b>Job Opportunities .....</b>	<b>53</b>
7.2.1.2	<b>Gains in the Local and National Economy .....</b>	<b>53</b>
7.2.1.3	<b>Provision of Market for food vendors .....</b>	<b>53</b>
7.2.1.4	<b>Increased business within the surrounding .....</b>	<b>53</b>
7.2.1.5	<b>Optimal use of Land .....</b>	<b>54</b>
7.2.1.6	<b>Provisions of gated community construction material.....</b>	<b>54</b>
7.2.1.7	<b>Utilization of the land .....</b>	<b>54</b>
7.2.1.8	<b>Promotion of development.....</b>	<b>54</b>
7.2.1.9	<b>Increase government revenue .....</b>	<b>54</b>
7.2.2	<b>Negative Impacts .....</b>	<b>54</b>



7.2.2.11	<b>Water Pollution</b> .....	57
7.2.2.12	<b>Disease vector harbour</b> .....	57
7.2.2.13	<b>Disruption of wildlife habitat</b> .....	57
7.2.2.14	<b>Increased energy use</b> .....	57
7.2.3	<b>Impacts Related to Occupational Health and Safety</b> .....	58
7.2.3.1	<b>Dust</b> .....	58
7.2.3.2	<b>Noise pollution and vibrations</b> .....	58
7.2.3.3	<b>Public Health and safety</b> .....	58
7.2.3.4	<b>Noise, Fly rock, Air pressure and ground Vibration</b> .....	58
7.2.3.5	<b>Risks of Accidents and Injuries to Workers</b> .....	58
7.2.3.6	<b>Solid waste generation</b> .....	59
7.3	<b>DECOMMISSIONING PHASE</b> .....	59
7.3.1	<b>Positive Impacts</b> .....	59
7.3.1.1	<b>Rehabilitation</b> .....	60
7.3.1.2	<b>Employment Opportunities</b> .....	60
7.3.2	<b>Negative Impacts</b> .....	60
7.3.2.1	<b>Dust</b> .....	60
7.3.2.2	<b>Noise and Vibration</b> .....	60
8	<b>MITIGATION MEASURES AND MONITORING PROGRAMMES</b> .....	61
8.1	<b>Mitigation of Construction and Operational Related Impacts</b> .....	61
8.1.1	<b>Air quality</b> .....	61
8.1.2	<b>Minimize the effects of noise and vibrations emitted from the site</b> .....	61
8.1.3	<b>Minimise the effects of exhaust emission</b> .....	62
8.1.4	<b>Hydrology and water quality degradation</b> .....	62
8.1.5	<b>Noise, Fly rock, Air overpressure and ground Vibration</b> .....	63
8.1.6	<b>Solid waste</b> .....	64
8.1.7	<b>Habitat and vegetation disturbance/loss</b> .....	64

8.1.8	Handling Hazardous Wastes.....	65
8.1.9	Increased runoff.....	65
8.1.10	Possible exposure of workers to hazards.....	65
8.1.11	Worker accidents during operation and decommissioning.....	65
8.1.12	Reduction of impacts at extraction sites and efficient use of raw materials.....	66
8.1.13	Minimization of vegetation disturbance.....	66
8.1.14	Minimization of run-off and soil erosion.....	66
8.1.15	Reduction of energy consumption.....	66
8.1.16	Minimization of water use.....	67
8.1.17	Controlling oil spills during operation.....	67
8.2	Public Health Safety and Awareness.....	67
8.2.3	Mitigation of Decommissioning Phase Impacts.....	67
8.2.4	Efficient solid waste management.....	67
8.2.5	Reduction of Dust Concentration.....	67
8.2.6	Minimization of Noise and Vibration.....	67
9	ANALYSIS OF PROJECT ALTERNATIVES AND THE PROPOSED ACTION.....	68
9.1	The Proposed Alternative.....	68
9.2	Relocation alternative.....	68
9.3	The No Action Alternative.....	68
9.4	Alternative Design and Technology.....	69
9.5	Comparison of alternatives.....	69
9.6	Mitigation for the proposed Action.....	69
10	ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN.....	70
10.1	Introduction.....	70
10.2	Decommissioning Phase.....	79
11	CONCLUSION AND RECOMMENDATIONS.....	82
11.	REFERENCES.....	83

## List of Figures

<i>Figure 1: Satellite map showing the location of the proposed site.....</i>	<i>20</i>
<i>Figure 2: Map showing the greater Nakuru – Naivasha catchment area.....</i>	<i>25</i>
<i>Figure 3: Rainfall distribution around Lake Naivasha Water Shed.....</i>	<i>27</i>
<i>Figure 4: Land Use / Land Cover around the study Site.....</i>	<i>30</i>
<i>Figure 5: Percent Slope for the Lake Naivasha Watershed.....</i>	<i>32</i>
<i>Figure 6: Geology of the proposed quarry site.....</i>	<i>34</i>
<i>Figure 7: Geological map of the area.....</i>	<i>34</i>
<i>Figure 8: Population distribution in the L. Naivasha Basin.....</i>	<i>35</i>
<i>Figure 9: Soils around the study site.....</i>	<i>37</i>
<i>Figure 10: Lake Naivasha's Watershed Land cover/Land Use Map, 2010.....</i>	<i>38</i>

## List of Tables

Table 1: List consultants for the project designs.....	19
Table 2: A comparison threats to biodiversity among the five divisions of Naivasha.....	29
Table 3: List of public participants.....	48
Table: 4: Environmental Management Plan for the Construction Phase.....	71
Table 5: Management of Environmental Impacts during the Operational Phase.....	75
Table 6: Environmental Management Plan for the Decommissioning Phase.....	80
Table 7: Environmental Restoration plan.....	81

## List of Plates

Plate 1: Location of the proposed site.....	26
Plate 2: Overview of land surrounding the proposed site.....	31
Plate 3: Public meeting attendants.....	48
Plate 4: Participants during public meeting.....	49

## Executive Summary

This environmental impact assessment study was carried out on behalf of Resorts and Cities Ltd of P. O. Box. 64553 – 00620 Nairobi who have proposed to develop a quarry and a crusher on a 50 acres land leased from Kendong Ranch **L.R. No. Naivasha/Maraigushu Block 10/13 (Kedong)** in Kedong ranch village, Munyo sub location, Longonot Location, Naivasha division and Naivasha sub-County on the foot hills of Mt. Longonot. The main aim of the development project is to extract rock materials for sale to local contractors.

The project was aimed at fulfilling the requirements of Part VI section 58 (1) and (2) of the Environmental Management and Coordination Act (EMCA)) which requires developers to undertake Environmental Impact Assessment study and submit a report to NEMA.

A number of methodologies were employed in gathering data relevant to this study including desk top studies, focussed group discussions and in-depth interviews with key informants from lead agencies, stakeholders as well as with the potentially affected community.

The study analyzes some of the potential positive and negative environmental impacts and proposes measures to reinforce economic and social benefits as well as mitigating measures for the negative impacts. `

The following are some of the potential economic and social benefits (positive impacts) likely to arise as a result of the project:

- Increased employment Opportunities.
- Gains in the Local and National Economy.
- Increase in building and construction materials availability.
- Improved road access by the proponent and his workers and later by the land owners.
- Convenient access to road construction materials for easier execution of Government project.
- Optimal use of land resources.
- Complimentary spin-off benefits in other economic sectors such as retail and informal sector.
- Boosting host community development goals.
- Participation and increased human productivity amongst others.

The project identifies the following negative impacts that are likely to occur as a result of the project:

- Hydrology and water quality degradation.
- Noise pollution.
- Vibrations in the surrounding buildings due to drilling and blasting machines.
- Dust emissions due to vehicle and machinery movement.
- Increased water demand during construction and operation phase.
- Generation and emission of exhaust fumes.
- Waste management issues amongst others
- Workplaces injuries

In order to ensure project sustainability and environmental enhancement, the study recommends the following mitigation measures to be incorporated into the project:

- Provide soil conservation structures on the areas prone to soil erosion.
- Provide surface runoff water drainage channels to discharge water to safe areas.
- Avoid excessive use of water.
- Provide workers with relevant personal protective equipment.
- Control generating dust particles by regularly cleaning and sprinkling with water to reduce dust.
- Machineries should be maintained regularly to reduce noise resulting from friction.
- Maintenance of machineries must be carried out in a designated area (protected service bays) and where oils are completely restrained from reaching the ground.
- Use an integrated solid waste management system; through a hierarchy of options: source reduction, recycling, and reuse, and sanitary disposal to municipal designated safe areas or disposal sites.
- Avoid unnecessary clearing of vegetation by conserving vegetation in sections not being used.
- Landscape and plant vegetation in all open areas after the completion of the project and manage the introduced vegetation on completion of the development to restore or improve the site.
- Strictly adhere to the Factories and other places of Work Act, Building Code and other relevant regulations.
- Adapt an effective Accident prevention and Emergency Response Plan (ERP).
- Sanitary facilities should be provided (for each sex where conditions warrant).
- During construction phase, Workers should always be sensitized on social issues such as drugs, alcohol, HIV/AIDS.

The study concludes that the positive impacts outweigh the negative impacts by the ratio of 25:8 making the project highly positive on environmental considerations.

The project was also found to be in line with the government policy of providing standard and affordable housing infrastructure to society. The study established that the developer had complied with the existing legislative and regulatory requirements in relation to the proposed development.

The Environmental Impact Assessment while supporting the approval of the proposed project further recommends for the full implementation of the Environmental Management and impact mitigation plan proposed at the end of the document.

This report covers the following:

1. Development of crusher site
2. Development a magazine for keeping explosives
3. Drilling of holes to launch blasting explosives
4. Extraction of rock materials for ballast or building stones

## 1. Introduction

The Resorts and Cities Ltd, the proponent of the Longonot Quarry and Crusher project have contracted Dr. Joseph M. Maitima a lead Expert in environmental Impacts assessment to conduct a study on the environmental impacts associated with the proposed development.

Administratively the development is located in Nakuru County, Naivasha sub-county, Longonot Division, Longonot location, Munyo sub location , Kedong ranch village **L.R. No. Naivasha/Maraigushu Block 10/13 (Kedong)**, The area targeted for development measures approximately 50 acres located on the foot hills of Mt. Longonot bordering Mt. Longonot National Park. On the northern side, the fresh water Lake Naivasha is approximately 10 kilometres from the northern end of the proposed development.

Rock extraction and material borrowing is done in three common ways: - It can be done **manually** using simple hand tools like chisel and mallet. It can also be **mechanized** using stone cutting machine, bulldozers, wheel loaders and other machineries. Mechanized extraction is efficient and produces materials in large scale, covering large and expansive areas, within a short time, and last but not least is the **chemical** means; this is by use of explosive materials. Both the mechanized and the chemical methods, therefore have a pronounced environmental impact as they leave behind large excavations, after mass movement of materials. They usually accelerate land degradation and erosion especially after the soil has been set loose. Vegetation is also affected as well as human settlements.

All these rock materials extraction and blasting/crushing activities usually alter the biophysical and social environments of the mining areas. Control measures and procedures are thus inevitable to limit its impacts to acceptable levels. Generally, mechanized mass excavations aided by explosives in Kenya are subject to government regulations relating to environmental protection and safety of the working conditions discussed later in this report.

The rationale for the EIA project report is to integrate environmental aspects in the planning and implementation processes of this proposed project to mitigate adverse impacts and enhance the positives. Besides, Environmental Impact Assessment (EIA) for such projects is now a legal requirement. The ultimate objective of an EIA is to provide decision makers, relevant institutions/organizations, proponent and other stakeholders with the foreseeable environmental impacts of a proposed activity and therefore enable planning ahead taking into account all predictable outcomes and adequately providing for them for sustainability.

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

## 1.1 Objectives of the EIA

This EIA study report establishes the baseline conditions of the proposed development site, evaluates the existing conditions, assesses the anticipated impacts and proposes measures to enhance the positive impacts and measures to mitigate the effects of the significant negative impacts for the purposes of environmental enhancement and sustainability. The Proponent's intention to carry out an environmental impact assessment of the proposed development is to achieve the following:

- Comply with the legal requirements, as outlined in the Act and Regulations, and submit a Project Report to the National Environment Management Authority (NEMA);
- Produce a material output that presents a comprehensive background to the proposed development and one that will satisfy Kenyan environmental regulations in order to seek the approval of the regulating authority -NEMA;
- Obtain and define the baseline data for comparison during future environmental audits and monitoring procedures of the proposed project;
- Identify in detail the potential positive and negative environmental impacts envisaged as a result of the implementation of the project;
- Consult with Interested and Affected Parties (IAPs);
- Formulate recommendations on the appropriate measures needed to reinforce positive impacts and minimize any negative impacts at all phases of the project cycle; and
- Ensure that the project incorporates adequate protection of the environment, and protects essential interests of the local communities affected.

### 1.1.1 Specific Aims and Objectives of the impacts study

1. To assess the environmental impacts associated with the proposed developments
2. Prepare a report detailing all impacts and the mitigation measures that the proponent should take to avoid or minimize the adverse effects and maximise the beneficial effects so as to preserve the environment for all
3. Conduct community participation surveys
4. Prepare an environmental Monitoring Plan
5. Prepare recommendations
6. Submit the report to the proponent
7. Submit the required number of copies of the report to NEMA for purposes of statutory approvals

## 1.2 Terms of Reference

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

1. Development of baseline surveys (full screening and scoping) on:
  - a. Compliance with sectoral regulatory requirements or provisions
  - b. Current vegetation and seasonal variations
  - c. Current biodiversity and seasonal variations
  - d. Soils
  - e. Water resources
  - f. Climate including air and local microclimate conditions
2. Effects of various project phases (construction, operations and decommissioning) of the development on the items listed above.
3. Conduct adequate public and stake holder participation
  - a. Stakeholder consultations on
    - i. the views on benefits and effects of the proposed development on their economic activities, socio cultural processes, and environment
    - ii. public views on the proposed development especially in relation to the environment identifying the issues the project proponent should take care of

4. Identification of project specific impacts and development of mitigation measures
5. Development of Environmental Monitoring Plan (EMP)
6. Preparation of a comprehensive report with details of all the above for NEMA evaluations.
7. Submission of the relevant number of copies to the proponent (Longonot Gate Development Ltd. and NEMA.
8. Responding to any areas of concern to NEMA

### **1.3 Responsibilities**

The responsibilities are as follows:

The Proponent is to provide the following:

1. Site maps for the developments showing roads, services, development layout showing neighbouring lands and the full set up of the land to be developed.
2. Proposed measures intended for handling solid wastes, soil erosion and vegetation degradation
3. To provide permits and corporate principles that govern the proposed activities

The consultant is to provide the following:

1. An Environmental Impacts Assessment Study draft report to the Client
2. An Environmental management Plan (EMP) to the client
3. Final Environmental Impact Assessment Study report to the proponent that will be submitted to NEMA for approval



## 1.4 Scope of the study

The study focuses on the project site and the surrounding areas that are likely to be impacted by the development. Physical environment included landscape, air quality, microclimate and water. On the other hand, the cultural environment considered religious beliefs and cultural practices, land use, population, space, safety and ambient environment. Manmade environment covers the socioeconomic infrastructure (roads, traffic flow, electricity, sewerage, telephone and space) while the biological environment covered sensitive ecosystem, important ecosystems and ecological processes. The study also covers both the direct and indirect impacts interaction of the project in addition to the short-term, long term, cumulative impacts and impact interaction. The impacts were classified as positive and negative.

