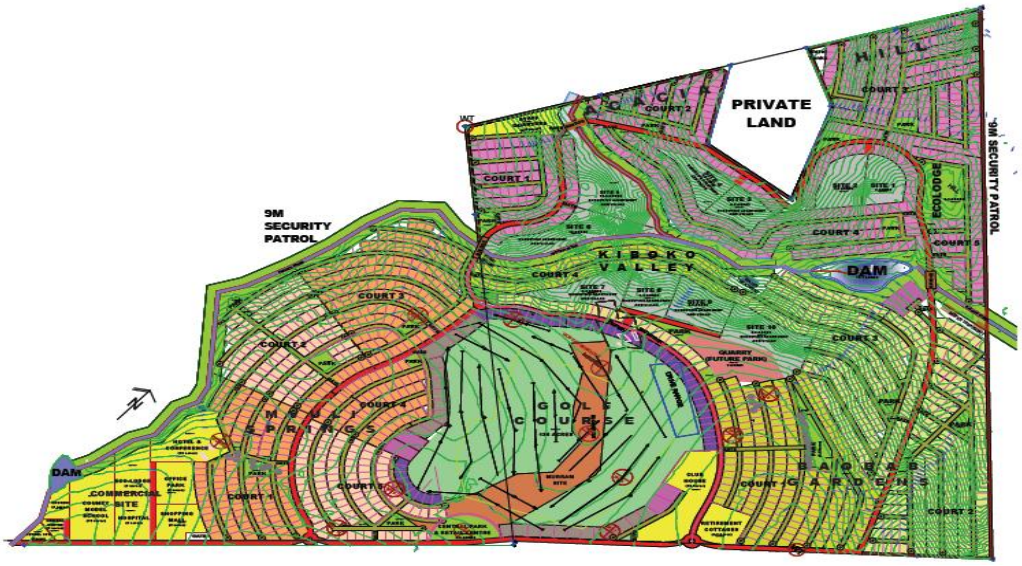
Environmental and Social Impacts Assessment

Study Report For the Proposed

Makuyu Ridge Mixed Development



In Makuyu, Maragua District, Muranga County

By

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

Conducted by

Joseph M. Maitima, PhD
Lead Expert – NEMA, License No. 2815
Ecodym Africa Ltd. Firm License No. 6026
P.O Box 50901- 00200, Nairobi, Kenya
Tel: 0733 255 739

This EIA Study 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).

SUBMISSION

The undersigned, submit the following Environmental Impact Assessment Study Report for the proposed Makuyu Ridge Mixed Development located in Makuyu area, Makuyu Division of Murang'a County, on L.R. Nos. 4929 & 4744-Makuyu. 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.....

PROPONENT

I,…….....Submit this Environmental Impact Assessment Study Report for the Proposed Makuyu Ridge Mixed Development located in Makuyu area, Makuyu Division of Muranga County *L.R. Nos. 4929 & 4744-Makuyu.* 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 Study Report is strictly confidential to Resorts and Cities (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 13th June 2003.

Table 1: List of Participating Consultants/Experts

NAME	DESIGNATION	QUALIFICATION
Dr. Joseph Mworia Maitima **Lead Expert Reg. No. 2815**	Lead Consultant	PHD.
Mr. Victor Odhiambo **Associate Expert Reg. No.7242**	Associate EIA/EA Expert	Bachelor Science in Environmental Planning and Management
Ms. Kimberly Nita	Programme Assistant	Bachelor of Arts in Development Studies (B.Sc. DS) Student: 1. 3rd year Law Student (Catholic University of East Africa) 2. Higher Diploma in Human Resource Management
Ms. Jerusha Njeri **Associate Expert Reg**. No. 7825	Associate EIA/ EA Expert	Bachelor Science in Environmental Conservation and Management

Project Cost

The part of the project to be undertaken by the proponent is estimated to cost Ksh. 1.5 Billion. NEMA fee calculated at 0.1% of the project cost is ksh.**1, 500, 000**. This amount was paid in full and receipted by NEMA on 21st October 2015, before the project brief was submitted.

ACRONYMS

EIA	Environmental Impact Assessment
EMCA	Environmental Management Coordination Act
EMP	Environmental Management Plan
HWM	Household Waste Management
EA	Environmental Audit
ERP	Emergency Response Plan
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
PPE	Personal Protective Equipment
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

EXECUTIVE SUMMARY

The Environmental Impact Assessment study was carried out on behalf of Makuyu Ridge Development Ltd (formerly Resorts and Cities ltd) who have proposed to develop:

- Site offices, storage rooms and few site houses for staff
- Road networks
- Fresh water and liquid waste water reticulation system
- Sewage system and treatment facility
- 18-hole golf course and landscaping
- Sports facilities
- Solar powered electric fence all around the property, and
- Electricity generation and distribution to individual consumers

All these and associated infrastructure will be on a 1000 acres land in Kakuzi area, Kakuzi Location, Makuyu Division of Muranga County. The plot is located about 8km east- north- east Makuyu shopping center.

The aim of the development project is to develop a community away from the urban stress with basic facilities for comfortable modern living, less traffic and noise, with privacy and good security.

The study was aimed at fulfilling the requirement 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, focused 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 positive impacts likely to arise because of the project:

- Provision of high class and affordable housing to the residents

- Provision of housing, hence, easing housing problems especially in Nairobi
- Optimal utilization of vacant land
- Increase in land values of surrounding areas
- Improved security
- Direct and indirect employment
- Promotion of development by influencing commercial trends in the area hence contributing to poverty reduction
- Creation of market for goods and services and secondary businesses
- Improved standards of living for the local population through generated income
- Contribution to Government Revenue
- Economic investment
- Promotion of social cohesion and cultural integration

The study identifies the following negative impacts that are likely to occur because of the project:

- Soil erosion due to disturbance during site clearing and construction
- Stress of the existing water supply
- Sanitation, challenges in disposal of grey water and sewage
- Surface runoff, that is, storm water
- Noise and vibration from construction machinery used in the site
- Dust and gas emission which can affect public health ans safety
- Oil leaks and spills
- Generation of solid waste
- De-vegetation leading to temporary and permanent disturbance to insects and micro-organisms

To ensure project sustainability and environmental enhancement, the study recommends the following mitigation measure to be integrated into the project:

- Install soil conservation structures to reduce soil erosion

- Install drainage channels to discharge storm water
- Proper utilization of water
- Equip workers with relevant personal protective equipment
- Sprinkling of water to reduce emission of dust
- Regular maintenance of machinery to reduce noise from friction and ensure that they work efficiently
- Maintenance of machinery should be done in a designated area where oils are completely restrained from reaching the ground
- Use an integrated solid waste management system
- Minimizing vegetation removal in sections not being built
- Landscape and plant vegetation in all open areas after project completion and manage the introduced vegetation to restore and improve the site
- Adhere strictly 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)
- Provision of sanitary facilities for each sex
- Sensitization of workers on social issues such as drugs, alcohol and HIV/AIDS
- Observe occupational health and safety Act (OSHA), 2007

The study concludes that the positive impacts outweigh the negative impacts making the project highly positive on environmental considerations.

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.

1. Introduction

This is a study report for a proposed project to carry out a mixed development in a 1000 acre farm in Makuyu, Muranga County. The purpose of the study report is to present full details of the proposed project to NEMA for approval before the proponent begins the implementation of the project.