An environmental management plan is formulated to provide viable and environmental friendly options to manage both the positive and the negative impacts. To assess potential environmental impacts, use is made of descriptive checklists and matrices. Sectoral guidelines on natural resources management were most useful during the initial stages of EIA process. The Leopold matrix was used because it allowed for systematic analysis, the interactions between the project activities and environmental components.

The Leopold matrix proposes a three step process to estimate the impact:

*First step;* for all the interactions considered significant by the experts, the 1<sup>st</sup> step was to mark the corresponding boxes in the matrix with a diagonal line

*Second step:* once the boxes with supposed significant interactions are slashed, the experts evaluated on the box by applying a number from 1 to 10 (1 is the minimum and 10 is the maximum) to register the magnitude of interaction. This number was transferred to the upper left hand corner. It represented the scale of the action and its theoretical context.

*Third step;* the final step for this method is to mark 1 to 10 from the lower right hand corner, the real importance of the phenomenon for the given project. It then gave an evaluation of the extent of the environmental impact according to the assessment judgment.

The Systematic Sequential Approach (SSA) is the most useful method during the assessment. The SSA required the development of conceptual model that represented the casual chain: activity- changes-impact –mitigation. The SSA method led to an understanding of how the environmental, social and economic systems were interrelated, and how they will react to human disturbances.

This met the objectives of the various tasks of the EIA process detailed in the TOR. The above assessment has been followed by mitigation measures which may alter the project design to ensure environmental sustainability.

Besides the approach outlined above, a significant part of the objectives of the EIA were arrived through primary data collection. The baseline studies included habitat and vegetation, demography and settlement, various aspects of the physical environment, and wildlife, livestock and range resources, agricultural pests and diseases, forest products and wood energy, community environmental growth, environmental laws and policies.

## 1.5 Methodology

The scope of this study was guided by the requirements of the Environmental Management and

Coordination Act No 8 of 1999 and in particular by the Environmental Impact assessment and audit regulations of 2003. Wide range of methods used in the various stages of study. They included methods used by the various specialists for: Stakeholder analysis; Scoping of key issues; Consultation and public participation; carrying out the various baseline studies; definition of the projects sphere of influence; and impact analysis.

An intensive survey provided an overview of the general implications of the proposed project. This involved the following steps:

1. Screening of the project, a process that identified the project as being among those that require an EIA study under schedule 2 of EMCA act 1999.
2. A scoping exercise that identified the key issues to be addressed in the study was also done.
3. The aims of the scoping exercise are firstly to identify at an early stage (when the project design is still amenable to modification) the key receptors, impacts and project alternatives to consider, the methodologies to use, and the stake holders to consult. Secondly to ensure that resources and time are focused on important impacts and receptors. Thirdly to establish an early communication between the proponents, consultants, statutory agencies and other interested groups who can provide advice and information. Lastly, to inform the proponent of any constraints which may pose problems if not discovered on time.
4. Documentary review on the nature of the proposed activities, policy and legal frameworks, environmental settings of the area and other available relevant data/information.
5. A detailed discussion with the project proponent and consultation with relevant officials in the regulatory authorities.
6. Physical investigations of the site and the surrounding areas using a pre –prepared checklist identifying possible environmental and human safety issues that are likely to occur or be affected.
7. Reviewing the proposed project designs and implementation plan/schedules with a view of implementation of mitigation measures such as suggesting suitable alternatives, modification of methods and timing of construction; modification of design features e.g., landscaping, minimising of operational impacts (e.g., pollution and wastes); specific measures to compensate for losses, e.g., amenity or habitat features.
8. Developing an environmental management plan outlining the responsibilities, schedules, monitoring indicators and timeframes among other aspects.
9. A comprehensive report including all issues as listed in the environmental Impact Assessment and Audit Regulation 2003.
10. Developing a post EIA Study monitoring protocol.

## 2. Project Information

### 2.1 Project Objectives

The objectives of the project are as follows:

1. To provide opportunities for building stones extraction and sale.
2. To open up the area through improved roads and other infrastructure.
3. To attract investment in the area.

#### 2.1.1 Major activities of the project

The project will largely comprise of

1. Extraction of stones. Extraction of stones may use **explosives** whose strengths will be recommended by experts and the ministry of mines.
2. Moving the stones to crusher or the crusher moving to the location of the stones
3. Crushing stones into different sizes of ballast. Big builders may be broken into smaller pieces by use of light explosives so that they can be fed into the crusher. It is anticipated that blasting of stones will be done once in two to four weeks.
4. Loading of ballast to trucks
5. Movement of trucks to and from the site

### 2.2 Project Designers

The project is being handled by a team of consultants covering all aspects of development. The consultants are as listed here below:

Table 1 List consultants for the project designs

Project activity	Consultants	Address
Geological surveyor	Dept..of Geological Sciences, School of Earth Sciences, South Eastern Kenya University	P.O Box 170- 90200, Kitui, Kenya. Email: <a href="mailto:pkariuki@seku.ac.ke">pkariuki@seku.ac.ke</a>
Environmental Impacts Assessment	Ecodym Africa  (Dr. Joseph Maitima)	P.O. Box 50901 – 00200 Nairobi Tel: 020-233 1246 Email: <a href="mailto:info@ecodymafrica.com">info@ecodymafrica.com</a>

### 2.3 Site Location

The site proposed for development is located less than 100 kilometres from Nairobi along the old Nairobi Naivasha road on plot number Naivasha/Maraigushu Block 10/13 (Kedong) in Naivasha Municipality. The land was formally used for agriculture and change of user to comprehensive development has already been obtained and all due payments have been made

(see attached documents). The site is situated between Mt. Longonot and Lake Naivasha (Fig.1) Mt. Longonot situated at 0.92 S, 36.45 E, rises to 2617 m above sea level. The mountain which is a stratovolcanic mountain is at the southern end of Naivasha trough and is situated between the rhyolite dome field of Olkaria, 20 km to the north-west and the phonolite-dominated Suswa, 30 km to the south.

*Figure 1: Satellite map showing the location of the proposed site*



## **2.4 Other existing quarries close to the proposed site**

There are two other quarries operating within a distance of 5 to 7 kilometres from the site for the proposed quarry. One quarry is owned by H.Z. Young Construction Company that produces ballast and dust stone particles for use in road construction. The quarry is owned by a Chinese road construction company. The proposed site and both the existing companies are within Kendong Ranch.

## **2.5 Infrastructure and services**

### **2.5.1 Roads and Accessibility**

The property lies off the old Nairobi-Naivasha road. The site can be accessed off Naivasha road onto a 5 km long access road that leads to Mt. Longonot National park and to the site as well.

The access road also connects to the railway line that runs parallel to the eastern border of the site.

The area is served by an all weather road running from Nairobi to Naivasha and beyond. The Nairobi Kampala railway line also serves the area running along the eastern border of the

proposed site. The old Naivasha road passes on 5 kilometres from the proposed site from which a motorable road serving the Longonot National Park ends about a kilometre to the Proposed Gate B of the development. The proposed development will extend this road from the gate of the park to the entrance of the proposed development. A railway station is planned to be developed at the proposed site to serve the residents of the area and the general public.

On the northern side of the proposed site an all weather road runs from Naivasha town round Lake Naivasha serving towns and the flower farms around the lake. This road will link to the proposed development. The distance between this all weather road and the proposed site is only 5 kilometres and serves several other properties currently used as cattle ranches and for cultivation. This road linking the flower (South Lake Road) is government classified road and will be maintained by the government accordingly.

### **2.5.2 Water supply**

No visible water connection was noted. However, the proposed project site shall be connected to existing water piping from a neighbouring land with a 4 inches pipe. It is noted that the proposed development will have boreholes water supply which shall be channelled to an elevated tank of substantial capacity. Rain water harvesting shall also be done to supplement the water supply. The proponents also plan to tap water from River Malewa to supplement that from the piped system and that from the boreholes. The report in the annex provides a more detailed account of water sources and reticulation plans for the proposed development.

### **2.5.3 Waste Management**

#### **Waste Water Management**

There are no plans to set up a sewer system for Longonot Gate quarry. Septic tanks will be sunk to manage waste water from the site. This will be emptied periodically as it fills up by licenced waste water transporters.

### **2.5.4 Surface Water Drainage**

The area is generally drained by the general topography. The proposed design has provided for internal drains to collect the surface run-off and safely contain it into dams and lakes whose overflow will be channelled along the road network. The proposed quarry shall have drainage water channelled towards the peripheral drainage. The operations will be monitored appropriately to ensure the water from the site is not contaminated.

### **2.5.5 Solid Waste Management**

Wastes from the project will be many and especially during construction (clearing of the existing debris) and occupation phase. Since the site is far from Naivasha Municipality, the proponent/ contractor has an option of contracting a private garbage collecting company. Upon completion, the residents will be responsible for contracting private company for collecting garbage and disposing it to appropriate locations provided for by Naivasha local authorities. The area currently has little or no vegetation in most parts and where there is, the constructors will be encouraged to save it as much as possible. Where vegetation will have to be removed, the same should be used to feed livestock in the neighbourhood or let to decompose in the areas that will be left intact. This way the biomass will be recycled back into the productive system. Wastes arising from the construction materials, (wooden, glass, plastics, sanitary litter etc.) should be contained in dust bins and disposed to appropriate

locations. This calls for sound waste management system especially during construction. All solid wastes should be dumped in approved dumpsites and in accordance with the regulations.

### **2.5.6 Energy supply and use**

Construction machinery will require fuel during construction. This will be sourced from legalized dealers. Electrical power will come in handy in driving the selected construction machinery. It will also be needed on occupation of the completed project. The power (electricity) is in close proximity of the site and will very easily be accessible even during the construction phase. It will just be connected to the facility on project inception or completion of the project. The proponent shall apply for upgrading of the power supply from KPLC to accommodate the anticipated demand such that transformer(s) shall have to be installed within the project but this shall be determined in liaison with the KPLC. In addition to the above, the need for energy conservation will be emphasized mostly during construction and occupation phases. During occupation phase, the use of renewable energy sources such as solar will be encouraged. The solar backup system shall be used to power the street lights, heating water and lighting up the emergency lights and also the electric perimeter fence that will be erected around the entire development. The batteries shall be stored at the guarded house and the panels shall be installed in a secure place.

### **2.5.7 Communication**

The area is well covered by communication facilities such as all mobile and fixed telephony service providers. The nearby Naivasha town has excellent communication facilities including postal services, offices for all mobile telephone providers and offices for private couriers both for parcels and general services. The proposed project will also be connected to fibre optic cable. All these will facilitate communication during the implementation and on completion of the project.

### **2.5.8 Security**

The site will be fenced with specific gates which will be guarded by trained security personnel. All traffic to and out of the estate will be through the demarcated gates that will be manned by security personnel for 24 hours daily. Guard houses shall be provided at the gates with enhanced security gadgets. The entire area will be patrolled regularly by security personnel to survey all the area around. Streetlights will be installed sufficiently within the project area. The Quarry management is anticipated to engage security firms to enhance security.

### **2.5.9 Safety and health Equipment**

The people working at the site will be provide with necessary protection gear like the helmet, ear muffs safety boots, overalls, reflective jackets, dust masks to protect them from falling objects that may cause injures. Also, safety equipment will be maintained and ready for use in good working order at all times with regard to ongoing activities. There will be adequate escape and rescue facilities to ensure safe escape of the workers in case of danger and emergencies.

## **2.6 Data collection and recording**

### **2.6.1 Site surveys**

A team of consultants surveyed the site and its surroundings. This field visit ensured the study took into consideration potential receptors of impacts, any sensitive environment to the project surrounding, human activities and land uses, biophysical aspects (topography, visual aspects, noise, soils, potential water sources and aesthetic quality) and biological aspects.

### **2.6.2 Photographic recording**

A photographic survey of the site and the surrounding areas was also performed. This was captured through the means of a digital camera. Key photographs acquired were used for further analysis in the study. They were also used as data illustrators in the final study report.

### **2.6.3 Desktop study**

Baseline data was collected through desktop studies and evaluations. This was mainly through literature review of past works in the area where field studies had been carried out and documented both electronically and through hard copy report surveys. Data retrieved was to a large extent on the natural setting; vegetation, climate, Soils, geology and socioeconomic setup.

### **3. PROJECT DESCRIPTION AND ACTIVITIES**

---

#### **3.1 Introduction**

##### **3.1.1 Nature and description of the proposed project**

The proposed activity will mainly involve the extraction of the underlying rock by blasting and then transporting them to the crusher plant to grind them to small-standardized sizes of various sizes to be used for construction of houses in the proposed Longonot gated community and the surplus will be sold. Rock extraction and crushing is to be done by the use of explosives and mechanical equipment such as excavators and trucks. In this case, the extracted stone will be crushed and stored on site.

##### **3.1.2 Preparatory work**

The initial activity on the proposed project is the preparatory works for the site which will normally entail the provision of an access road, soil stripping, transportation of excavated rock material and earth moving equipment, installation of service lines and other basic facilities.

##### **Transportation of excavated stone for crushing**

To get the appropriate standardized sizes of the stone/gravels, a stone crushing machine will have to be used at designated contractor sites at Longonot camp site and other working sites within the project area. The machine will be set to produce stones of a given size per time. The machine is adjustable to different sizes thus it will be possible to crush rocks/stone into different sizes of stones.

The stones produced will be moved mechanically by the use of the conveyor machine which is set to various standards which will transport the materials to designated storage areas. In the process stones that will break down and those which may not meet the required standard will be kept in another area to be used later to back fill the quarried pit on decommissioning.

##### **3.1.3 Transportation to road construction sites**

Finished product will be then be stored and sold to contractors and other business people dealing in building materials. The proponent intends to sell the product and will ensure appropriate traffic control is observed on site.

##### **3.1.4 Project Budget and duration.**

The proponent has been using a mobile crusher in the adjacent Longonot Gate development to produce ballast from stones excavated in road construction. The activity was licensed by reference [NEMA/PR/5/2/1588](#). The cost of the stone crusher to be used in this project was already reported and accounted for during the issuance of this license.



Apart from replacement of parts no other purchases of equipment is envisaged in this project.

## **3.2 Project Description and (stone excavation and crusher site) Activity**

### **3.2.1 Site Preparation**

The project site is generally characterized by short shrubs, bushes and scattered trees making the site clearance fast. There is no unique habitat or species of conservation interest within the 50 acres where the quarrying will be done. After the complete demarcation of the site, the contractor is to erect a site office; security installations, sub-ordinate staff housings, crusher and the transportation conveyor belt machine.

### **3.2.2 Rock and Stone Mining**

The provision of the excavator tractors with the aid of drilling machine, the site will be excavated starting from the opposite side where the offices, housing and crushing machines are not located. The excavator will excavate and load the stones into the Lorries, which will transport the material into the site crushing machine. In the cases where the rock is hard for the excavator then the drilling machine will be used and explosives put into the drilled hole for explosion.

### **3.2.3 Transportation of rock materials**

There will be several trucks depending on the quantity of the material which will be loaded with the excavated rocks for transportation to the site crushing machine. These transportation trucks will alternate at a given time sequence to control the interference, and the emission of dust and noise to the workers and neighboring areas.

### **3.2.4 Crushing of Rock and Storage Materials**

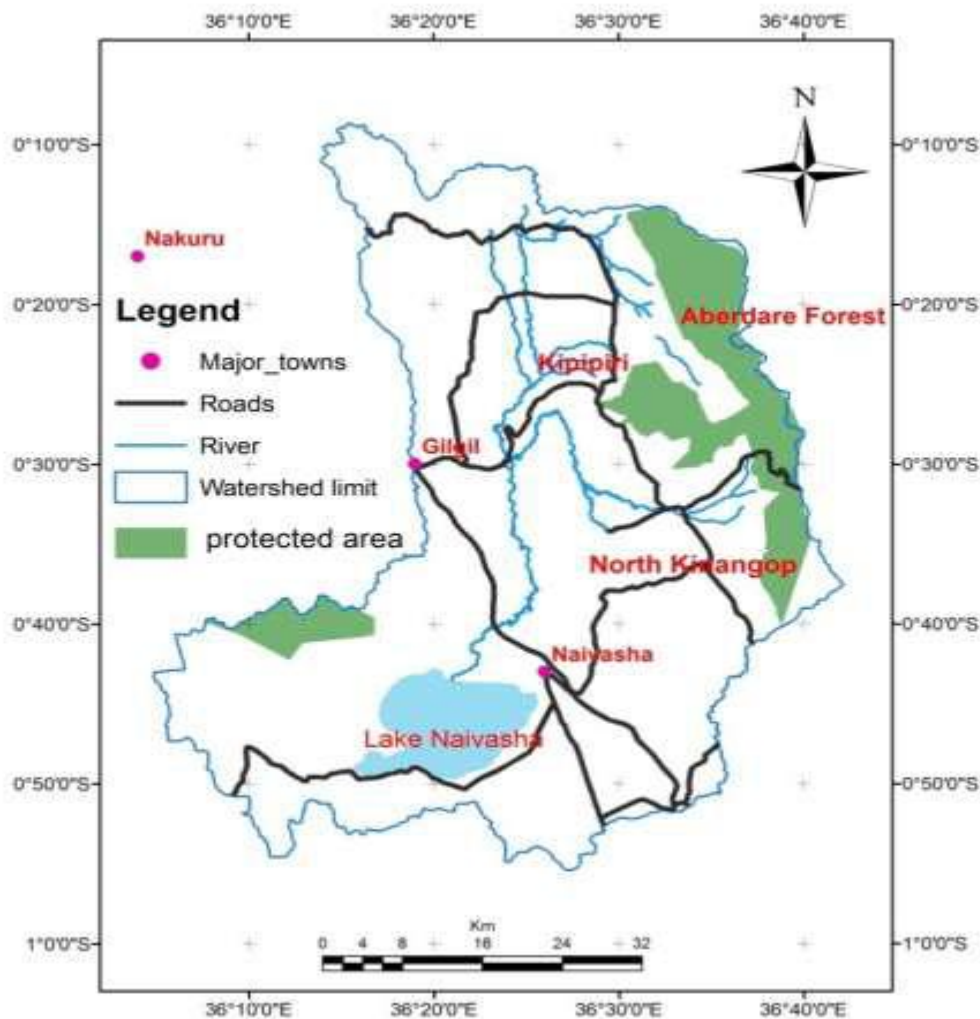
The crushing machine will be installed on site for use in the crushing of stones into different grades as required by the construction engineers. The machine will be fitted with conveyor belts, which moves the materials for storage within the site.

## 4. BASELINE INFORMATION OF THE STUDY AREA

### 4.1 Baseline Survey of the Area

The proposed Resorts and Cities quarry site is located in Naivasha within Nakuru County; the baseline study below covers the area within the scope of the project area.

Figure 2: Map showing the greater Nakuru – Naivasha catchment area



### 4.2 Environmental Profile of the Project Site and the Surroundings

Naivasha is located in the vast central Rift Valley of Kenya, a lowland area that resulted from the formation of the rift. The area forms a catchment from two extensive forest stands on both margins of the rift. Lake Naivasha (0°. 45' S and 36° 20' E) is located northwest of Nairobi in the eastern Rift Valley at 1890m above sea level. The Lake is fed by several rivers from the north, where the Gilgil River and the Malewa River form the main inlets. The lake has an average depth of about 4 m. with a maximum of 7.6m. The lake has an area of about 120 m<sup>2</sup> and a shoreline of about 50 m. These

measurements were made some two decades ago and changes in climate and human impacts may have caused some alterations. The area around the project site receives drainage from the higher parts of the rift floor and also from the flanking escarpment to the east (Nyandarua Mountains. With over 3960 m high) and to the west from (Mau Escarpment – over 3000 m high) The Kinangop plateau extends between the Nyandarua mountains and the valley floor east of the site. To the south, Mt. Longonot, Mt. Suswa and other smaller volcanoes form conical extrusions where Mt. Longonot is an inactive volcano that forms a crater currently a National Park.



Plate 1: Location of the proposed project site

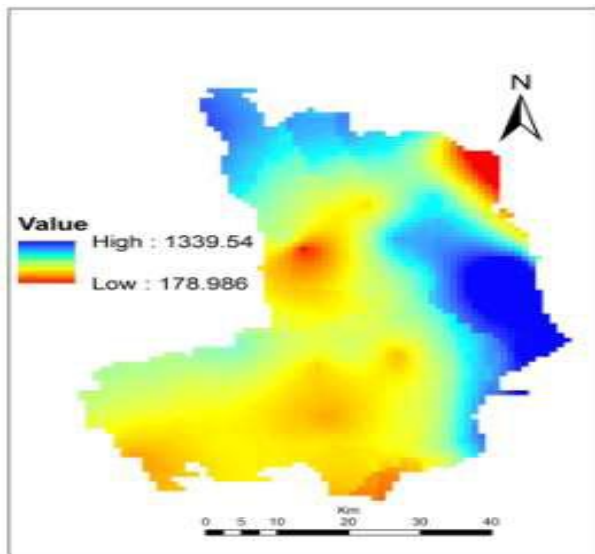
#### 4.2.1 Climate

The proposed site is located within one degree south of the equator and lies within the Inter-tropical Convergence Zone (ITC). The prevailing winds are from the east and north east. Mt. Kenya and Nyandarua Mountains capture most of the rainfall from the monsoons and cast a significant rain shadow over the central Rift Valley particularly over the Naivasha basin where the proposed site is located. The central part of the Naivasha basin has about 600mm of precipitation per year. Rainfall and temperatures are closely correlated with altitude but this relationship is altered by the rain shadow cast by the mountains east of the proposed site such that temperature decreases with altitude at a rate much faster than precipitation increases.

On the Rift floor at 1850 m temperature averages 18.2<sup>0</sup> C., with a mean minimum of 10 and maximum of 26.4<sup>0</sup> C. Mean annual rainfall ranges from 490 mm in the central Naivasha basin where the proposed site is located to 1300mm at the crest of Mau escarpment. In general the floor of the Rift is mildly warm and dry, while the higher reaches of Mau and Kikuyu escarpments are increasingly cold and wet. Climatic conditions are difficult for agriculture; particularly the Naivasha basin where the proposed site is located.

The good climate of Naivasha and its proximity to Nairobi are an attraction to many people. Currently many people living in Nairobi take off to Naivasha for weekend holidays and outings as families' friends or individuals. Many government and NGO meetings are held in Naivasha. Naivasha has therefore developed as both a holiday and meetings town.

Figure 3: Rainfall distribution around Lake Naivasha Water Shed



High rainfall is recorded on the escarpments but as one descends down to the Rift floor rain reduces.

## 4.2.2 Biological Environment

### 4.2.2.1 Biodiversity

#### 4.2.2.1.1 Flora

The vegetation is heterogeneous from aquatic plants such as papyrus around the lake margins, submerged macrophytes to terrestrial vegetation comprising of grasslands, bushlands, woodlands and forests. Generally, savannah vegetation is predominant (Harper, 1990). The vegetation types and distribution patterns are strongly associated to soil type that in turn is associated to topography (Watson & Parker, 1970; Harper, 1990). Other factors that influence the vegetation types include the level of water table, herbivory or selective feeding, trampling and human disturbances such as logging and farming (LNRA, 1993). The natural vegetation of the basin mainly consists of low *Acacia* shrub grassland with *Acacia drepanolobium* (“Whistling Thorn”) as the main woody species and *Themeda triandra* as the dominant grass. Since the 1980s, however, most of the natural vegetation has been cleared or degraded into grassland or converted to cropland due to population increase especially due to migration into the area.

Woodland surrounding the lake is dominated by *Acacia xanthophloea*, grasslands by *Pennisetum*

*claudstenum*, *Digitaria abyssnica*, *Cynodon dactylon*, *Themeda triandra* and herb, *Indigofera brevicalyx* while shrubland is dominated mainly by *Tarchonanthus comphoratus* and *Achyranthes aspera*. In rocky areas, *Euphorbia candelabrum* and *Euphorbia buseii* are dominant and the habitat is also suitable for succulents. *Themeda triandra*, *Eragrostis superba*, *Hyparrhenia hirta*, *Setaria pumila* and *Cynodon pleotostachy* are the common grasses and are all associated with *Tarchonanthus camphorates* shrubland. At the head of the River Malewa is a sub-montane tropical evergreen forest dominated by *Podocarpus falcatus*. Slopes above the lake are typically dominated by *Setaria* sp. (*S. pumila*, *S. sphacerata*, *S.*

*verticillata*) grasses, although these areas are now drastically overgrazed and the wooded grasslands have been degraded down into bushland of *Tarchonanthus camphoratus* typically common in the Rift valley floor.

#### 4.2.2.1.2 Fauna

##### A. Avifauna

Lake Naivasha that is 10 kilometres away from the proposed development site regularly supports more than 20,000 water bird congregations, with a mean of 22,000 (1991-1997). In total, there are more than 350 bird species, including many waterfowl species like grebes, pelicans, cormorants, herons, storks, ibises, African darters, spoonbills, flamingos, 22 species of ducks and geese, waders, gulls and terns. The woodland provides habitat for the globally threatened Grey crested Helmet shrike *Prionops poliophus* (Red List: NT). Another globally threatened bird found in the Naivasha woodlands is the Basra Reed Warbler *Acrocephalus griseldis* (Red List: EN), a winter visitor and passage migrant whose exact status is unknown. There are regionally threatened species both as regular visitors and residents e.g. Great Crested Grebe *Podiceps cristatus* (critical), Maccoa Duck *Oxyura maccoa* (endangered), African Darter *Anhinga rufa*, Great Egret *Casmerodius albus* (CITES Appendix III), Saddle-billed Stork *Ephippiorhynchus senegalensis* (CITES Appendix III), White-backed Duck *Thalassornis leuconotus*, Baillon's Crake *Porzana pusilla* obscura and African Skimmer *Rynchops flavirostris* (all vulnerable). The riparian/papyrus habitat supports certain endemic species such as Papyrus Gonolek and White-winged Swamp-Warbler.

##### B. Mammals

The riparian, papyrus and littoral macrophyte zones provide safe haven, foraging and breeding ground for many resident and migrant bird species, as well as other wildlife such as the Hippo, Waterbuck, Buffalo, Giraffe, Eland, Zebra, Thomson's and Grant's gazelles, bushbuck, duikers, mongooses, otters, various snakes and rodents as well as the occasional leopard which are found on the shores of the lake, in the acacia woodland and the neighbouring national parks and sanctuaries. There are several hundreds of hippos Hippopotamus amphibious at Lake Naivasha. Other species of mammals, mainly living in the riparian lands, are buffalo *Syncerus caffer*, monkeys *Colobus sp.*, Impala and waterbuck *Kobus ellipsiprymnus*. Hell's Gate National Park, which has an access corridor to the lake, hosts many other species of game. The lakeside is also important for raptors, like the eagle *Haliaeetus vocifer*, harriers *Circus ranivorus* and *C. aeruginosus*, and osprey *Pandion haliaetus*.

Hell's Gate National Park covers an area of 68.25 square km and is located south of Lake Naivasha, approximately 90 km from Nairobi. It has diverse topography and geological formations. It has historically been an important home for the rare lammergeyer Olkaria and Holley's extinct volcanoes can be seen as well as obsidian forms from the cool molten lava. The park is home to such animals as the buffalo, Maasai giraffe, eland, Coke's hartebeest, lion, leopard, and cheetah. There are over 103 species of birds in the park, including vultures, Verreaux's Eagles, augur buzzard and swifts. At the park also is a Maasai Cultural Center providing education about the Maasai tribe's culture and traditions. The park is popular due to its close proximity to Nairobi and lowered park fees compared to other National Parks. One is encouraged to hike and cycle in the park. This is unique in Kenyan National Parks, and is only made possible due to the lack of dangerous animals such as lions and elephants, though

there is a small number of cheetahs and African Buffalo. It is also known for its scenery which includes the Fischer's Tower and Central Tower columns and Hell's Gate Gorge. The national park is also home to three geothermal power stations at Olkaria.

Mt. Longonot National Park is located southeast of the proposed site where it shares a border with the site and covers about 52 km<sup>2</sup> most of it being occupied by Mt. Longonot, a volcano rising to 2,776 meters above sea level. Mount Longonot is a dormant stratovolcano which is thought to have last erupted in the 1860s. The sides of the mountain have beautiful V-shaped valleys and ridges. The stony soils have little vegetation but the crater has a forest of small trees covering the crater floor. Small steam vents are found spaced around the walls of the crater. The park has limited range of mammals, including buffalo baboons and monkeys in the crater. The mountain is also home to various species of wildlife, notably zebra and giraffe.

Between these two National parks lies the 80,000 acres Kedong Ranch (the land that the proposed site was part of) straddling the slopes of Longonot and bordering Hell's Gate National Park to the west. It acts a dispersal area for wildlife and amongst the many species of game, which roam freely over the open plains are eland, giraffe, zebra, impala, gazelle, Coke's Hartebeest, hyena and bat-eared fox. There are several nocturnal species such as the African springhare, white tailed mongoose, and the armadillo.

Table 2: A comparison threats to biodiversity among the five divisions of Naivasha

	<b>Threat</b>	<b>Elmenteita</b>	<b>Otut/Kikipey</b>	<b>Kiambogo</b>	<b>Eburu</b>	<b>Longonot</b>
1	Tree cutting	YES	YES	YES	YES	YES
2	Poaching	YES	YES	YES	YES	
3	Mining	YES				YES
4	Overgrazing	YES	YES	YES	YES	YES
5	Charcoal burning	YES	YES	YES	YES	YES
6	River water Abstraction	YES				YES
7	Land Conversion		YES	YES	YES	YES
8	Fires (Forest or grass)			YES	YES	
9	Habitat destruction				YES	

### 4.2.3 Land Use

Current land use is mainly pastoralism with some marginal arable farming on small isolated farms; some are remnants of the smallholder settlement schemes that were abandoned in the early 1990s. The indigenous people of the areas surrounding Lake Naivasha are the Maasai who originally were pastoralists and now many are practicing crop production. At present due to intermarriages with other communities, coupled with human settlements in these areas, they have also started practicing agriculture. However most of the areas in the basin are suitable only for grazing, unless irrigation is practiced. The land around the lake is being used for horticultural industry but under irrigation but these area has been steadily been expanding into the neighbouring ranges as seen from satellite images taken over the years. Farms range in size from those owned by large companies for flower farming to small farms. Other socio-economic activities around the lake include geothermal power generation, commercial fishing, domestic water supply, and tourism and recreation services. The area is therefore very attractive and supports a wide array of economic activities.

Little natural vegetation is left in the catchment. The headwaters of the Malewa, the main water source for the lake, are situated in the Aberdare National Park and the adjoining gazetted forest. The vegetation consists of humid Afro-mountain forest and bamboo. Fog is very frequent and may play a role in the water balance. The Kinangop and Bolosat Plateau were large grassland plains in the past. An estimated 30% is now covered with maize or vegetables and many fast growing tree species. The upland areas are largely covered by tree-savannah landscape and dryland forest. Remnants of this forest can still be seen on the escarpment. The bottom of the rift valley is an open savannah landscape in the past.