Environmental and Social impact assessment was carried out on behalf of Resorts and Cities who have proposed to develop their property into a resort city. When complete the development will comprise of self-constructed residentials house, hotels, schools, churches, an 18-hole golf course, sports facilities and the associated infrastructure on approximately 1000 acres piece of land located in Maragua sub County of Muranga County. The proponent wishes to acquire a NEMA license to undertake the development activities on the property. Details of the development are presented in this report. The acquisition of an Environmental Impact Assessment (EIA) license is a requisite under section 58 of the Environmental Management and Coordination Act (EMCA), 1999 that stipulates that a proponent must seek an Environmental Impact Assessment (EIA) license "notwithstanding any approval, permit or license granted under this Act or any other law in force in Kenya. This requirement applies to all projects listed in the Second Schedule to the Act. The purpose of Environmental Impact Assessment (EIA) is to identify potential positive and negative environmental impacts associated with the proposed development project and thus provide recommendations on how to take advantage of the positive impacts on one hand and how to mitigate the negative environmental impacts on the other hand. The proposed development will include retreat for holiday and retirement homes, leisure, golf and conferencing. This will include polo field, sporting field, beautiful landscaped gardens and water features. Others include university, hospital, school, a petrol station, a shopping mall, a police post and a community church.

The proposed project to be undertaken by the proponent is the development of infrastructure (roads, perimeter fence, gate, water reticulation and electricity supply services, sewerage system and IT connections to serve the plots, and sites for the common or commercial usage. It is expected that individual plot buyers will construct their own houses at their cost and the buyers of commercial properties like hotels, schools and shops will do the same. It is also expected that

buyers of commercial plots for construction of hotels, schools, shops etc. will seek NEMA certification for their developments

The proponent expected to spend approximately K.shs. 1.5 billion to lay out the infrastructure, for the project.

The EIA team carried out the assessment using a combination of methods including site inspection and interviews with the neighbouring community, the project proponent and workers on the site. Existing literature on statutory and other requirements will were also reviewed. Reference was made from documents relating to the proposed project including land ownership documents, structural and architectural plans for the proposed building. The main project components include but not limited to the following:

a) Clearing and preparation of the project site;
b) Construction of site buildings and other structures;
c) Construction of local access roads, parking, walkways and drive ways;
d) Installation and reticulation of utilities (water, drainage and electricity among others);
e) Site landscaping and building finishing.
f) Extraction of buildings stones from the site (quarrying). Note that quarrying may involve use of blasting with explosives for which a license will be sought from the Mines department of the ministry of Mineral Resources.

The Environmental Impact Assessment (EIA) identified specific areas of concern that needed to be considered in the implementation of the proposed project in all the three phases; construction, operation and decommissioning and proposed mitigation measures for these impacts. An Environmental and Social Management and Monitoring Plan (ESMP) has been provided to guide the proponent in ensuring that environment is not degraded.

1.1. Justification for Environmental Impacts Assessment at full study level

In schedule II "urban development" that includes,

(a) designation of new townships;
(b) establishment of industrial estates;

(c) establishment or expansion of recreational areas;

(d) establishment or expansion of recreational townships in mountain areas, national

(e) parks and game reserves;

(f) shopping centers and complexes.

"Dams, rivers and water resources" including—

(a) storage dams, barrages and Piers;

(b) river diversions and water transfer between catchments;

(c) flood control schemes;

(d) drilling for the purpose of utilizing ground water resources including geothermal

(e) energy.

"Mining, including quarrying and open-cast extraction and Blasting" of—

(a) precious metals;

(b) gemstones;

(c) metalliferous ores

(d) coal;

(e) phosphates;

(f) limestone and dolomite;

(g) stone and slate;

(h) aggregates, sand and gravel;

(i) clay;

(j) exploration for the production of petroleum in any form.

(k) extracting alluvial gold with use of mercury.

Hence, the Makuyu project encompasses some of the above activities that make the proposed project be categorized as a high impact project and thus requiring full study assessment.

1.2. Project proponent

The project proponent is Resorts and Cities Limited of P.O. Box 64553-00620, Nairobi, Kenya.

1.3. Project development

The project seeks to develop a gated community that is fitted with various amenities such as polo field, sport field, landscaped gardens, water features, hospitals, university. Petrol station, shopping mall, police station, community church, residential houses, hotels, schools and 18 hole golf course.

1.4. Objectives of the ESIA

The principal objective of this assessment was to identify significant potential impacts of the project on environmental and social aspects, and to formulate recommendations to ensure that the proposed project takes into consideration appropriate measures to mitigate any adverse impacts to the environment and people's health through all of its phases (construction, implementation and decommissioning phases).

The specific objectives of this ESIA were to:

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 maximize 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 obtaining a NEMA license.

1.5. Scope of the Study

This impact study was for the following developments: a mixed low density residential occupation with golf course, road network, water reticulation, solid and liquid waste management plans, cemetery, dams, and solar powered electric perimeter fence and as agreed

upon with the project proponent. The current understanding is that developments earmarked for later implementation and whose architectural designs are not provided here will be subject to further environmental impacts assessment when the details of their designs will be provided. These include developments like, school, hotels, hospital, college, shopping malls, office park, petrol station, conference centre and others as provided for in the project master plan. Due to the magnitude of the project, the impact assessment has necessitated a full study according to the EMCA 1999.

The study is provisioned to comprise of:

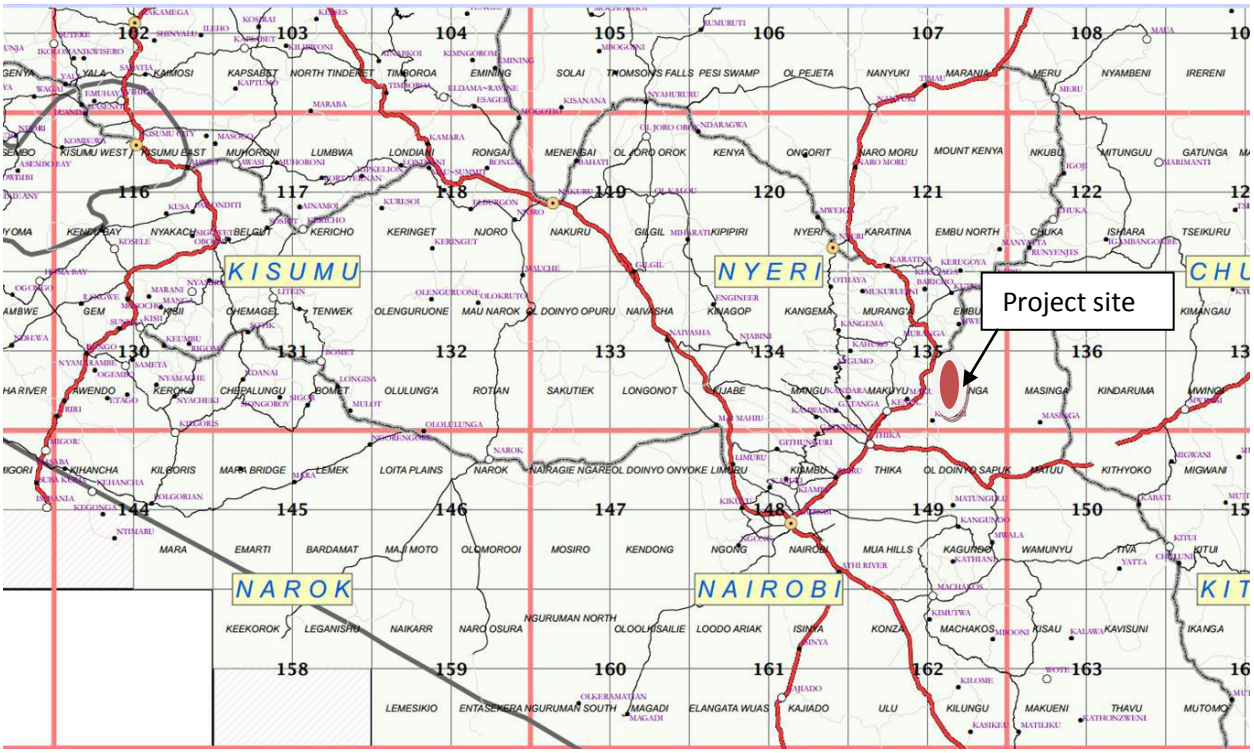
1. Development of baseline surveys (full screening and scoping) on:
    (a) Compliance with sectoral regulatory requirements or provisions
    (b) Current vegetation and seasonal variations
    (c) Current biodiversity and seasonal variations
    (d) Soils
    (e) Water resources
    (f) Climate including 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 and Social Monitoring Plan (ESMP)
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 and NEMA.
8. Responding to any areas of concern to NEMA

2. Study area

Figure 1; Makuyu Study Area

The project site is located 72 km from Nairobi in Makuyu, near Kakuzi off the Nairobi-Thika-Sagana highway. The Resort is 8 km off the main road on the rolling ridges amid scenic coffee estates.