Figure 4: Land Use / Land Cover around the study Site

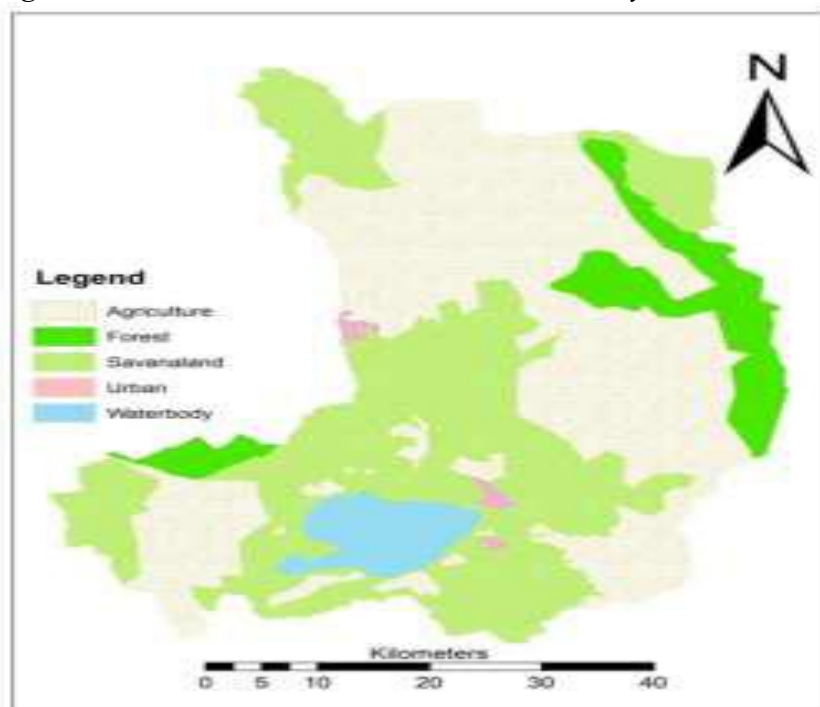




Plate 2: Overview of land surrounding the site

#### **4.2.4 Hydrology**

Hydrology of the study site and the surroundings is dominated by Lake Naivasha. Other surface water bodies are the Malewa and Gilgil rivers whose waters feed into the lake. Lake Naivasha is a unique ecosystem in that it is the only fresh water lake in Kenya's Rift Valley floor, all others being salty (Gaudet, 1979). The lake has no surface outlet. It receives 90% of its inflow from the perennial Malewa and Gilgil rivers, which originate from Nyandarua ranges. Malewa River has drainage area of 1730 km<sup>2</sup> and that of Gilgil is 429 km<sup>2</sup> (Sikes, 1989). The remaining input comes from seasonal streams, and direct precipitation. The catchment is dominated by igneous rocks and a number of pyroclastic formations including basalts, pumice and tuffs as a result of volcanic activity.

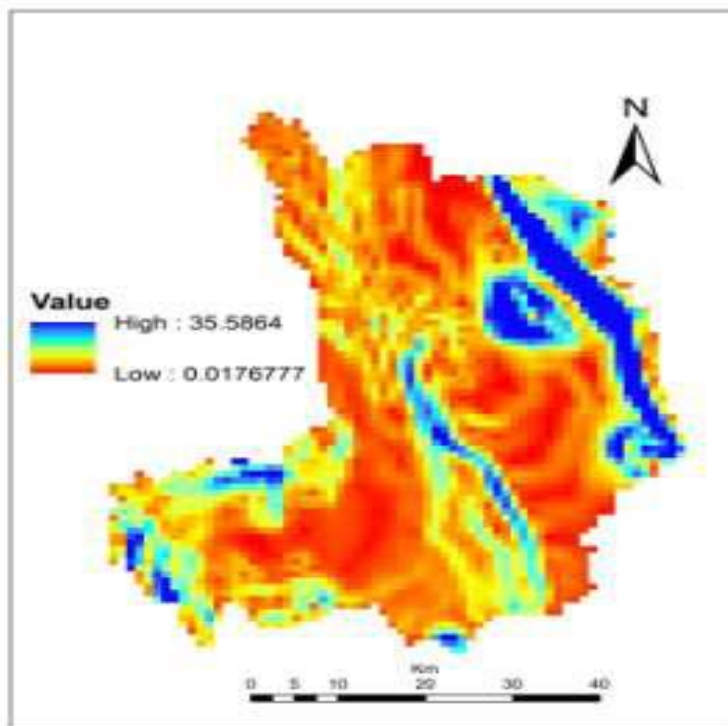
#### **4.2.5 Drainage**

Naivasha town and its environs depend upon the water from Lake Naivasha for most of the domestic water supply. There a number of horticultural irrigation farms around the lake whose only source of water is from Lake Naivasha. The lake is fed mainly by River Malewa that originates from Aberdares forests. The lake also receives significant amount of water from surface runoff during the rainy seasons due to its central location as a catchment area from both the eastern and western escarpments of the central rift valley. River Malewa has water throughout the year but some of its tributaries dry up during the dry seasons due to increased land use and deforestation.

Generally, Naivasha town and its environs have adequate water supplies for domestic use and livestock rearing.



Figure 5: Percent Slope for the Lake Naivasha Watershed



#### 4.2.6 Geology

The proposed project site has two types of rocks: -

- Trachytes
- Pyroclastic Deposits-Pumaceous Deposits and Volcanic Ash. A geological map of the area is provided in page 6 of annex A of this report.

##### 4.2.6.1 Phonolitic Trachyte

This is a porphyritic igneous volcanic rock. The mineral assemblage consists of essential alkali feldspar; relatively minor plagioclase and quartz or a feldspathoid such as nepheline may also be present. This rock type essentially has more mafic minerals than trachyte and hence the darker appearance. The trachyte outcrops were dark grey to dark green in colour with white feldspar phenocrysts. This is the main rock that forms the proposed quarrying area. The rock is typically fine grained, dense and hard. This is the most recent formation in the area. Trachytic flows underlie this formation.

##### 4.2.6.2 Trachytes

Trachyte is an aphanitic to porphyritic igneous volcanic rock. The mineral assemblage consists of essential alkali feldspar; relatively minor plagioclase and quartz or a feldspathoid such as nepheline may also be present. Different trachytic flows of different ages underlay the entire Longonot area. Trachytic flows are believed to be underlying the phonolitic trachytes on the proposed quarrying area. The trachyte are lighter than the phonolitic trachytes above and the colour vary from grey to dark grey in colour with white feldspar

phenocrysts. The rock is typically fine grained, dense and hard as shown in figure 2 of Annex A.

### **4.2.6.3 Pyroclastic Deposits**

These are clastic rocks composed of volcanic material and which may be a range of clast sizes, from the largest agglomerates, to very fine ashes and tuffs. These include volcanic ash and pumiceous deposits.

### **4.2.6.4 Volcanic Ash**

The volcanic ash is a grey to grayish white loose unconsolidated materials which result from explosive volcanic activity. It is composed of fragments of pulverized rock, minerals and volcanic glass. Volcanic ash can be seen strewn all over the study area obscuring the lava flows from the surface.

### **4.2.6.5 Pumiceous Deposits**

Pumice is a volcanic rock that consists of highly vesicular rough textured volcanic glass, which may or may not contain crystals. It is typically light colored. Scoria is another vesicular volcanic rock that differs from pumice in having larger vesicles and thicker vesicle walls and being dark colored and denser. In the study area, boulders of scoria/pumice are seen to overlie the trachytic deposits in the area behind the proposed quarrying site towards Mt. Longonot. The rock is light (less dense) and highly vesicular as shown in **figure 4 of Annex A**. The deposits are in form of boulders and can thus be easily excavated to expose the underlying trachytes.

## **4.2.7 Availability of rocks for Quarrying**

The geological study established that the entire proposed quarrying area is covered by trachytic flows of different ages. The phonolitic trachyte is buried below boulders of pumiceous deposits which can be easily excavated to expose the fresh compact trachyte. The older trachytic flows lay below the younger phonolitic trachyte.

The results show that there is substantive phonolitic trachyte and trachytes that can be mined for ballast and rock fills in the entire proposed quarry. Geophysical measurements have indicated that the trachytes extend to depths of approximately 60m bgl while the phonolitic trachyte has an estimated thickness of 10m. Further, geological mapping have established that the phonolitic trachyte and trachytes have suitable qualities for use as foundation and dimension rocks in building and road construction. Deeper flows may be weathered and fractures and may contain water in the joints and interstices.

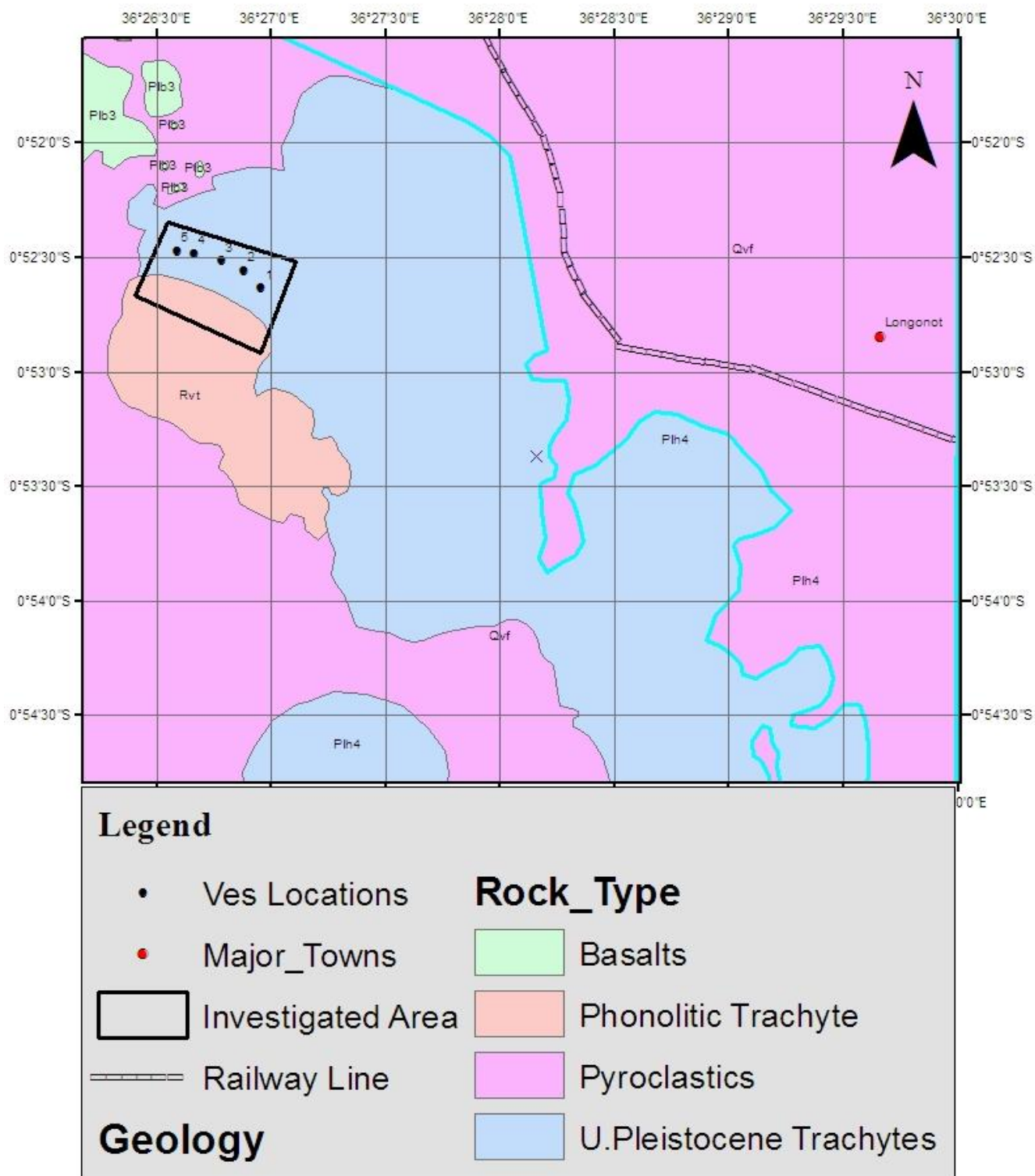
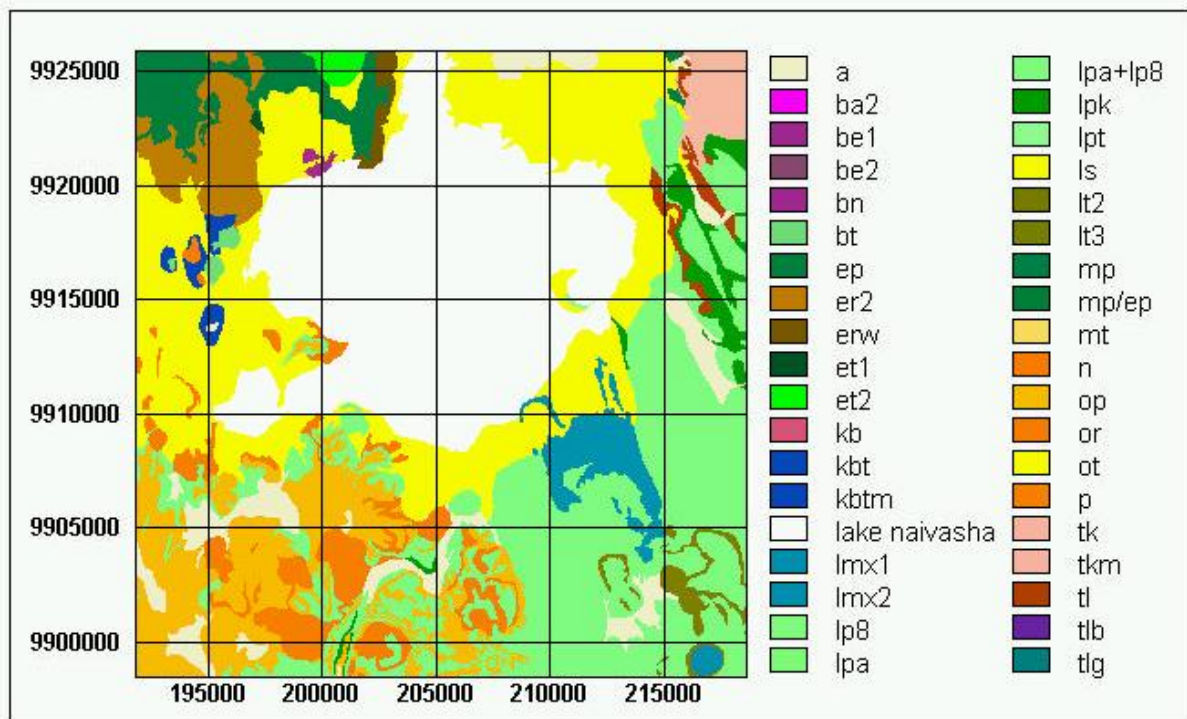


Figure 6: Geology of the proposed quarry project area

Figure 7: Geological map of the area (Clarke et. al., 1990)



### The Geological map legend

**A:** Alluvial deposits

**Kbt:** Surtseyan tuff cones

**Ls:** Lacustrine Sediments

**n:** Ndabibi comendite lava flows, domes and pyroclastic

**lpa:** Akira pumice

**op :** Olkaria comendite, pyroclastics

**p :** Pantellerite lava flows

**or :** Olkaria comendite, lava flows and domes

**lpk:** Kedong Valley tuff, Trachytic ignimbrites and associated fall deposits

**lp8:** Longonot ash

**lpa+lp8:** Akira pumice, Longonot Ash

**lmx1/lmx2:** upper (lmx2) and Lower (lmx1) longonot mixed basalt/trachyte lava flows, and pyroclastic cones

**lt2/lt3 :** Upper (lt3) and lower (lt2) Longonot trachyte, lava flows and pyroclastic cones

**lpt :** tuff cones

**Ba2** Akira basalt; basalt and hawallite lava flows and pyroclastic cones

**Be1/Bn** Older Elmentia (Be1) and Ndabibi (Bn) basalt and hawaiiite lava flows and pyroclastic cones

**Bt/Kbt/kbtm:** Surtseyan tuff cones (Kbt) with laterally equivalent fall tuffs (kbtm), and transitional

surtseyan/Strombolian ash cones (Bt)

**Er2:** Eastern Eburu pantellerite; lava flows and pyroclastic cones

**Et1/Et2;** Older (Et1) and Younger (Et2) Eburu trachyte; lava flows and pyroclastic cones

**Kb:** Kijabe Hill basalt

**Tlg:** Gilgil trachyte

**Mp:** Maiella pumice, trachyte and? pantellerite pumice and ash fall deposits

**Ot:** Olkaria trachyte; lava flows

**Tk/Tkm:** Kinangop tuff (Tk) eastern rift margin. Mau tuff (TKm) Western rift margin

**TI** Limuru trachyte

**Tlb** Karati and Ol Mogogo basalts

**Tlg** Gilgil trachyte

#### 4.2.8 Water resources

The most observable water body in the study area is the Lake Naivasha that is approximately 10 kilometres from the northern end of the proposed site. The lake as described elsewhere in this report is the second largest fresh water lake in Kenya after Lake Victoria the largest lake in Africa. Lake Naivasha is the source of water for Naivasha town and is the source for irrigation water used in all the flower farms close to the proposed site. The lake is fed by River Malewa and River Gilgil which originate from Nyandarua Mts on the eastern side of the escarpment. Use of the water from Lake Naivasha however, has been subject for a recent debate among the conservationists of the lake and the residents. The greatest threat however, is not the use of the water from the lake but the land use changes along the rivers catchment areas and vegetation clearance around the lake. Land use changes (particularly overgrazing) within the rift floor also contribute to excessive water loss leading to lower water levels in the lake.

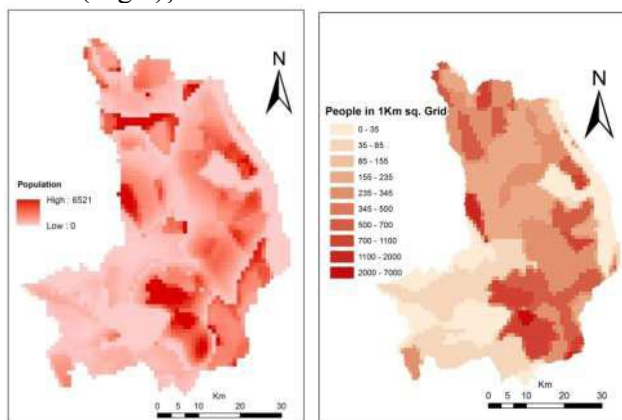
The proposed project will increase surface water bodies in the area by creating several dams and reservoirs from the surface runoff and maintain them to have water all the year round. This will change the micro climate of the area by having more wetlands in the area. To conserve the water the proposed development will create and maintain a substantial amount of riparian vegetation characterized and mapped in the master plan an arboretum earmarked to be established along a cliff separating the Naivasha Gardens and the Crater Park developments. The area marked for establishment of dams and lakes are already drainage areas that already retain water for several months. Dredging them to increase the depth will enable more water retention and thus hold water all the year round.

To supplement water supply from surface runoff, the proponent intends to drill four boreholes where one already exists. The existing one will be rehabilitated while 4 new ones will be drilled a fresh. The proponent also plans to tap water from available municipal supply in full consultations with Water resources management Authority (WARMA) and ministry of water development when need arises especially when all plots are developed. The borehole water will be pumped using solar energy.

#### 4.2.9 Demography and Population profile

The population of Naivasha in Kenya is 38366 according to the Geo Names geographical database.

*Figure 8: Population distribution in the L. Naivasha Basin. {Lake Naivasha's Watershed Population Density Surface (left) and Population Density Map using Areal Weighted Interpolation without WGR (Right)}*



#### 4.2.10 Archaeology of Naivasha Basin

In general there are no archaeological materials in the basin of Lake Naivasha. A detailed study examining the area between Mount Longonot in the east through Lake Naivasha Basin to

Mount Eburru in the west found no archaeological materials. Though many surface concentrations of worked obsidian were found, no discrete sites were located. Obsidian occurrences from several quarry sources within this general area are described including their geochemistry. Geochemical results suggest possibility of extreme interaction and assimilation with the crust in the 'secondary' volcanic feeder chambers. The associated rocks encountered, are limited to volcanic lava flows and pyroclastics of the central rift system. Faulting, a major structural feature in the area is described and later considered as a possible major contributor to the development and distribution of obsidian outcrops although some of the faults have been covered by late stage volcanic activity together with weathering.

## **4.2.11 Socio-Economic Environment**

### **4.2.11.1 Health**

Naivasha and the entire Nakuru county experiences the following main diseases: Malaria, respiratory tract infections, diarrhoea diseases, skin diseases and infections, and eye infections; Nakuru has a 22.8% malnourishment rate of children under 5 years of age, being ranked 21<sup>st</sup> of 42 of the nationally ranked counties.

Nakuru has 46 of 1000 of its live babies dying before the 1<sup>st</sup> birthday, being ranked 13<sup>th</sup> of 44 of the nationally ranked districts; It has a life expectancy of 57.4 years, being ranked 19<sup>th</sup> of 45 of the nationally ranked Districts.

### **4.2.11.2 Socio-Economic Profile**

According to the 1999 Population and Housing Census report, the population for the Naivasha division was 112,058, with population growth at 3.5 %. According to 2005 Household poverty survey, Naivasha division had 39,692 individuals (39%) living below the poverty line. The locations with the highest number of individuals living below the poverty line include Moindabi (45%), Longonot (43%) and Ndabibi (42%) with populations of 2,249 out of 4,974, 8,596 out of 19,955 and 1,467 out of 3,534 respectively. People are involved in smallscale mixed farming. Maize and beans are the main crops grown but for subsistence only as crop failure is very high due to low and erratic rainfall. Some households keep a few livestock (sheep, goats and cattle) that are occasionally liquidated to buy food and as a result they have accumulated very little assets.

Majority of these farmers live below the poverty line are trapped in the vicious cycle of poverty and environmental degradation. To make up for crops losses, the people are involved in commercial production of charcoal. Those living close to Lake Naivasha are involved in fishing for both subsistence and commercial purposes. However, due to unsustainable fishing methods and over fishing, the lake is usually closed to fishing for six months (June to November) every year since 2005 and only about 42 boats are then licensed to fish. The most significant activity but for large scale farmers, however, is the intensive irrigated greenhouse floriculture and horticulture - Kenya is currently the leading exporter of cut flowers and Naivasha supplies about 75% of these. Although the sector employs thousands of Kenyans and significantly contributes to the GDP, it also poses a threat to the lake's integrity due to pesticide and fertilizer use, removal of fringing swamps, and over-abstraction of water. Livestock ranching and private game sanctuaries and conservation areas exist in the division.

#### 4.2.12 Soils

Soils in the catchment area are generally developed from volcanic activity, and are of moderate to low fertility, deep clayish loam, greyish, brown to black in colour, often with drainage problems. The soils often degenerate into black cotton soils with impeded drainage in low-lying areas (Harper, 1990). The area in the lower portion of Malewa River has imperfectly drained silty, clay and sandy soils. The Eastern and Northern portion of the lakeshore has a combination of silty loam, sandy loam or clay loam that has developed in lacustrine deposits. The principles controlling the depth of the soil in the area are influenced by the complex relationship between the parent materials, climate, topography, vegetative cover, time and weathering process (Terborgh, 1974) The general conditions of the lakeshore soil series are predominantly alkaline, sodic and lacking organic matter. The high ration of sandy soil and high rate of land degradation through human interferences makes the soil susceptible to surface erosion by water and wind. Slopes around the mountains and major escarpments are generally steep and pose a serious erosion hazard.

Figure 9: Soils around the study site

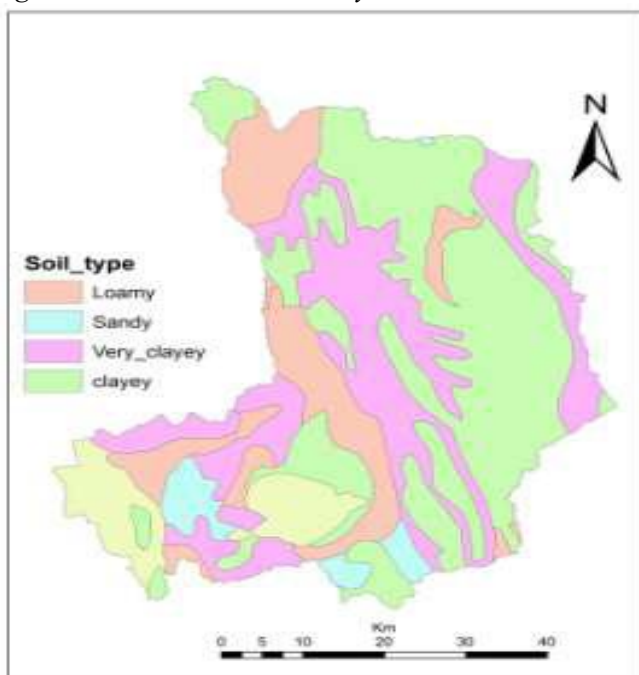
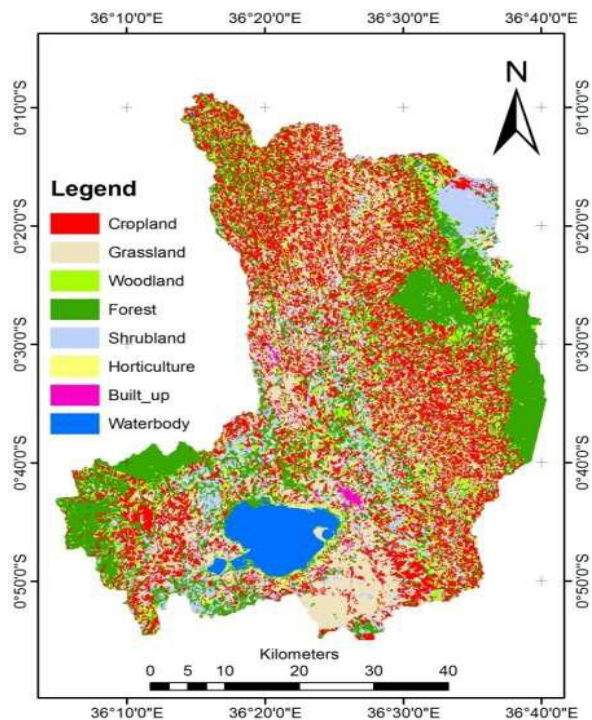


Figure 10: Lake Naivasha's Watershed Land cover/Land Use Map, 2010



#### 4.2.13 Infrastructure

The area is served by an all-weather road running from Nairobi to Naivasha and beyond. The Nairobi Kampala railway line also serves the area running along the eastern border of the proposed site. The old Naivasha road passes on 5 kilometres from the proposed site from which a motorable road serving the Longonot National Park ends about a kilometre to the Proposed Gate B of the development. The proposed development will extend this road from the gate of the park to the entrance of the proposed development. A railway station is planned to be developed at the proposed site to serve the residents of the area and the general public.

On the northern side of the proposed site an all-weather road runs from Naivasha town round Lake Naivasha serving towns and the flower farms around the lake. This road will link to Gate A (the main gate) of the proposed development. The distance between this all-weather road and the proposed Gate A is only 5 kilometres and serves several other properties currently used as cattle ranches and cultivation. This road linking the Naivasha south Lake road is a government classified road and will be maintained by the government accordingly.

#### 4.2.14 Structures in the site area

Currently the site is bare, covered with only sparse vegetation and bare ground. The neighbourhood on two sides are also bare but the two others are bordered by individually owned plots. On the eastern side, the site is bordered by a railway line beyond which small scale agricultural producers exist in sparsely populated settlements.



## **5 RELEVANT LEGISLATIVE AND REGULATORY FRAMEWORK**

---

### **5.1 Mining policy and Environmental legislation**

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

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

#### **5.1.1 The Mining and Minerals Act, Cap 306**

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

#### **5.1.2 Environmental Policy Framework**

Environmental Impact Assessment (EIA) critically examines the effects of a project on the environment. An EIA identifies both negative and positive impacts of any development activity or project, how it affects people, their property and the environment. EIA also identifies measures to mitigate the negative impacts, while maximizing on the positive ones. EIA is basically a preventive process. It seeks to minimize adverse impacts on the environment and reduces risks. If a proper EIA is carried out, then the safety of the environment can be properly managed at all stages of a project-planning, design, construction, operation, monitoring and evaluation as well as decommissioning. The assessment is required at all stages of project development with a view to ensuring environmentally sustainable development for both existing and proposed public and private sector development ventures. The National EIA regulations were issued in accordance with the provisions of Environmental Management and Coordination Act (EMCA) of 1999. The

EIA Regulations must be administered, taking into cognizance provisions of EMCA 1999 and other relevant national laws.

### **5.1.3 Institutional Framework**

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

#### **5.1.3.1 National Environment Management Authority (NEMA)**

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

#### **5.1.3.2 National Environment Council (NEC)**

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

#### **5.1.3.2 National Shelter Strategy to the Year 2000**

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

#### **5.1.3.3 The National Poverty Eradication Plan (NPEP)**

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

### **5.1.4 Environmental Legal Framework**

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

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

#### **5.1.5 Public Health Act (Cap. 242)**

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

#### **5.1.6 Local Authority Act (Cap. 265)**

Section 160 helps Local Authorities ensure effective utilization of the sewages systems. Section 170, allows the right to access to private property at all times by Local Authorities, its officers and servants for purposes of inspection, maintenance and alteration or repairs of sewers. The Act under section 176 gives powers to Local Authority to regulate sewage and drainage, fix charges for use of sewers and drains and require connecting premises to meet the related costs. According to section 174, any charges so collected shall be deemed to be charges for sanitary services and will be recoverable from the premise owner connected to the facility. Section 264 also requires that all charges due for sewage sanitary and refuse removal shall be recovered jointly and severally from the owner and occupier of the premises in respect of which the services were rendered. This in part allows for application of the “polluter-pays-principle”.

#### **5.1.7 Physical Planning Act, 1999**

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

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

#### **5.1.8 Electricity Power Act No. 11 of 1997**

The Electric Power Act No. 11 enacted in 1997 deals with generation, transmission, distribution, supply and use of electrical energy as well as the legal basis for establishing the

systems associated with these purposes. In this respect, the following environmental issues will be considered before approval is granted:

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

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

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

### **5.1.9 Penal Code Act (Cap.63)**

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

### **5.1.10 Way leaves Act Cap 292**

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

### **5.1.11 The Land Registration Act, 2012**

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

- (a) Registration of interests in all public land as declared by Article 62 of the Constitution;
- (b) Registration of interests in all private land as declared by Article 64 of the

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

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

#### **5.1.12 The Environment and Land Court Act, 2011**

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

#### **5.1.13 The National Land Commission Act, 2012 (No. 5 of 2012)**

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

- (a) to manage public land on behalf of the national and county governments;
- (b) to recommend a national land policy to the national government;
- (c) to advise the national government on a comprehensive programme for the registration of title in land throughout Kenya;
- (d) to conduct research related to land and the use of natural resources, and make recommendations to appropriate authorities;
- (e) to initiate investigations, on its own initiative or on a complaint, into present or historical land injustices, and recommend appropriate redress;
- (f) to encourage the application of traditional dispute resolution mechanisms in land conflicts;
- (g) to assess tax on land and premiums on immovable property in any area designated by law; and
- (h) to monitor and have oversight responsibilities over land use planning throughout the country.