2.1. Location of the Project Site



2.2. Project activities

The principal objective of the assessment was identify significant potential impacts of the project on environmental and social aspects, and to formulate recommendations to ensure that the proposed project takes into consideration appropriate measures to mitigate any adverse impacts to the environment and people's health through all of its phases (construction, implementation and decommissioning phases).

The specific objectives of this ESIA were to:

- Identify and assess all potential environmental and social impacts of the proposed project;
- Identify all potential significant adverse environmental and social impacts of the project and recommend measures for mitigation;
- Identify problems (non-conformity) and recommend measures to improve the environmental management system;
- Recommend cost effective measures to be used to mitigate against the anticipated negative impacts;
- Prepare an Environmental Impact Assessment Study Report compliant to the Environmental Management and Coordination Act, 1999 and the Environmental (Impact Assessment and Audit) Regulations, 2003, detailing findings and recommendations.
- Verify compliance with the environmental regulations and relevant standards;
- Generate baseline data that will be used to monitor and evaluate the mitigation measures implemented during the project cycle;

Master Plan for the proposed Makuyu Ridge Mixed Development

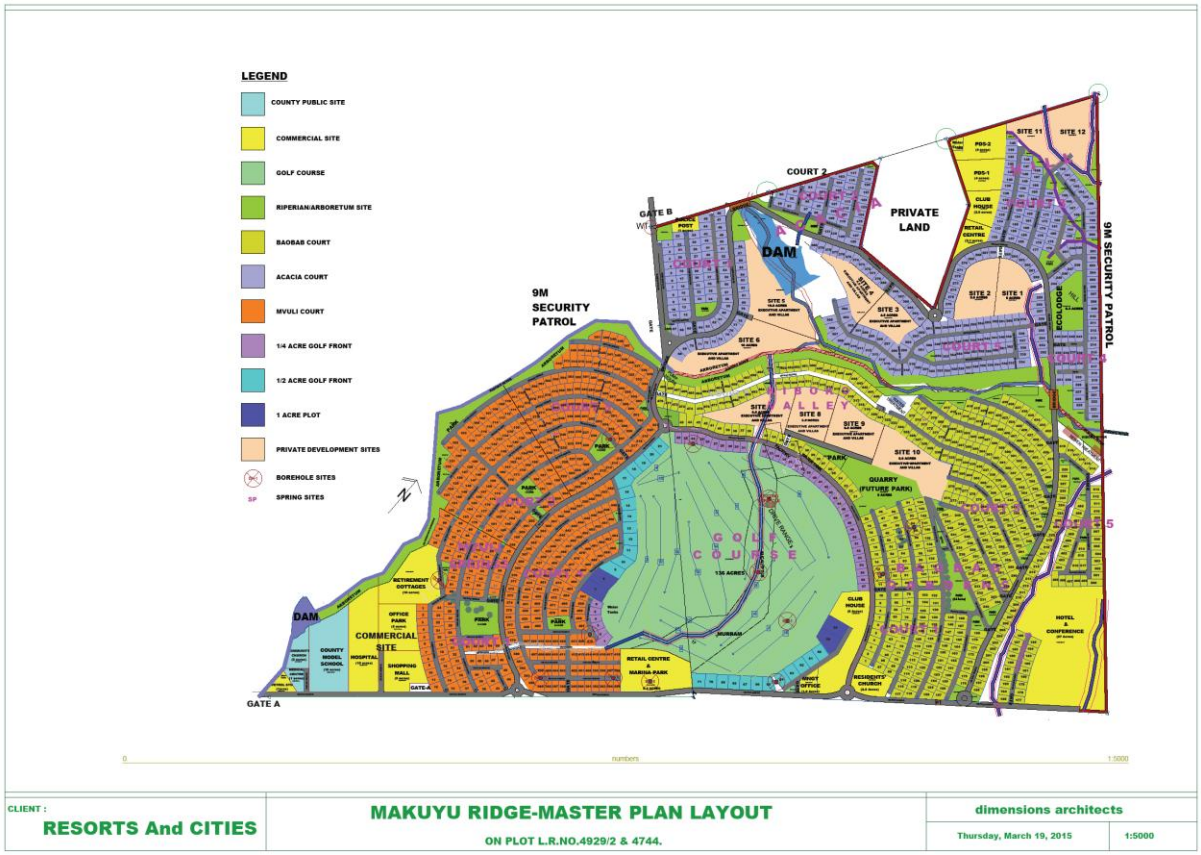


Figure 1: Makuyu Ridge Master Plan Layout

In order to maintain a uniformity of standards in housing structure the proponent will provide a number of alternative architectural designs that plot buyers will choose from. These designs together with roads and gate designs have been provided in this study report.

The study report has also provided details of all designs of the proposed dams, water reticulation, wastewater treatment plans, landscaping plans, water and electricity supplies as well as traffic management plans.

3. Project Description

3.1. Introduction

The proponent, Resorts and Cities Limited have proposed to develop their property into a resort city. When complete the development will comprise of self-constructed residential house, hotels, schools, churches, an 18-hole golf course, sports facilities and the associated infrastructure on approximately 1000 acres piece of land located in Maragua sub county of Muranga County. The proposed project to be undertaken by the proponent is the development of infrastructure (roads, perimeter fence, gate, water reticulation and electricity supply services, sewerage system and IT connections to serve the plots, and sites for the common or commercial usage. It is expected that individual plot buyers will construct their own houses at their cost and the buyers of commercial properties like hotels, schools and shops will do the same. It is also expected that buyers of commercial plots for construction of hotels, schools, shops etc. will seek NEMA certification for their developments

The proponent expected to spend approximately K.shs. 1.5 billion to lay out the infrastructure, for the project.

Details of the proposed project are provided in the map in appendix.

3.2. Site Analysis

From the initial analysis of the site by the project, implementation team the site was analyzed and found to be good with pleasant weather with stable soil for construction. The site has no built forms and therefore no demolition will be needed during site preparation. The site has connections to the main road network within Murang'a area.

3.3. Description of the proposed project

Resorts and Cities Limited have proposed to construct a mixed-use facility in 1000 acres land within Kakuzi area, Kakuzi Location, Makuyu Division of Muranga County. The plot is located about 8km east- north- east Makuyu shopping center.

The proposed development includes the construction of;

- Site offices, storage rooms and few site houses for staff

- Road networks
- Fresh water and liquid waste water reticulation system
- Sewage system and treatment facility
- 18-hole golf course and landscaping
- Sports facilities
- Solar powered electric fence all around the property, and
- Electricity generation and distribution to individual consumers

4. Project Design

Refer to the master plan presented above to see the layout of the project with details of homes distribution, common facilities, water reticulation and roads network

4.1. Water use and Waste Water Management

The proposed site will be connected to the Murang'a Water and Sewerage Company that serves the area. Ten boreholes will also be sunk to supplement Murang'a Water and Sewerage Company water. There will be water storage tanks to increase water capacity at the project site to the required amount. All wastewater from the mixed-use facility will be channeled to the sewer treatment plant while storm water will be channeled by gravity to the proposed dam that will be constructed on the South Western side of the facility. Water from the treatment plant will be used in gardening and car washing.

4.2. Lighting Systems

All functions within the facility will be fitted using the latest energy saving lighting equipment. Lighting will be dimmable and be under daylight and occupancy controls. To save on energy, provision is made for lighting controls with; daylight linked dimming, occupancy controls in spaces that are not continuously occupied including the car park. Solar panels will also be installed to provide renewable energy for lighting where necessary.

4.3. Safety and Security Systems

A 24-hour CCTV surveillance system will be installed with fixed cameras monitoring the main access points and final escape exits and additional key internal areas. An electric fence will be erected above the block fence around the facility. Street lighting will also be put in place to increase security. A security firm will be contracted on full time basis by the facility management to provide security services. The facility will have two gates i.e., gate A and gate B. Contracted security officers will watch the gates. There will also be an internal gate for each plot/house once constructed.

4.4.Communication Infrastructure

A structured cabling network will provide a resilient, high bandwidth system for facility user services. Fibre internet will be connected to all residential areas and other facilities.

4.5. Electricity

Kenya Power will serve the facility for provision of electricity services. Power distributions will be done in a sustainable manner by employing the use of energy saving gadgets such as bulbs within the facility. Solar panels will be installed within the facility to supplement the national grid supply.

4.6. Solid waste management

Solid waste management will consist of color-coded bins for each type of waste in the blocks and along the corridors at designated points. A NEMA registered garbage Collection Company for disposal to a registered dumping site will then collect the waste.

4.7. Roads/Transport Infrastructure

The proposed site will have access roads that will connect the various functions within the area. There will be common roads around the residential buildings and other facilities. In between plots will be 15 metres road reserves while on the outside, the roads will be 18 metres. Bridges will also be constructed across Kiboko River to connect various areas within the facility.

5. Description of the Project's Construction Activities

5.1. Pre-construction Investigations

The implementation of the project's design and construction phase started with preliminary surveys and cost-benefit analysis to establish the need for a residential estate and associated facilities. Investigations also covered identification of any existing legal and regulatory requirements that may affect the project at any stage of its implementation. The site will have to be cleared to pave way for the construction.

5.2. Mobilization of Building Materials

The proponent plans to source several building materials locally and expressed the confidence that the materials can be procured locally. The great emphasis laid on procurement of building materials from within the local area makes both economic and environmental senses since it reduces negative impacts of transportation of the materials to the project site through reduced distance of travel by the materials transport vehicles.

Building materials are transported to the project site from their extraction, manufacture, or storage sites using transport trucks. There are adequate road linkages for the purpose of smooth transport of building materials into the project site.

5.3. Storage of Materials

Building materials will be stored on site according to their need. Bulky materials such as rough stones, ballast, sand and steel will be carefully piled and covered on site. Materials such as cement, paints and glasses among others are to be stored in temporary storage rooms conveniently within the project site for this purpose.

5.4. Masonry, Concrete Work and Related Activities

The construction of the building's foundations, floors, and drainage systems among other components of the project involves a lot of masonry work and related activities. General masonry and related activities include reinforced structure of columns and beams filled with stone/block walls, concrete mixing, plastering, slab construction, construction of foundations, and erection of building walls and curing of fresh concrete surfaces. These activities are labor

intensive and are to be supplemented by machinery such as concrete mixers. In addition, activities such as concrete mixing and curing require large amounts of water.

5.5. Structural Steel Works

The buildings are to be reinforced with structural steel for stability. Structural steel woks involve steel cutting, welding and erection of forms for beams and slabs.

5.6. Roofing and Sheet Metal Works

Roofing activities include galvanized iron sheet metal cutting, raising the roofing materials to the roof, fastening the roofing sheets to the roof, fixing of the concrete tiles.

5.7. Electrical Work

Electrical work during construction of the development will include installation of electrical gadgets and appliances including electrical cables, lighting apparatus and sockets. In addition, there are other activities involving the use of electricity such as welding and metal cutting.

5.8. Plumbing

Installation of pipe work for water supply and distribution will be carried out from the existing supply and then to associated facilities. In addition, pipes will be installed to connect sanitary facilities and all the ablution blocks with sewerage treatment plant to be constructed, and for drainage of storm water from the rooftop into the peripheral drainage system. Plumbing activities will include metal and plastic cutting, the use of adhesives, metal grinding and wall drilling among others.

5.9. Installation of Equipment

Several equipment will be installed within the buildings and other facilities. Equipment to be installed include air conditioning equipment and refrigeration equipment, firefighting equipment, alarms, lighting systems, sanitary equipment and waste handling facilities, railings and others as needs be.

6. Description of the Project's Operational Activities

6.1. Solid Waste and Waste Water Management

The proponent will provide facilities for handling solid waste generated within the facility. These will include dustbins and skips for temporarily holding waste within the premises before final disposal at the designated dumping site.

Wastewater from sanitary facilities and ablution blocks will be discharged into the sewerage disposal system, while storm water from the roof of the premises will join the natural drainage system.

6.2. Cleaning

The proponent will be responsible for regular washing and cleaning of the common roads and way leaves, however, the owners will clean their own houses .Cleaning operations will involve the use of substantial amounts of water.

6.3. General Repairs and Maintenance

The facility and its support facilities will be repaired and maintained regularly during its operation phase. Such activities will include repair of building walls and floors, repairs and maintenance of electrical gadgets and equipment, repairs of leaking water pipes, painting, maintenance of flower gardens and grass lawns, and replacement of worn out materials among others.

7. Project Description and Location

The Makuku Ridge project is located in Muranga County to the eastern side of the Thika–Sagana Highway. The main access road to the site starts at Makuyu (near the existing Makuyu golf course located along the Thika – Sagana highway) and takes an easterly direction for 8km to reach the site. The site is located approximately 3km from the route of the proposed Greater Eastern By-Pass road that starts from Lukenya and runs in a northwesterly direction through Kilimambogo on to Makuyu.

7.1. Site Topography

The topography of the site comprises of a rolling to a highly steep terrain with Kiboko River cutting across the site. The area to the north of the river is extremely steep.

The predominant in-situ soils are red coffee soils. The site also has evidence of gravel deposits of lateritic type. The gravel is proposed for use in road construction.

Additionally the site has rock deposits that have been found to be suitable for quarrying and establishment of a hard stone crushing plant. The crushing plant will produce hand-packing stone for the road base and for road and building aggregates.

7.2. Site Roads Network and Bridges

The road network comprises of trunk roads (major roads) which link various development zones and residential courts. The Residential areas are designed in clusters that are further subdivided in to individual courts. Within the residential courts, estate roads provide access to the homesteads and then connect to the trunk road for linkage to other zones. As a design philosophy, human and motorized traffic cannot access homesteads from trunk roads to avoid conflict and unnecessary interruption of traffic flow on the trunk roads. Instead, estate roads will join the trunk road at designated junctions, for each residential court. The roads will also be provided with street lighting. Additionally peripheral (perimeter) security roads have been provided.

The table below describes the road network and proposed no. of bridges.

Description	**Trunk Roads**	**Estate Roads**	**Perimeter Road**	**Bridges**
Estimated length	10km	27 km	6 Km	3 No.
Width of Road Reserve	18m	15m	9m	-
Proposed carriageway Width	6.5m, with designated footpath of 1.5m width	5.5m	4m	-
Proposed surfacing	Cabro	Cabro	Cabro	

The typical road sections for the trunk and estate roads are provided in **Appendix A**

The bridges will be either box culvert or structural concrete bridges depending on desired capacity. Where erosion is likely to occur on the embankments of the bridges, gabions, stone pitching and grassing measures will be undertaken.