#### **5.1.14 The Land Act, 2012**

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

#### **5.1.15 The Environment Management and Coordination Act (1999)**

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

Though there are other sectoral laws on environmental conservation, this is the supreme Act. It provides guidelines on issues of environment, stipulates offences and penalties and establishes NEMA. The second schedule of the Act lists the type of projects, which must be subjected to the EIA. The proponent appointed experts to conduct the EIA project report to seek approval before implementation as required by NEMA.

#### **5.1.16 The Environment (Impact Assessment And Audit) Regulations, 2003**

In exercise of section 147 of the EMCA, the Minister made these regulations which have provided the framework for carrying out EIAs and EAs in Kenya. This EIA project report is conducted in conformity with these regulations and EMCA, 1999.

#### **5.1.17 The Environmental Management and Co-ordination (Water Quality) Regulations, 2006**

These regulations set the standards of domestic water and waste-water. The regulations are meant for pollution control and prevention and provides for protection of water sources. *The proposed project has no chance of significantly affecting the water quality as there is no water source near the project and the water used in the project is sourced from the campsite borehole.*

#### **5.1.18 Environmental Management and Co-ordination (Waste Management) Regulations 2006**

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

#### **5.1.19 The Explosives Act (Cap 115)**

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

makes it an offence liable for penalties to any person causing an explosion where life or property is endangered.

#### **5.1.20 Public Health Act – (Revised 1986)**

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

#### **5.1.21 Water Act, 2002**

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

#### **5.1.22 The Traffic Act**

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

#### **5.1.23 The Workman's Compensation Act, Cap 236**

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

## **6 PUBLIC PARTICIPATION AND CONSULTATION**

---

### **6.1 Introduction**

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

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

In addition, the process enabled,

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

## **6.2 Methodology used in Public consultation**

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

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

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

## **4.3 Sources of information**

The exercise of public consultation was conducted on 14<sup>th</sup> November 2015. The exercise was conducted via interviews under the guidance of questionnaires developed to capture the concerns, comments and issues that the stakeholders, neighbours and business people around the project site have regarding the proposed project. The completion of such questionnaires allowed for the synthesis and analysis of issues that arose. The list of participants who were interviewed is shown in the Table below and the questionnaires administered are attached at the appendix of the report.



Table 3 : Name of public participants

Name	Village	Phone Number
Daniel Gichuru	Suswa	0712290855
David Kanugu	Mirera	0722394933
William Ngathi	Longonot	0731126454
Anthony Kamwana	Rubiri	0710879957
James Mutuma	Longonot	0720654494
Anne Gakii	Longonot	0708100395
Daniel Njuguna	Longonot	0722 388 610



**Plate 3: Public participation meeting attendants**



## **Plate 4: Participants of public participation meeting**

### **4.4 Issues Raised by the Respondents**

#### **4.4.1 Positive Issues**

##### **4.4.1.1 Employment**

The residents expressed optimism that the project will create employment opportunities to the residents, especially the unemployed youth. They urged the proponent to consider locals while hiring employees.

##### **4.4.1.2 Boost to Businesses**

The residents were of the view that such a project will bring more people into the area who will buy from their shops and stalls. This will increase their sales and boost their businesses. More business opportunities will also arise as a result of the project such as food kiosks and other retail businesses.

##### **4.4.1.3 Improvement of roads**

The residents were optimistic that once the project kicks off, the roads will be opened up and improved by the proponent thus making the area more accessible. It will also make transport within the area easier.

##### **4.4.1.4 Availability of building materials**

Residents argued that the project will avail building materials to the residents and ease transport cost usually incurred by residents hauling building materials from far off places.

##### **4.4.1.5 Water Availability**

Residents were optimistic that the borehole that will be constructed by the proponent for use in the project will produce enough water that would be drawn by residents for domestic purposes. They urged the proponent to consider allowing residents to use the water as part of Corporate Social responsibility.

##### **4.4.1.6 Increase in the price of land**

Land owners were happy that the project will invite more people to buy land in the area thereby making the price of land to go up. This will lead to increased income from the sale of land.

##### **4.4.1.7 Revenue to the government**

Residents were optimistic that the project will be a great source of revenue to both national and County governments since taxes will be paid by both the proponent and the workers and business people who will come as a result of the project.

#### **4.4.1.8 Increased development**

The participants were happy that the project will open up the area to other developments. These would include residential developments and shopping centres. This would open up the area for growth.

#### **4.4.1.9 Improved Security**

Residents were of the view that the project will improve security in the area. This is due to increased number of people who will reside in the area making it less insecure as before.

### **4.4.2 Negative Issues Raised**

#### **4.4.2.1 Insecurity**

The project will result to migration of people from the neighboring towns in search for employment. This influx of people will increase incidences of crime making the area to be insecure. They appealed to the proponent to make proper security arrangements to ensure criminal activities do not occur.

#### **4.4.2.2 Noise**

Residents expressed concern about the possibility of Increase in the level of noise in the area from blasting of rocks, vehicles transporting materials in and out of the site and various machineries that will be used in the site. They appealed to the proponent to consider operating during the day when residents are at work to avoid interference during the night.

#### **4.4.2.3 Air Pollution/ Dust**

Residents intimated that there will be an increase in air pollution from the transporting vehicles moving from the site and back to site. During blasting, lots of dust will be released into the air exposing to the neighboring communities to diseases such as asthma, bronchitis, flue, frequent coughs etc. They appealed to the proponent to ensure water is sprinkled regularly within the site to reduce high incidences of dust emission. Vehicles transporting materials from the site should be covered properly to avoid dust resulting from wind-blown materials.

#### **4.4.2.4 Reduced Privacy**

The residents expressed concern that the anticipated increase in the number of people in the area as a result of the project will interfere with the silence and privacy that they have been enjoying. They appealed to the proponent to educate the workers so that they do not interfere with the privacy of the residents.

#### **4.4.2.5 Destruction of Roads**

The residents expressed fear that the proposed project will lead to influx of lorries in the area that will be used to load building materials for use in other areas. This will lead to destruction of roads. They appealed to the proponent to continuously upgrade the road leading to the proposed site so that it can be used easily by the residents.

#### **4.4.2.6 Cultural Erosion**

Residents argued that the influx of people from different places into the site will lead to cultural erosion and further fuel moral decadence. They appealed to the proponent to come up with a program to educate workers on the value of respect for community beliefs and to avoid social ills such as immorality.

## **7 POTENTIAL ENVIRONMENTAL IMPACTS**

---

### **7.1 INTRODUCTION**

The environmental baseline information and the project characteristics discussed earlier, form the basis for impact identification and evaluation. The impacts that are expected to arise from the project could either be termed as positive, negative, direct, indirect, short-term, long-term, temporary, and permanent depending on their area of cover and their stay in the environment. This assessment is done for all the project phase namely; operational and decommissioning phases.

### **7.2 OPERATIONAL PHASE**

#### **7.2.1 Positive Impacts**

##### **7.2.1.1 Job Opportunities**

During the operational phase, there will be job opportunities especially to casual workers. Several workers including casual labourers, truck and digging machines drivers are expected to work on the site for a period that the project will start to the end. Apart from casual labour, semi-skilled and unskilled labour and formal employees are also expected to obtain gainful employment during the period of operation. The proposed project will provide direct and indirect job opportunities to many local people thus reducing the unemployment and in the process provide livelihood.

##### **7.2.1.2 Gains in the Local and National Economy**

The proposed project will improve income/economic status of people within the project neighbourhood. There will be gains in the local and national economy. Through consumption of locally available materials including: rocks and boulders. The consumption of these materials, fuel oil and others will attract taxes including VAT which will be payable to the government. The cost of the materials will be payable directly to the producers.

##### **7.2.1.3 Provision of Market for food vendors**

The project will require supply of food most of which will be sourced locally in within Longonot and the surrounding areas. This provides ready market for food suppliers such as food courts and food vendors.

##### **7.2.1.4 Increased business within the surrounding**

The operations crew will buy various commodities from the neighbouring business premises. This would boost to some extent the businesses of the concerned people and hence of their families.

#### **7.2.1.5 Optimal use of Land**

Since the parcel of the land is close to the Longonot gated community project site, extracting materials in another location will be deemed expensive and time consuming therefore use of the existing land in Longonot area is economical and this will optimise use of land.

#### **7.2.1.6 Provisions of gated community construction material**

The main purpose of the proposed project is to provide stones and gravel for the construction of Longonot gated community project, and the surplus will be sold.

#### **7.2.1.7 Utilization of the land**

The proposed quarry and crusher site is currently under-utilized. Excavating the area to get construction materials will make this land economical since there is an access road provided to the area for transporting the excavated materials and with the provision of employment there is an exchange of money.

#### **7.2.1.8 Promotion of development**

The material to be extracted is to be used in the construction of the Longonot gated community project. Infrastructure projects are a key indicator of development as it provides access to human habitat and also business premises. It is a contributor to the G.D.P as it creates several employment opportunities, both direct and indirectly hence a booster of the Kenyan economy.

#### **7.2.1.9 Increase government revenue**

The proposed quarry and crusher site will generate taxable income to the government and other charges will be payable to the Nakuru County.

#### **7.2.1.10 Increase in population**

There will be an increase in population size and settlement around the area and the town itself due to the various people coming from different towns seeking employment and possible investors who will be using the quarry to get building materials.

### **7.2.2 Negative Impacts**

#### **7.2.2.1 Impact on the Natural/Physical environment**

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

#### **7.2.2.2 Soil Compaction**

Moving machinery will compact the soils as construction operations take place. Compaction has the undesired effect of hindering air and water penetration beneath the soil surface limiting aerobic activities of the organisms in the process. This may have negative consequences in soil productivity though at a localized scale. Compaction will also enhance run-off during the rainy season.

#### **7.2.2.3 Soil erosion**

Site preparation, opening up of service minor roads as well as laying down of service lines will entail vegetation clearance. The exposed grounds will be prone to water and wind erosion. This will greatly contribute towards land degradation. Restricting traffic to designated areas and minimizing.

#### **7.2.2.4 Impact on flora and fauna**

All vegetation on the area where quarrying will be done will be cleared. This clearance will spill over to other areas to pave way for the establishment of the various structures and service lines such as power lines, water lines and feeder roads that will traverse areas outside the project site. Cutting down/clearing of vegetation is known to have adverse effects on the environment such as reduction of biodiversity, reduction of aesthetic beauty, exposure of soil to surface run-off, reduction of shade and increment in dust pollution among others. However, the quarry area is small hence can be easily rehabilitated after decommissioning of the project. On sites for service lines such as water, electricity etc, and the contractor will avoid unwarranted destruction of vegetation by strictly restricting clearance on key areas. The contractor will also need to restrict traffic on the designated area as per the site plan to reduce unwarranted vegetation clearance or trampling.

#### **7.2.2.5 Reduction of grazing and farmlands**

The proposed site is predominantly agro pastoral characterized by livestock grazing and rain-fed agriculture. Crops on farmlands leased for the quarry will be destroyed. Clearance of vegetation will reduce livestock feed. This will impact negatively on agro pastoral activities in the project area. However, the impact will be minimal (value of 1) since the area for the quarry is small and the owners of the affected farmlands (if any) will be compensated.

#### **7.2.2.6 Impact on Air Quality / Dust and Exhaust Emissions**

Earth moving activities would lead to the release of dust and smoke from the moving vehicles. A lot of dust will emanate from the site as the ground is opened and large volumes of soil excavated. Movement of the loading trucks and excavating machines will also

contribute to release of a lot of dust into the surrounding area. Exhaust emissions are likely to be generated by the construction equipment during the construction phase. Motor vehicles used to mobilize the work force and materials for construction would cause a potentially significant air quality impact by emitting pollutants through exhaust emissions. Because large quantities of building materials are required, such emissions can be enormous and may affect a wider geographical area. The impacts of such emissions can be greater in areas where the materials are sourced and at the construction site as a result of frequent gunning of vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas. This will needless to say contribute to air pollution. The use of poorly maintained vehicles and digging machines will exaggerate the air quality degradation problem.

#### **7.2.2.7 Noise Generation**

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

Further, the noise will disturb livestock, wildlife and the bee colony within the project site. Excessive noises are known to cause abortions among livestock and wild game. In bees, excessive noises are known to cause complete consumption of honey by the colony or migration of the bees. Such noise emissions should be minimized as much as possible from the source point while workers should be provided with appropriate personal protective wear wherever necessary.

#### **7.2.2.8 Storm water**

There is a likelihood of interference of the mining operation from storm water runoff either from the site or from the neighbouring compounds.

#### **7.2.2.9 Disposal of Excavated rejected/ unusable materials**

Extensive excavation is likely to take place at the project site; the excavation works to mine the required rocks will result in the generation large amounts of excavated material. Most of the excavated soil will be utilized on site to adjust levels and fill the land openings after project completion.

#### **7.2.2.10 Increased Water Demand**

Both the workers and the construction works will create additional demand for water in addition to the existing demand. Water will be mostly used in dust reduction by sprinkling on the roads used by trucks and for cleaning and drinking purposes.



Both the workers and the construction works will create additional demand for water in addition to the existing demand within the project site. This impact will, however, be minimal since the contractor has already earmarked a site for a borehole.

#### **7.2.2.11 Water Pollution**

If the unused excavated materials from the site are not well taken care of, they may cause contamination to the nearby streams flowing near the site. The proponent will put in place an efficient waste management scheme that will prevent the accumulation of uncontrolled waste, as well as an efficient collection system and off-site disposal.

#### **7.2.2.12 Disease vector harbour**

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

#### **7.2.2.13 Disruption of wildlife habitat**

The rocky terrain and acacia dominated proposed site houses a number of wildlife such as squirrels, snakes, frogs, lizards, geckos, rabbits, birds among others. As construction phase starts, the wildlife will be interfered with. Some of these animals will be killed in the process while others will migrate to the neighbourhood. This migration will put pressure on niches that will acts as sinks for the migrants. However, the magnitude of this is within acceptable level because the quarry site is small.

#### **7.2.2.14 Increased energy use**

The project will consume fossil fuels (mainly diesel) to run vehicles and other machineries. Fossil fuel is non-renewable and its excessive use has environmental implications on its availability, price and sustainability. The quarrying will make use of heavy diesel-powered machineries. This will result to excessive consumption of diesel in the locality. Use of diesel to run generators in case of hydroelectricity power failure will also arise. This impact will be moderate.

#### **7.2.2.15 Earth tremors**

The various machinery being used at the site and the transportation trucks being used will lead to an increase in the earth tremors. In turn, earth tremors lead to miscarriages from both women and animals due to shock and others get heart attacks. Wild animals will also migrate from the area around from fear of the tremors.

## **7.2.3 Impacts Related to Occupational Health and Safety**

### **7.2.3.1 Dust**

Large quantities present in the air may result in respiratory hazard. It may also cause visual intrusion hence presenting accident risks. Dust may also affect the eyes.