7.3. Roads Pavement and Surfacing Design

The process of road construction will involve site clearance of the road reserves followed by earthworks that involves cutting and/or filling of low areas with earthwork materials. The final formation layer will then be processed before a gravel sub base layer is processed. After the sub base, a hand packed stone base layer shall be constructed and then finished with cabro paving blocks.

7.4. Storm Water management

The construction of roofed and concrete structures in the overall development is expected to result in concentrated runoff that if not properly channeled and managed has the potential to cause serious environmental degradation. To solve this problem the numerous roads will all have side drains to act as catchment for runoff and will be designed to have sufficient capacity to carry the runoff and discharge it to designated water ways (way leaves) eventually ending up in the valleys and river courses that punctuate the site. By and large the rolling to steep terrain of the site makes drainage easy to handle.

Where the gradients of the side drains and waterways are steep as to be susceptible to erosion, lining with stone pitching or concrete will be undertaken. Scour checks will also be constructed where possible.

7.5. Rehabilitation of borrow pits

Materials for earthworks will be generated by balancing of cuttings and fills so that the resultant necessity to borrow material outside of the construction area will be negligible.

The proposed gravel pit sites are located within the confines of the proposed golf course. It is therefore expected that any unsightly pits that may result will be backfilled with earthwork material from cuttings made in the process of constructing roads.

Concerning the rehabilitation of hard stone quarry sites, it is proposed that the open areas that may result from quarrying be converted to community parks.

By and large the construction of roads is not expected to pose any environmental degradation that cannot be mitigated.

8. Traffic Management Plan

Traffic Management is defined as the interaction between vehicles and their immediate environment (e.g. pedestrians, other vehicles, and infrastructure) and the processes undertaken to eliminate and/or reduce the risks associated with those interactions.

The specific objective of traffic management should consequently be to improve traffic flow, movement of people and goods, upgrading the quality of life and safety of the traffic systems and general improvement of the environment.

The road leading to the development from Makuyu, on the Thika – Sagana road, is currently an 8 km all weather gravel road. We however understand that the Muranga County Government has plans to tarmac it in the near future. That notwithstanding, the first 5 km of this road from Makuyu falls on the route of the proposed greater eastern bypass road leaving only a 3 km of link road off the bypass road to the site. The general level of development in the proximity of the development is low and hence traffic volume is expected to be low. While it is expected that traffic volume will increase once the bypass is constructed, the improvement of the link road / bypass junction will fall within the bypass construction team.

8.1.Potential Risks and Mitigation Measures

Potential risks likely to arise from the generated traffic and the management / mitigation of the risks are summarized in Table 1 below.

Potential Risks and Mitigation Measures

	Potential Risks	**Mitigation Measures**
1	Risk of accidents when traffic is exiting or joining the existing public roads	✓ *Acceleration and deceleration lanes to be provided at the junctions* ✓ *Appropriate road signs to be provided* ✓ *Speed bumps and other traffic calming measures to be provided*
2	Inadequate road capacity within the estate and link roads	✓ *Adequate roads have been provided to serve the estate and zoned areas (e.g commercial centres).* ✓ *As a design philosophy homes cannot be accessed directly from the trunk road so as to reduce risk of traffic interruption/ conflict within trunk roads*
3	Traffic conflict within the estate junctions	✓ *Traffic signs to be provided* ✓ *Estate roads to be labelled and clearly marked* ✓ *Provision of traffic calming measures in any corners with reduced sight distances*
4	Risk to Pedestrians within the estate	✓ *Trunk roads to have designated pedestrian walkways.* ✓ *Pedestrian crossings will be provided next to commercial centres* ✓ *Driver speeds will be controlled within the estate with adequate signs provided.*
5	Vehicular conflict within commercial sites	✓ *Ample parking to be provided with clearly demarcated zoning.* ✓ *Estate management to monitor and control parking*

9. Makuyu Ridge Security Plan

9.1. Overview

The concept of Makuyu Ridge Development Project is to integrate security within the overall design and plan of a world class Gated community. The objective is to provide a proactive and holistic security management solutions and service that will not only benefit the owners and investors of the project but also the neighboring community.

The Makuyu Ridge Security approach is an innovative risk based community security model to deliver a safe and secure living environment in a gated community concept.

9.2. Objective

The management of Resorts & Cities has committed itself to delivering an excellent project for their clients and investors. It has identified the need for Security to be an integral component in their overall strategy of developing unparalleled excellent residential community that will redefine the essence of gated communities in Kenya.

Resorts & Cities has therefore contracted LYNX Security Services, an independent Security Consultancy, to develop a strategic and professional partnership to deliver security services and solutions for the project. **LYNX will provide security consultancy services that will involve indentifying, analyzing and managing the existing and potential security risks at Makuyu Ridge.**

The implementation plan will be a phased out plan, developed, coordinated and approved by the board of management.

Our need for independent security consultancy approach and strategy is therefore, intended to add value to the property development strategy by designing a security plan that is proactive, efficient, and cost effective. Security will be an integral part of the project design and risk management process aimed at strategically positioning Makuyu Ridge as an innovative project. The project design will demonstrate the value of introducing security technology i.e. visitor management, access controls, CCTV remote surveillance etc in the overall project design and implementation.

9.3. Rationale

- Gated communities are walled and fenced housing developments to which public access is restricted, often guarded using monitored CCTV surveillance systems, trained security personnel, patrol teams, access controls etc and usually characterized by legal agreements (tenancy or leasehold) which tie the residents to a common code of conduct.

- The Makuyu Ridge, gated community, will have additional amenities i.e. Golf course, club houses, swimming pools, private gyms; children play areas, schools, shopping

centers etc and a full accompaniment of care-taking staff, maintenance crew and security officers/guards.

- In recent years, gated communities in Kenya, have become more and more desirable to homeowners and families hoping for both security and privacy. Although no accurate data exists on the total number of households living in gated communities in Kenya, we approximate that they are in the thousands and the market is still growing.

- There has been a lot of emphasis on the fact that gated communities make its residents feel safer and also contribute significantly to the neighboring communities in enhancing their livelihood i.e. providing jobs, improved infrastructure, ready market for their goods and services.

9.4. Security System Plan.

The desired security plan is an integrated safe and secure gated community concept that takes in consideration the following issues:-

- The existing and other potential risks will always be reviewed within the surrounding internal and external environment e.g. the surrounding community

- Electronic security measures – This will compliment the overall security plan implemented on a phased out plan

- Effective Communications and coordination with the local community and law enforcement agencies.

- Electronic guard monitoring systems

- Emergency response – This requires back up response for both Fire and guarding services.

- A trained Guard Force; in security and emergency response. A professional outfit that meets security acceptable standards and requirements to patrol and guard key sites on 24/7 basis.

- Documented security-operating procedures.

- Fire prevention, detection, alarm system and response plan
- Develop effective security reviews, audit/ inspection, monitoring, surveillance and maintenance procedures conducted on quarterly basis.

9.5. Security Concept

The concept of security in Makuyu Ridge entails an integrated approach that will develop and establish the following;-

- Security design and plan that incorporates community security and policing strategy for effective crime prevention.
- Establish electronic security systems capable of operating on 24/7 basis, cost effective and efficient.
- Identify, vet and train a guard force that is highly motivated and has the necessary skills and competencies. The major consideration will be to retain, as much as possible, the existing group of guards- who meet the established criteria and standards.
- Review the existing physical security designs to ensure we achieve a layered security concept and depth.
- Develop, document and manage the desired security system on behalf of the residents in close liaison with the management company/committee.
- Develop and document security procedures. These procedures will also need periodic reviews to ensure it is aligned with prevailing security situation
- Most of the Makuyu Ridge clients, homeowners and investors will demand high-end security and efficient service delivery supported by key staffs well versed with procedures to be followed in case of incidences such as violent crime, thefts, injuries and accidents.
- The developer and homeowners will each take necessary security precautions and systems such as using ***trained patrol teams, CCTV controllers, surveillance systems,***

electronic access controls, alarm and response systems and secure door and window locking systems and documented security processes and procedures.