### **7.2.3.2 Noise pollution and vibrations**

The operation works will most likely be a noisy operation due to the machinery activities, explosion of large boulders and rocks, communicating workers and incoming vehicles to deliver materials and workers to site. The noise generated during the construction stage is at best described as part of a normal occupational hazard that workers in the construction industry face. However, noise levels in excavation works are usually below the threshold limit that workers can be exposed in an 8 hour working day and is consequently not of any major concern.

### **7.2.3.3 Public Health and safety**

During operation the movement of rocks dug out may result in accidents if good supervision is not provided. Accidental cuts and bruises are common among workers as a result of use of machinery, equipments and rocks bruising or injuring the site workers, an impact that need consideration.

### **7.2.3.4 Noise, Fly rock, Air pressure and ground Vibration**

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

Extensive quarrying operation has the potential to send some rocks flying precariously within and even out of the proposed site and this is likely to cause death, accidents and damage to property. Fly-rocks are produced when there is too much explosive energy, stemming is inadequate, or the explosive energy is too rapidly vented through a zone of weakness. In a hard rock quarry, it is necessary not only to loosen the rock but to fragment and move it away from the face of the quarry to produce a muck pile. Overpressure may vibrate buildings but damage would seem to be rare.

### **7.2.3.5 Risks of Accidents and Injuries to Workers**

Workers might be hurt by construction materials or equipment during construction phase of the proposed project. It is also expected that construction workers are likely to encounter occupational health hazards as a result of coming into contact with and handling hazardous waste. Because of the various construction activities including rock and metal grinding and cutting, concrete work, steel erection and welding, among others, construction workers will

be exposed to risks of accidents and injuries. Such injuries can result from accidental falls from high elevations; injuries from hand tools and construction equipment; cuts from sharp edges of rocks, metal sheets and collapse of rocks among others. This impact will however be minimal.

#### **7.2.3.6 Solid waste generation**

Some amounts of solid waste will be generated during construction of the project. These will include metal cuttings, rejected wood, rejected materials, surplus materials, surplus soil, excavated materials, paper bags, empty cartons among others. Solid wastes if not well managed have a potential of causing disease outbreaks due to the fact that their presence provides suitable breeding conditions for vectors of certain diseases such as malaria, cholera and typhoid. Outbreak of diseases such as Malaria could also be exacerbated by the presence of open water ditches for breeding of anopheles mosquitoes. The major vulnerable groups are children who could be exposed to these conditions. The workers on site will also generate faecal waste during their day-to-day operations. The generated waste needs proper handling to prevent diseases, such as cholera, typhoid and diarrhoea outbreak. Unless this is addressed, it can prove to be an environmental/health hazard. However, in view of precautionary measures to be undertaken, this impact will be minimal.

#### **7.2.3.7 Cross-cutting problems**

Interaction of people from different places leads to increase in various social problems. HIV/AIDS is one of the common problems that will be encountered during the implementation of the project and these will lead to taking longer than the expected time. There will be an increase in the unwanted pregnancies around the area, hence, increase in population in these area. A problem with congestion will also be encountered due the increase number of people streaming in from various towns looking for employment and investment.

### **7.3 DECOMMISSIONING PHASE**

#### **7.3.1 Positive Impacts**

### **7.3.1.1 Rehabilitation**

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

### **7.3.1.2 Employment Opportunities**

Several employment opportunities will be created for the restoration staff.

## **3.2.5 Negative Impacts**

### **3.2.5.1 Dust**

Large quantities of dust will be generated during restoration and rehabilitation works. This will affect staff as well as the neighbouring residents.

### **7.3.2.2 Noise and Vibration**

The land fill works will lead to significant deterioration of the environment within the project site and the surrounding areas through noise and vibrations.

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

## **8.1 Mitigation of Construction and Operational Related Impacts**

### **8.1.1 Air quality**

Controlling dust during operation is useful in minimizing nuisance conditions. It is recommended that a standard set of feasible dust control measures be implemented for all operation activities. Emissions of other contaminants (NO<sub>x</sub>, CO<sub>2</sub>, SO<sub>x</sub>, and diesel related PM<sub>B10B</sub>) that would occur in the exhaust from heavy equipment are also included. The proponent is committed to implementing measures that shall reduce air quality impacts associated with earthworks. All personnel working on the project will be trained prior to starting operation on methods for minimizing air quality impacts during operation. This means that workers will be trained regarding the minimization of emissions during operation. Specific training will be focused on minimizing dust and exhaust gas emissions from heavy earth moving equipment. Truck drivers will be under strict instructions to minimize unnecessary trips, refill petrol fuel tanks in the afternoon, and minimize idling of engines.

Dust emissions will be controlled by the following measures:

- Watering all active operation areas as and when necessary to lay dust.
- Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.
- Fast growing trees will be planted around the project area to act as a wind breaks to reduce the uplift of particulate matter that lead to respiratory diseases.

### **8.1.2 Minimize the effects of noise and vibrations emitted from the site**

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

- Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
- Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels.

- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

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

- Install portable barriers to shield compressors and other small stationary equipment where necessary.
- Use quiet equipment (i.e. equipment designed with noise control elements).
- Co-ordinate with relevant agencies regarding all substantial operation activities in nearby residential areas.
- Install sound barriers for pile driving activity.
- Limit pickup trucks and other small equipment to a minimum idling time and observe a common-sense approach to vehicle use, and encourage workers to shut off vehicle engines whenever possible.
- Excavation works should be done during the day when people are away and also the outside environment is also noisy.
- Adhere to the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009 regarding noise limits at the workplace.
- Adhere to times stipulated for blasting and settle disputes as stipulated in lease agreements and statutory requirements.

### **8.1.3 Minimise the effects of exhaust emission**

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

- Vehicle idling time shall be minimized.
- Alternatively fuelled construction equipment shall be used where feasible.
- Equipment shall be properly tuned and maintained.

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

### **8.1.4 Hydrology and water quality degradation**

Several measures shall be put in place to mitigate the impacts that are likely to lead to hydrology and water quality degradation. The proponent will prepare a hazardous substance control and emergency response plan that will include preparations for quick and safe clean-up of accidental spills. It will prescribe hazardous-materials handling procedures to reduce the potential for a spill during operation, and will include an emergency response programme to ensure quick and safe clean-up of accidental spills.

The plan will identify areas where refuelling and vehicle maintenance activities, storage of hazardous materials if any and excavated soil, will be permitted.

### **8.1.5 Noise, Fly rock, Air overpressure and ground Vibration**

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

A siren will be installed on the site for the purpose of sounding a warning to the residents and neighbours before blasting. The will be a public awareness creation before to inform the them that the siren is an indicator for blasting and the time it will take between the siren sound and the noise of blasting.

#### ***8.1.5.1 Mitigation***

- The operating hours should be limited to daytime i.e. between 8.00 am to 5.00 pm.
- Screening using baffle moulds material such as already excavated materials i.e. soils and other solid wastes. These should be located on the site boundary to reduce noise for noise-sensitive properties.
- Ear protection is necessary during operations using earmuffs.
- The proponent should conduct awareness and training to the staff on the risks of noisy environment
- Fly rock should be avoided altogether outside the site.
- If the assessment of the danger zone suggests it may extend beyond the site boundary, then a controlled space should be created, where people/animals are either excluded or protected, and not endangered by the blast and the subsequent fly rock.
- Supervision of the site by a person with knowledge of dangerous blasting activities, process design, controlled drilling and careful observation of borrow pit faces, and adherence to accepted blasting practices.
- Appropriate blasting design by ensuring the setting-out and drilling of blasts is as accurate as possible and the drilled holes should be surveyed for deviation along their lengths
- Correct stemming will help control overpressure and fly rock and will also aid the control of ground vibration.
- Monitoring of blasting and re-optimizing the blasting design in the light of results, changing conditions and experience should be carried out as standard.
- Avoid blasting in adverse weather conditions i.e. during significant temperature inversions; moderate to strong winds towards sensitive areas; foggy, hazy or smoky conditions with little or no wind; a still cloudy days with a low cloud ceiling; periods

when the surface temperature is falling in the middle of the day; periods when strong winds accompany the passage of a cold front; and before mid-morning or after sunset on clear calm days.

- Avoid any blasting during the night.

### **8.1.6 Solid waste**

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

#### ***8.1.6.1 Mitigation***

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

### **8.1.7 Habitat and vegetation disturbance/loss**

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

#### ***8.1.7.1 Mitigation***

- Introduce vegetation in already mined areas.
- Quality vegetation should be provided through close monitoring to try and restore or even improve physical and biological environmental attributes.
- Trees should be planted along the site boundaries and cared for and at the same time, trees will also serve as barriers to dust transmission.



### **8.1.8 Handling Hazardous Wastes**

Adequate collection and storage of waste on site and safe transportation to the disposal sites and disposal methods at designated area shall be provided. In addition the proponent is committed to adherence to the occupational health and safety rules and regulations stipulated in Occupational Health and Safety Act, 2007. In this regard, the proponent is committed to provision of appropriate Personal Protective Equipment, as well as ensuring a safe and healthy environment for construction workers as outlined in the EMP.

### **8.1.9 Increased runoff**

Increased runoff from de-vegetated grounds and opened pits and trenches causing extreme flooding and overflows of drainage systems shall be mitigated. Surface runoff shall be harvested and stored for reuse. A storm water management plan that minimizes impervious area infiltration by use of recharge areas and use of detention and/or retention with graduated outlet control structures will be designed.

### **8.1.10 Possible exposure of workers to hazards**

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

#### ***8.1.10.1 Mitigation***

- Training staff and workers on the nature of the environment they are working in and ensure there is an awareness programme concerning the effect of dust, noise and other gaseous emissions to human health.
- The operators should be provided with full safety gear and trained on occupational health and safety.
- A record of incidences and accidents should be kept on any occurrence in the site and the company should develop an effective emergency response plan and enlighten the staff on safety measures and procedures through training and strict adherence to provisions of the Occupational Health and Safety Act of 2007.

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

### **8.1.11 Worker accidents during operation and decommissioning**

Workers accidents especially in deep pits operation and loading and offloading points shall be mitigated by enforcing adherence to safety procedures and preparing contingency plan for accident response in addition safety education and training shall be emphasized.

### **8.1.12 Reduction of impacts at extraction sites and efficient use of raw materials**

To reduce the negative impacts on availability and sustainability of the materials, the proponent will only extract what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted in excessive quantities. Moreover, the proponent will ensure that wastage, damage or loss of materials at the operation site is kept minimal, as these would lead to additional demand for and extraction of materials.

In addition to the above measures, the proponent shall consider reuse of building materials and use of recycled building materials. This will lead to reduction in the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites

### **8.1.13 Minimization of vegetation disturbance**

Clearance of part of the vegetation and disturbance of the natural ecosystem at the project site to pave way for excavation of rocks will be inevitable. However, the proponent will ensure proper demarcation of the project area to be affected by the blasting works. This will be aimed at ensuring that any disturbance to flora and fauna is restricted to the actual project area and avoid spill over effects on the neighbouring areas. In the same vein, there will be strict control of operation vehicles to ensure that they operate only within the area to be disturbed by access routes and other works.

In addition, the proponent has committed itself to re-vegetation of some of the disturbed areas through implementation of a well-designed landscaping programme. It is recommended that part of the topsoil excavated from the pit site be re-spread in areas to be landscaped to enhance plant health.

### **8.1.14 Minimization of run-off and soil erosion**

The proponent will put in place some measures aimed at minimizing soil erosion and associated sediment release from the project site during operation. These measures will include terracing and levelling the project site to reduce run-off velocity and increase infiltration of rainwater into the soil. In addition, operational vehicles will be restricted to designated areas to avoid soil compaction within the project site, while any compacted areas will be ripped to reduce run-off.

### **8.1.15 Reduction of energy consumption**

The proponent shall ensure proper planning of materials transportation. This will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the proponent shall monitor energy use during operation and set targets for reduction of energy use.

### **8.1.16 Minimization of water use**

The proponent shall ensure that water is used efficiently at the site by sensitizing operations staff to avoid irresponsible water use.

### **8.1.17 Controlling oil spills during operation**

The proponent will control the dangers of oil, grease and fuel spills during operation by maintaining the machinery in specific areas designed for this purpose. Machinery site repair will be discouraged and repair work restricted to the proponent's approved garages to avoid pollution from oil, grease and fuel.

## **8.2 Public Health Safety and Awareness**

- i. The contractor should provide a small section of the construction site with a shed and a water stand where the food can be served to the construction workers to promote hygiene and health of the employees.
- ii. A fully equipped first aid kit should be provided at the site.
- iii. The contractor must have workmen's compensation cover as required by law (The Workmen's Compensation Act), as well as relevant ordinances, regulation and union's agreements.
- iv. Appropriate sanitation conveniences should be provided at the site as required in the OSHA, 2007 and echoed in the Public Health Act.

### **8.2.1 Proper stakeholder consultation and public education**

The proponent will ensure proper public education and stakeholder consultation through giving out notices, involving the local administration and using loudspeakers to pass information.

### **8.2.2 Mitigation of cross-cutting problem**

The proponent will avail or identify a nearby Voluntary Counselling and Testing clinic for all workers at the site. Condom dispenser will be placed at strategic points within the site to help reduce HIV/AIDS cases and unwanted pregnancies. A policy against sexual activities at the site is also recommended.

### **8.2.3 Mitigation of Decommissioning Phase Impacts**

#### **8.2.4 Efficient solid waste management**

Solid waste resulting from excavation works will be managed as described in **Section 8.1.6 above**.

#### **8.2.5 Reduction of Dust Concentration**

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

#### **8.2.6 Minimization of Noise and Vibration**

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

### **9.1 The Proposed Alternative**

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

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

### **9.2 Relocation alternative**

Relocation option to a different site is an option for the project implementation. At the moment, the proponent has no alternative sites for relocation. Looking for the land to accommodate the scale, type and size of the project and completing official transaction on it may take a long period. Besides, there is no guarantee that such land with suitable rock deposits would be available.

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

### **9.3 The No Action Alternative**

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

This option will however, involve several losses to the project proponent and other stakeholders such as the local community and Government. The landowner will continue to pay high taxes on unutilized land.

On the other hand, the operations is expected to create employment opportunities therefore contributing positively to the national economy .The No Project Option is the

least preferred option and it becomes apparent that the No Project Alternative is not the appropriate alternative.

#### **9.4 Alternative Design and Technology**

The proponent has an option of using manual extraction of rocks or mechanized removal. Manual operations would involve employing so many people to produce the required amount of stones. In addition, stone produced would not exactly match the quality. Therefore manual works may not be suitable for the proposed project site.

Mechanized and chemical means by use of explosive materials produces large quantities of high quality stones. It is best suited where large quantities of rock are needed and the pit is located relatively far from the residential areas as is the case in the proposed project site. The Proponent having evaluated the available technologies has settled for mechanized and chemical means of extraction.

#### **9.5 Comparison of alternatives**

Under the Relocation alternative, the proponent would have to look for another site and either buy or lease. The amount of money paid to lease would have to be lost among other direct and indirect loss. Beside such a land with suitable rock deposit may not be found. This may discourage investors and may lead to a No action alternative. Under the No Action Alternative, there would be no activities at all. There would be no benefits from the site and neither would there be the insignificant environmental Impacts.

If the proposed alternative goes on, the project would create employment opportunity both directly and indirectly. Stone produced would generate income for the government and hence maximum utilization of land. It would also provide building materials which will be used in construction of the Longonot gate project. The area would also be opened up and this will promote development. Provided the recommended Environmental Impact mitigation measures are adopted and implemented, negative impacts will be avoided /minimized. However, commitments related to development alternative would ensure that potential impacts are minimized to insignificance levels as envisaged in the EMP.

#### **9.6 Mitigation for the proposed Action**

The mitigation measures would be appropriately designed and implemented to protect the environment and especially water, soil, land degradation, flora and fauna of the proposed site.

## **10 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN**

---

### **10.1 Introduction**

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

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

Tables 3, 4 and 5 form the core of this EMP for the construction, operational and decommissioning phases of the proposed project respectively. In general, the tables outline the potential safety, health and environmental risks associated with the project and detail all the necessary mitigation measures, their financial costs, as well as the persons responsible for their implementation and monitoring. The EMP will be used as checklist in future environmental audits.

**Table 4: Environmental Management Plan for the proposed project-Construction Phase**

<b>Environmental Concern</b>	<b>Impact</b>	<b>Mitigation Actions</b>	<b>Responsibility</b>	<b>Time frame</b>	<b>Monitoring indicators</b>	<b>Cost Estimate (Kshs)</b>
Land degradation /Soil erosion	Soil deposition	-Silt fence should be established where erosion is predetermined -Introduce vegetation in already mined areas -Introduce physical barriers such as rocks to intercept soil material from being carried away by the run-off	Operator	Continuous	Soil deposition on the lower side of the pits	35,000
Air pollution /Dust and other emissions	Respiratory disease to workers and nearby animals	-Constant sprinkling of water to the bare areas -Identify wind direction during operation to avoid exposure to emission - Minimize the generation of bad emission from trucks used by assessing and evaluating whether they contain toxic by products -All the workers should be provided with dust masks to avoid inhaling such gases	Operator	Continuous	-Physical appearance in the immediate air space -Depositions on surfaces (plants and stationary vehicles and on the temporary houses)	100,000
Habitat and vegetation disturbance (Fauna & Flora)	Loss of vegetation Loss of dwelling animals	-Minimize area of clearance -Reintroduce the vegetation that coexist with the site	Operator	Continuous	-Decrease in number of vegetation around -Migration of dwelling habitats	100,000
Visual Intrusion	-Open	-Backfilling the burrowed pits using	Proponent	Continuous	-Complains of	10,000

	depression hindering animal movements which can cause death of both wildlife and domestic animals	earth excavated wastes		and throughout the project cycle	associated health hazards	
Noise and resulting from Vibrations	Disturbance to the nearby environs -Hearing problems -Fear to building damage	<ul style="list-style-type: none"> <li>- Install and use a siren to warn people before every blasting</li> <li>-The operation should only be done during the day time</li> <li>-Planning the trips of the vehicles can reduce such impacts.</li> <li>-Screening using baffle moulds material e.g. soil and wastes that has already been remove to access the rock</li> <li>-Locate screening baffle moulds on site boundary to reduce noise</li> <li>- The workers to be provided with earmuffs during operation hours.</li> <li>-Supervision of the site by a person with knowledge of dangerous blasting activity and accepted blasting practices</li> <li>-Correct stemming will aid the control of ground vibration.</li> <li>-Monitoring of blasting</li> </ul>	Proponent	Continuous	-Associated risks e.g. House breakage -House damage and vibrations	120,000



		-Avoid blasting in adverse weather conditions				
Solid and effluent wastes (Oil and other spills)	-Aesthetic effects -Health nuisance	-Soil and earth excavated wastes to be used for backfilling excavated pits Surface run-off from waste tips should be captured and treated to remove suspended solids prior to discharge. -Safe disposal of oil spills and filters from machineries	Operator	Continuous	-Overburden wastes around the quarried sites -Effluent flows in the natural drainage channels and filtration into underground water	70,000
Change on land /Loss of land	-Land value loss -Vegetation abrasion -Soil contamination	Rehabilitation	Operator	Throughout and before moving to another excavation section	-Open up borrow pits	50,000
Water pollution	-Siltation to drainage channels and nearby water bodies especially on the lower side of the pit	- Harmonize and design drainage ditches with the natural drainage to avoid affecting nearby land  -Divert run-off around working area.  -Install sedimentation traps or screen next to the silt fence by arranging a layer of stone chips and gravel to	Site Engineer and the Proponent Supervising foreman	Continuous	-Free flow of surface runoff and storm water	60.000

		trap any loose soil to the river				
Storage and care of explosives	cause of fire on ignition either by humans or by natural causes		Contractor			
Noise from use of explosives	Effects on people Wildlife and livestock	Blasting should not be done at night when people and animals are resting  Use of explosives should be limited to where it is absolutely necessary  The amount of dynamite or the size of the explosive to be selected to avoid excessive amounts	Contractor	During blasting		
Fire from use of explosives	Explosives emit sparks that can cause wild fires	Care should be taken to make sure vegetation does not catch fire from blasting	Contractor	During blasting		
Occupation Health and Safety	-Fall related hazards -Drilling a hole to ease explosions of rock related injuries (splitting stones)	Isolate the working site for rest of the community for their safety - All depressions should be filled and replanted. - All moving parts of machine should be covered with suitable guards. -Keep accidents and incidents records -Provide, and enforce use of personal	Operator/SHE Officer	Continuous	-Related injuries e.g. accidents, falls, fires chest problems etc	120,000

	-Respiratory and nuisance dust -Depression related risks	protective equipment and trained on occupational health. -Fire-fighting equipment and First aid kits should also be provided at the site				
Land restoration and landscaping	Employment	-Filling in the depressions and borrow pits before moving to another section to prevent ponding. -Landscaping and replanting of trees and other similar vegetation. -All pits where water may collect to form ponds should be filled -A layer of top soil should be introduced so as to achieve vegetation growth. <b>(NB)</b> (The landscaping will also include the measures included in the decommissioning and restoration section below)	Operator	Throughout the operation and also after decommissioning	Open Depression	100,000
<b>Total Cost</b>						<b>695,000</b>

**Table 5: Environmental Monitoring Plan for the proposed project-Operational Phase**

Element/ environmental and socioeconomic component	Sources or key areas	Key issues/Impacts	Parameter	Frequency of monitoring	Responsibility	Costs(Ksh)	Relevant legislation/guidelines
Water	Surrounding streams Boreholes	Water Quality and Quantity as a public health concern Aquatic life ecosystem support Domestic water standards Industrial water standards	Water Quality(physical and biochemical composition) and Quantity  Abstraction rates and drawdown for boreholes	Monthly or at least two times a year to cover seasonal variations	Contractor	90,000	EMCA (Water Quality) Regulations ,2006
Effluent and storm water discharge	Runoff from buildings  Road and other infrastructure	Water Quality and Quantity as a public health concern Aquatic life ecosystem support Waterborne diseases prevalence Riparian rights issues Effluent discharge license	Effluent Quality(physical and biochemical composition) and Quantity	Monthly	Contractor	120,000	EMCA(Water Quality) Regulations ,2006
Solid Waste Management	Infrastructure developments Construction	Key sources Amounts produced Nature or type of waste Storage means Transportation means	Quantities Per day/month Composition Equipment used	Monthly	contractor	50,000	EMCA(Waste Management) Regulations,2006

	n areas	Waste Treatment Disposal methods Disposal areas/siting and conveniences Hazardous waste	Waste reduction and recovery at source				
Biodiversity loss	Forests(natu ral and artificial)in and around the project area  Streams around the project sites	Loss of habitats & local biodiversity – rare and endangered flora & fauna  Loss of medicinal plants  Loss of critical isolated habitats and bird species  Disappearance of potential eco-tourism sites	BPI Indices For (E.G. Wetlands In Form Of Streams Bordering The pits  Individual species count(capture recapture) Biomass Index	Quarterly	contractor	80,000	EMCA, various Laws of Kenya and International Treaties
Soil System Monitoring	Forests(natu ral and artificial)in and around the project area  Streams around the site	Soil erosion rates, Slope stability, Water, sediments load, Types and effectiveness of soil conservation measures	Changes in soil structure Soil texture, bulk density, organic carbon, pH, aggregate stability, hydraulic conductivity, electrical conductivity, SAR Soil fertility through regular sampling and determination of pH, P, N, OC, Mn,	Quarterly in the particular project areas defined	contractor	50,000	EMCA EMCA Water Act,2002  Public Health Act  Waste Management Regulations (2006)  Water Quality Regulations (2006)

			Zn, Cu, Mg, EC, Na and Ca; Heavy metals Pesticide residues				
Occupational Health and Safety for any development:	Workers and machinery on site	Compliance to the OSHA, 2007	Audit of safety and health conditions in all premises and work places	Continuous and upon completion annually	contractor	150,000 p.a	EMCA OSHA 2007
Air Quality and Noise	Machinery and moving vehicles	Compliance to Occupational Safety and Health Act 2007	Noise levels	Continuous during construction and certain areas(generators and noisy machines)	Contractor	120,000 p.a	EMCA OSHA 2007
Vibrations	Machinery and moving vehicles	Compliance to OSHA,2007	Vibration levels	during construction and certain areas(generators and noisy machines) semiannually	Contractor	90,000	EMCA OSHA, 2007
Loose stones during blasting and crushing operations	Loose stone in the air can cause injuries to birds and other organisms	Do not blast when birds, bees etc. are flying above or across the site	particles in the air	During blasting	Contractor	-	
Loading and transportation of stones /ballast	Injuries by rolling stones to individuals	Workers and other people should keep off the stone loading and unloading sites	Particles in the air	During blasting	Contractor	-	
<b>TOTAL</b>						<b>750,000</b>	

## 10.2 Decommissioning Phase

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

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

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

**Table 6: Environmental Management Plan for the decommissioning and Closure**

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

Action required	Responsible party	Time frame
<ul style="list-style-type: none"> <li>▪ All stone wastes should be used in landscaping and covered with soil which can support vegetation.</li> </ul>	Contractor	Once
<ul style="list-style-type: none"> <li>▪ All pits and depressions should be filled as much as possible and landscaping involving covering the surface with suitable soils for plant growth</li> <li>▪ Improve soil fertility where needed.</li> </ul>	Contractor	Once
<ul style="list-style-type: none"> <li>▪ Once operations cease, areas under modification /rehabilitation must be demarcated with danger tapes or barbed wire to prevent access by animals and human beings as rehabilitation continues.</li> </ul>	Contractor	Continuous
<ul style="list-style-type: none"> <li>▪ A security fence should be constructed and only one gate left to completely limit access from other areas.</li> </ul>	Contractor	once
<ul style="list-style-type: none"> <li>▪ Transport all equipment and dispose wastes appropriately.</li> </ul>	contractor	Once

**Table 7: The Restoration Plan**

<b>Environmental Social Impact Aspect</b>	<b>Mitigation Action</b>	<b>Responsibility</b>	<b>Time frame</b>	<b>Cost Estimate</b>
Material Site	<ul style="list-style-type: none"> <li>-Exhaust and rehabilitate on material site before opening another section.</li> <li>-Exhausted excavations and borrow pits be backfilled</li> <li>-Holds top soils by planting vegetation on the pit backfilled.</li> <li>-Ensure reduced stagnation of water in borrow pits</li> <li>-Develop appropriate agreement with land owners on conditions and terms of operations</li> </ul>	Contractor	Throughout the project cycle	<b>150,000</b>
Destruction of physical environment, soil erosion and loss of biodiversity	<ul style="list-style-type: none"> <li>-Protective structures should be used to avoid small scale landslides</li> <li>-Topsoil should be stockpiled , backfilled and compacted separately from subsurface and after completion works be restored in order to facilitate natural regeneration around the area of operations</li> <li>Planting of trees</li> </ul>	Contractor	Throughout and once after completion work	<b>60,000</b>
Sediment run-off	<ul style="list-style-type: none"> <li>-Install sedimentation traps</li> <li>-Silt fence should be established where erosion is predetermined</li> <li>-Design drainage ditches to avoid affecting nearby land</li> <li>-Divert run-off around working area</li> </ul>	Contractor	Throughout the project cycle	<b>100,000</b>
Storm water run off	Create of diversion channel to ensure no water flows across rehabilitated areas until it is stable	Contractor	Once off	<b>50,000</b>
Flora and Fauna	<ul style="list-style-type: none"> <li>-Minimize area of clearance</li> <li>-Sensitize natural habitats</li> </ul>	Contractor	Throughout the project cycle	<b>40,000</b>



	-Re-vegetate disturbed area within the site with fast growing plant that are existing within and around the borrow pit site			
Surface and ground water drainage obstruction	-Preserve vegetation along drainage channel -create runoff barriers	Contractor	Throughout the project cycle	<b>80,000</b>
Loss of land	Soiling and grassing of all the borrowed pit -Compensation	Contractor	Once –off	<b>80,000</b>
<b>Total Cost</b>				<b>Kshs.560,000</b>

## 11 CONCLUSION AND RECOMMENDATIONS

---

The desire to implement any project is normally driven by the potential foreseeable/predicted benefits. However, all human activities are associated with some shortcomings whether significant or insignificant thus the need for subjecting to the EIA process. The EIA process is used to identify potential negative impacts with the intention of avoiding them in the design and planning stages or if not possible; provide for appropriate remedies or compensation.

The proposed quarry site project has various benefits as indicated herein the body of this report, notably for the production of construction materials for the construction of the Longonot gated community project and for sale, employment creation, opening up the area and infrastructure improvement among others. These benefits notwithstanding, the proposed project will bring forth some negative impacts such as increased dust (air pollution), fly-rocks and overpressure, noise and ground vibration, health and safety risks, pressure on existing infrastructure, potential pollution to water and soil, visual intrusion and landscape effects, removal of vegetation and increased waste (solid and liquid) generation among others.

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

We also recommend that the proposed mitigation measures should be implemented. The project proponent should also work closely with the Environmental Experts, the local authority, department of Mines and Geology and other bodies to enhance the facilitation of the issues of concern. This will also help in solving any problem arising and which may not have been foreseeable during the EIA project report.

This will ensure that environmental concerns are integrated into the project at every stage of the project cycle. Conservation of resources such as energy and water within the project should be encouraged. Sound operational practices aimed at environmental conservation should also be adopted and special attention should be paid to conservation of the environment. Finally, restoration of the project site should be implemented throughout the project cycle as provided in the report restoration plan.

## 11. REFERENCES

---

Kenya gazette supplement Acts 2000, Environmental Management and Coordination Act Number 8 of 1999. Government printer, Nairobi

Kenya gazette supplement number 56. Environmental Impact Assessment and Audit Regulations 2003, Government Printers, Nairobi

Kenya gazette supplement Acts Building Code 2000, Government Printers, Nairobi

Kenya gazette supplement Acts Local Authority Act (Cap. 265), Government Printers, Nairobi

Kenya gazette supplement Acts Penal Code Act (Cap.63) Government Printers, Nairobi

Kenya gazette supplement Acts Physical Planning Act, 1999, Government Printers, Nairobi

Pollution prevention and abatement handbook – Part III, (September, 2001)

Kenya gazette supplement Acts Water Act, 2002, Government Printers, Nairobi

Kenya gazette supplement Acts Public Health Act (Cap. 242) government printer, Nairobi

Noise Prevention and Control Rules 2005, Legal Notice no. 24, Government Printers, Nairobi

The Occupational Safety and Health Act, 2007, Government Printers, Nairobi

World Bank (1991), Environmental Assessment sourcebook volume I: Policies, procedures and cross-sectoral issues. World Bank, Washington.

Kenya gazette supplement number 57, Environmental Management and Coordination (Controlled Substances) Regulations, 2007, Government printer, Nairobi

Kenya gazette supplement number 68, Environmental Management and Coordination (Water Quality) Regulations, 2006, Government printer, Nairobi

Kenya gazette supplement number 69, Environmental Management and Coordination (Waste management) Regulations, 2006, Government printer, Nairobi

Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009, *government printer, Nairobi*