9.6. Benefits for the proposed security concept

Enhancement of security and safety in will have the following benefits:

a) Make Makuyu Ridge project an attractive investment i.e. better return on investment for the owners, investors and local community.

b) Develop phased out security plan that is cost effective and efficient.

c) Develop a system of proactive security and emergency response in the entire area.

d) Demonstrate the value a structured and proactive security risk management process that contributes to the overall crime prevention strategy.

e) Demystify the perception of community security and Policing.

f) Demonstrate the value of incorporating security the overall seamless property development strategy and consultancy process.

g) The exclusivity of living in a clean, safe and secure Gated community

h) Increased value-add to Makuyu Ridge clients, homeowners and investors.

i) Reduce the risk of potential crime internally and externally

j) Enhance service delivery, efficiency and effectiveness.

k) Enhance the overall risk management process especially on emergency response and business continuity plans.

l) The added on advantages will include Security awareness training, alerts/advisories, emergency handbooks and security vetting and training of home owners, domestic house helps, staff and technical staff.

10. Description of the Project's Decommissioning Activities

10.1. Demolition Works

Upon decommissioning, the project components including buildings, pavements, drainage systems, parking areas and perimeter wall will be demolished. This will produce a lot of solid waste, which will be reused for other construction works or if not reusable, disposed of appropriately by a licensed waste disposal company.

10.2. Dismantling of Equipment

All equipment including electrical installations, furniture, partitions, pipe work and sinks among others will be dismantled and removed from the site. Priority will be given to reuse of these equipment in other projects. This will be achieved through resale of the equipment to other building owners or contractors or donation of this equipment to charitable institutions.

10.3. Site Restoration

Once all the waste resulting from demolition and dismantling works is removed from the site, the site will be restored/ rehabilitated through replenishment of the top soil and vegetation using indigenous plant species.

10.4. Building Materials and Energy Used

During the construction phase, several building materials will be required. Where possible, building materials will be sourced locally, with importation sought where necessary e.g. finishes & fittings. Materials such as sand, ballast and hard core can be obtained from quarrying companies in the surrounding areas.

The main sources of energy required for construction of the facility include mains electricity and fossil fuels (especially diesel). The proponent will promote efficient use of building materials and energy through proper planning to reduce economic and environmental costs of construction activities.

10.5. Solid Waste Generated

A lot of solid waste is expected to be generated during construction of the project and these will include metal cuttings, rejected materials, surplus materials, surplus spoil, paper bags, empty

cartons, empty paint and solvent containers, broken glass among others. The proponent has plans to minimize the generation of waste during construction and proper management of all the waste.

10.6. Liquid Effluents Generated by the Project

During construction, liquid effluents emanating from the project site will include site drainage and run-off. Such run-off may result from curing processes and drainage of areas filled with storm water. The major liquid effluent during the operation of the project will be sewage. In addition, cleaning/washing operations will lead to generation of substantial amounts of liquid effluents.

11. Environmental baseline of the project area

11.1. Physical Environment

11.1.1. Climate

The climate of Muranga is very varied as the county extends from the cold highlands of Aberdares (Nyandarua Ranges) where tea is the main cash crop to the dry and hot lowlands bordering Machakos County. Rainfall ranges between 700-1000 mm per annum and daily temperatures range from 14 -28^0 C. Makuyu Division is on the lower part of Muranga County that borders with Machakos but the land is much more fertile with a mixture of red loam soils that support a number of perennial crops like coffee, bananas, and peas and a number of fruit crops like oranges, mangoes and papaws. The long rains fall in the months of March, April and May with the highest amount recorded in the month of April, during which reliability of rainfall is high. The short rains are during the months of October and November. It is generally wet and relatively humid due to the influence of the Aberdares to the north and Mt. Kenya to the east. The inhabitants of Makuyu are engaged mainly in subsistence agriculture, growing maize and a variety of horticultural crops and rearing of livestock. However there are several medium to large scale farms with Kakuzi located near the project site as the largest as farm Ecological Conditions of Muranga County.

The county is divided into six agro ecological zones. The agro ecological zone one consists of the highest potential zones where forestry, tea and tourism industry form the most important economic activities. Agro-ecological zones two and three are the lowlands east of Aberdares and are generally suitable for both coffee and dairy farming. The flatter area of Makuyu division of Maragwa constituency is characterized by arid and semi-arid conditions. This forms the agro ecological zones 4, 5, and 6. In these zones, coffee and pineapple plantations thrive by irrigation.

11.1.2. Land Use

The site is presently with unmanaged coffee plantation that appears to have been neglected for some time. There are a few buildings in one of the properties that include and old residential house formally used by the caretaker of coffee estate and old offices of the former estate. Land use in the area around the project site comprises of mixed farming in small production units and a few medium size coffee farms.

11.1.3. Hydrology

Rainfall in the project area is due to the movement of the inter-tropical convergence zone of the southern and northern hemisphere air masses. This gives rise to two rainy seasons, the short rains (October-November) and the long rains (March-May). Relief largely dictates the amount of rain. The mean annual rainfall in the area is 1200mm.

11.1.4. Geology

The geology of the area consists of volcanic rocks of Pleistocene to Recent and Tertiary eras and Basement System rocks of Archean type. The volcanic rocks occupy the western part of the County bordering the Aberdare while the rock of the Basement System occupies the eastern part. The volcanic accumulations originated from the Rift Valley and Mount Kenya; the earliest of the, the phonolites, flowed from the west during the Miocene period. Deposits of ash and basalt subsequently covered these.

11.1.5. Ecological Conditions of Muranga County

The county is divided into six agro ecological zones. The agro ecological zone one consists of the highest potential zones where forestry, tea and tourism industry form the most important economic activities. Agro-ecological zones two and three are the lowlands east of Aberdares and are generally suitable for both coffee and dairy farming. The flatter area of Makuyu division of

Maragwa district is characterized by arid and semi-arid conditions. This forms the agro ecological zones 4, 5, and 6. In these zones coffee and pineapple plantations thrive by irrigation.

11.1.6. Hydrology and Water supply

Rainfall in the project area is due to the movement of the inter-tropical convergence zone of the southern and northern hemisphere air masses. This gives rise to two rainy seasons, the short rains (October-November) and the long rains (March-May). Relief largely dictates the amount of rain. The mean annual rainfall in the area is 1000mm.

Water supply to the proposed project will be provided from the following sources:

- 10 boreholes (EIA for ten boreholes submitted separately) – one borehole (the 11th) drilled by the previous land owners already exists on site.
- Piped water to be supplied by Muranga County Government
- 3 dams fed by surface runoff on the land under development

11.1.7. Site Topography

The topography of the site comprises of a rolling to a highly steep terrain with Kiboko River cutting across the site. The area to the north of the river is extremely steep.

The predominant soils in Makuyu are the deep and well-drained red/brown soils. These soils are loose and combined with the hilly terrain are easily eroded and sometimes are responsible for the landslides which are common in the district.

The predominant in-situ soils are red coffee soils. The site also has evidence of gravel deposits of lateritic type. The gravel is proposed for use in road construction.

Additionally the site has rock deposits that have been found to be suitable for quarrying and establishment of a hard stone crushing plant. The crushing plant will produce hand-packing stone for the road base and for road and building aggregates.

11.1.8. Biological environment

Natural vegetation is dominated by wooded grasslands with more woody vegetation along the drainage channels and in the localized wetlands created by blockages of surface runoff. Open

grasslands are common in the direr parts where soils are sandy and rocky and comprised of short chloridoid grass species with little tree canopy.

The area around the project site is highly inhabited by people who practice intensive mixed farming with cultivation of crops and raring of livestock in mainly at subsistence level because of small production land units.

Due to the intensity of human activities, wildlife is scarce and is limited to mainly pests like squirrels, rats and birds. According to the local residents, wild animals are more common in the lower drier areas bordering Machakos where there are still large tracts of wild bush lands.

List of birds identified in the project area

Common	***Scientific***
Hadada Ibis	*Bostrychia hagedash brevirostris*
African Black Duck	*Anas sparsa leucostigma*
Long-crested Eagle	*Lophaetus occipitalis*
Red-eyed Dove	*Streptopelia semitorquata*
Grey-headed Kingfisher	*Halcyon leucocephala leucocephala*
Cinnamon-chested Bee-eater	*Merops oreobates*
White-headed Barbet	*Lybius leucocephalus*
African Pied Wagtail	*Motacilla aguimp vidua*
Common Bulbul	*Pycnonotus barbatus*
White-bellied Tit	*Parus albiventris*
Black Cuckoo-shrike	*Campephaga flava*
Pied Crow	*Corvus albus*
Variable Sunbird	*Nectarinia venusta*
Beautiful Sunbird	*Nectarinia pulchella*
White-browed Sparrow-Weaver	*Plocepasser mahali melanorhynchus*
Baglafecht Weaver	*Ploceus baglafecht*
Red-billed Quelea	*Quelea quelea aethiopica*
African Citril	*Serinus citrinelloides*
Marico Sunbird	*Nectarinia mariquensis*

11.1.9. Biodiversity

The proposed site is under agricultural use hence the site is dominated mainly by coffee plants that appears to have been neglected for some time. Areas surrounding the project site have food crops such as beans, maize, and assortment of horticultural crops and fruit trees like mangoes and avocadoes. The plants that will be cleared for the proposed development are the old neglected coffee trees that are no longer in production.

There is a rich diversity of arthropod fauna whose life was dependent on the plants that are at the proposed site but the landscape is a continuum of similar land cover and land use. There is no unique natural habitat that the proposed development will disturb or destroy.

The vegetation that will be removed to give way to the developments is the old coffee trees. However, the proponent intends to leave most of the coffee plants as ornamental trees especially within the proposed 18-hole golf course and in all the open spaces within the site.

However, it is worth noting that considering the scale of the proposed project and commonly found flora and fauna within the project area, no significant adverse effects are envisaged on the ecology of the area. Similarly, there are no known archaeological sites or unique habitats. Hence, no major impact in this area is anticipated.

11.1.10. Archaeology of Makuyu Area

A thorough literature search has been made to determine presence of any known pre-historical site in the area. This search has not revealed any site of archaeological or paleontological importance either within the project site or in Makuyu area in general.

If prehistorically important materials are unearthed during construction in the proposed project, relevant authorities in the National Museums of Kenya will be informed with a purpose to collect and preserve the materials in accordance to the procedures laid down by the National Museums of Kenya**.**

11.1.11. Socio-Economic Environment

Muranga is a predominantly agricultural County with nearly 70% of the population engaged in cultivation. However, the farming sub-sector is yet to achieve its full potential owing to constraints such as use of uncertified seeds, shortage and high costs of farm inputs, lack of appropriate storage facilities, poor farming skills and drought in the semi-arid parts of the County.

The County has witnessed a rise in livestock production with the main enterprises being dairy cattle, poultry and pig keeping, in that order. The local food processing industries and proximity to a ready market in Nairobi has increased the demand for livestock products. The County's Industrial sector is robust owing to demand from and proximity to the capital city of Nairobi and it has flourishing milk processing and packaging industries, among others. Prospects for industrialization remain high in the dairy sector and manufacture of animal feeds. Though there

are a good number of financial institutions operating in the county, the demand for financial services by the hardworking and enterprising population is enormous and expansion and further capacity building is needed.

Makuyu division where the project site is located is dominated by Kakuzi Corporation that produces coffee in large scale among other tree and fruit crops. Majority of people in the division depend of subsistence agriculture in small scale farming system. Many people provide labor to the large scale commercial farmers to subsidize their farm outputs.

11.1.12. Demography and Population profile

Population: 942,581 (Male 49%, Female 51%)

Population Density: 524 people per Km2

National Percentage: 2.44%

Age Category

Table 1: Age Range

Age Category	Range (%)
0 – 14	30
15 – 64	59
> 65	11
15 – 64	59

11.1.13. Health

HIV and AIDS pandemic poses a serious threat to the development of the county as the prevalence rate stands at 3.7per cent. Like in all other counties in the republic, the scourge is on the increase virtually in all the sub counties of the county.

Adverse social issues due to the implementation of the project such as the risk of the spread and contamination of HIV-AIDS and other sexually transmitted diseases and unwanted pregnancies were identified. However, the sensitization of workers for the use of appropriate preventive

measures such as abstinence and the use of condoms by workers is recommended as appropriate management tools to be implemented by the Contractor.

One of the proposed facilities to be developed by the proponent is to put up a hospital within the site. This hospital will provide service to the local residents to supplement the already existing government and other private health care facilities in the region.

11.1.14. Soils

The predominant soils in Makuyu are the deep and well-drained red/brown soils. These soils are loose and combined with the hilly terrain are easily eroded and sometimes are responsible for the landslides which are common in the district.

The proposed development of roads, houses and other infrastructure will take cognizance.

11.1.15. Infrastructure

The project site is served by a dust all weather murram 8-kilometer road from the junction of Thika- Sagana- Embu tarmac road. This road will be improved to a high quality murram that will be motor able by all types of vehicle all year round.

The area is served by piped water and has some individually owned boreholes. The proponent has granted the residents request for an additional borehole dedicated to the public and will be located outside the project area in a site to be proposed by the residents.

11.1.16. Structures in the site area

The site was formerly comprising of two large scale coffee farms whose acreage total to about 1000 acres. The permanent immovable structures on site are old buildings that were used as farm houses and an old coffee factory that used to process coffee from the farm. The firm is supplied with piped water that was used for irrigating the coffee and providing for all other water needs in the farm. Some of the buildings are now being used by the proponent as site office, store and residential for some of the site workers.

12. Anticipated Environmental Issues

The proposed development plan will include retreat for holiday and retirement homes, leisure, golf and conferencing. This will include polo field, sporting field, beautiful landscaped gardens and water features. Given its location and scale of operation, the project has the potential to influence the environment and socio-economic landscape of the region within which it is located in both positive and negative ways. The potential impacts identified are presented below:

12.1. Physical Environment

1. Water quality aspects for both surface water sources like piped water, storm water, and other related aspects
2. Soil conditions, soil contamination and landscape alterations/degradation (based on aesthetic aspects) associated with the proposed project.
3. Drainage patterns especially in relation to wastewater effluents
4. Air quality aspects especially atmospheric emissions and related discharges from machinery like diesel run equipment etc.
5. Noise and Vibrations where applicable Natural

12.2. Environment

1. Natural flora and fauna from the proposed development and the adjacent ecosystems where applicable. (i.e., effects to natural plants and animals where applicable).
2. Effects on water flow patterns especially during the rainy seasons and quality aspects, user interference and contamination.
3. Topography: effects on soil and landscape.

12.3. Social welfare, Economic and Cultural Environment

1. Determination of implications to the human society distribution, demographic details, settlement patterns, changes to the cultural lifestyle and indigenous knowledge of the local society/public where applicable.

2. Notable changes in land use systems and the general land utilization types where applicable.
3. Implications on the employees, visitors and public health, safety and related hazards/risks such as HIV/AIDS, consumption of contaminated intravenous infusions products due to disease outbreaks, sanitary facilities, etc.
4. Aesthetic, landscape alterations and changes to infrastructural facilities, among others.
5. Effects associated with the construction and operation activities and related handling and disposal of wastes generated during the operations.
6. Effects associated with income generation opportunities created by the project due to the upcoming operations.
7. Introduction of nuisances, such as pests and related multiplication breeding sites.

13. Estimated quantities of generated components

13.1. Design and construction phase

The components and wastes generated at the design phase are very negligible. During construction, the proponent is advised to purchase materials that are needed to avoid wastage. Purchasing of excess materials will obviously foresee more wastes and leftovers. On the other hand, poor management and planning will also cause wastage even if the material purchased is adequate for the construction work. The proponent has planned for materials to be re-used to minimize waste.

13.2. Quarrying for construction materials

In the area proposed for development there is a site with materials suitable for construction. The proponent is planning to develop a quarry for extract building stones for use in the building of road infrastructure and buildings. This will minimize movement of vehicles supplying building stones around the area as these will be obtained within the site.

Extraction of building stones might require use of explosives to blast the rocks. The proponent will however, seek approval for the use of explosives from the relevant authorities in the ministry of Mineral Resources.

14. ENVIRONMENTAL AND LEGISLATIVE FRAMEWORK

14.1. Overview

There are a number of legislations and regulatory frameworks that the proposed development will have to consider in order for the development to be in full compliance with their guidelines and requirements. This study has outlined them here below and given suggestions of how the development can comply or the steps proponent has taken in compliance.

14.2. The Environmental Management and Co-ordination Act, 1999

The Act entitles every person in Kenya to a clean and healthy environment and aims to safeguard and enhance the environment. Though there are other sectoral laws on environmental conservation, this is the supreme legislation. It provides guidelines on issues of environment, stipulates offences and penalties and establishes NEMA. The Act also lists the type of projects, which must be subjected to the EIA process and establishes NEMA as the statutory body responsible for the implementation of the act.

In compliance to the requirements of the act, the proponent was appointed an expert to conduct the EIA study project report in order to seek approval before implementation of the proposed project.

14.3. The Environment (Impact Assessment and Audit) Regulations, 2003

The regulations are entrenched under section 147 of the EMCA. The regulations provide the framework for carrying out EIAs and EAs in Kenya.

This EIA project report is conducted in conformity with these regulations and EMCA, 1999.

14.4. Discretionary approvals required

The Act requires that projects acquire approval before their commencement. NEMA approves and issues an environmental license after the Environmental Impact Assessment or a project report depending on the extent to which the project satisfies it. This is also in compliance with the requirements of the Environmental Management and Coordination Act (EMCA) Part VI section 58 (1) and (2) which states:

Notwithstanding any approval, permit or license granted under this Act or any other law in force in Kenya, any person, being a proponent of a project, shall, before financing, commencing, proceeding with, carrying out, executing or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person any undertaking specified in the second schedule to this Act, submit a project to the authority in the prescribed form, giving the prescribed information and which shall be accompanied by the prescribed fee.

The proponent of the project shall undertake or cause to be undertaken at his own expense an environmental impact assessment study and prepare a report thereof where the authority, being satisfied, after studying the report submitted under Subsection (1), that the intended project may or is likely to or will have a significant impact on the environment, so directs.

14.5. Environmental Management and Co-ordination (Waste Management) Regulations 2006

These regulations define the responsibilities of waste generators and define 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 proponent shall adhere to the regulations and proposes to contract a NEMA registered waste transporter.

14.6. Environmental Management and Co-ordination (Noise and Excessive Vibrations Pollution) (Control) Regulations, 2009

The recently gazetted noise and excessive vibrations regulations require that noise and excessive vibrations should be minimized to the largest extent possible and that this should not exceed particular decibels. To minimize the impacts of noise and vibrations from the proposed activities, the activities will be limited to working hours between, 8.00 am and 5.00 pm. All possible care will be undertaken to ensure that the machinery are properly greased and oiled to reduce friction and possible noise emission.

The proponent shall strictly adhere to the provisions and requirements of these regulations.

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

Then law is based upon the principle that everybody is entitled to a healthy and clean environment. Section 42, pertinent to the implementation of this project

14.8. National Environmental Action Plan (NEAP)

According to NEAP, 1994 the Government recognized the negative impact on ecosystems emanating from development programmes that disregarded environmental sustainability. Established in 1990, the plan's effort was to integrate environmental considerations into the country's economic and social development. Under the NEAP process, EIA was introduced.

14.9. The world commission on environment and development–the Brundtland Commission of (1987)

The Brundtland Commission addresses the environmental aspects of development. It has emphasized on sustainable development that produces no lasting damage to the biosphere and to particular ecosystems. In addition to environmental sustainability is the economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resource.

The proponent is committed to adhere to the proposed EMP to ensure environmental enhancement and this would first be monitored through the initial environmental audit.

14.10. National Policy on Water Resources Management and Development

It enhances a systematic development of water facilities in all sectors for the promotion of the country's socio-economic progress, and recognizes the by-products of these processes as wastewater. It calls for development of appropriate sanitation systems to protect people's health and water resources from pollution.

The proponent has conducted a detailed analysis of the hydrology and water resources in the area and has provided designs for septic tanks to be used by individual plot owners.

14.11. Factories and Other Places of Work Act – (Cap. 514)

The Act aims at making provision for the health, safety and welfare of persons employed in factories and other places of work. Section 13 states that every factory shall be kept in a clean state and free from effluvia, arising from any drain, sanitary convenience or nuisance. Effective and suitable provisions is also proposed for securing, maintaining by circulation of fresh air in each workroom, the adequate ventilation of the room. Section 36 provides for precautions with respect to explosive inflammable dust or gas. The Section is specific that where in any building, if dust that could escape to work man's room and explode by ignition, steps must be taken to prevent such an explosion. Section 41 compels that in every factory; there shall be maintained fire extinguishers, which shall be adequate and suitable in case of fire out breaks. Similarly, it mandates every factory to provide adequate means of escape in case of fire outbreak for the employees. The Act further requires that if a factory worker is employed in any process involving exposure to wet or to any injurious or offensive substance, suitable protective clothing must be provided by the employer.

The proponent will appoint a reputable contractor who will be responsible for enforcing the requirements during construction and subsequent repairs and maintenance after project completion.

14.12. The Physical Planning Act (Cap. 286)

This is the principle Act governing land use planning in Kenya. The Physical Planning Act (Cap. 286), which commenced on 29 October 1998, aimed at developing a sound spatial framework for co-existence, through plan proposals that enhance and promote integrated spatial/ physical development of socio-economic activities. Because building/construction of residential houses constitutes making of material change to land, the activity constitutes "development", hence need to be controlled by local authorities. From the foregoing, the Physical Planning Act (Cap. 286) has made specific provisions in respect to the mandate of local authorities in the need for physical planning. The project proponent is required to acquire a Certificate of Compliance or approval letter from the relevant institutions as set out in the Act. The sole objective of the Act is to harmonize development.

- Section 24(1): the Director may prepare with reference to any Government land, trust land or private land within the area of authority of a city, municipal, town or urban council or with reference to any trading or marketing centre, a local physical development plan.

- Section 24(3): the Director may prepare a local physical development plan for the general purpose of guiding and co-coordinating development of infrastructure facilities and services for an area referred to in subsection (1), and for the specific control of the use and development of land or for the provision of any land in such area for public purpose.

- Section 25(b): a local physical development plan shall consist of such maps and description as may be necessary to indicate the manner in which the land in the area may be used According to Section 33 of the Physical Planning (Building and Development Control) Regulations, the Director of Physical Planning shall refuse to recommend any new building or proposed development, or alteration or addition to any existing building if:

    i. The proposal is not in conformity with approved development plan
    Such plans discloses a contravention of the physical planning (Building and Development) rules
    ii. The plans are not correctly drawn or omit to show information required
    on such being required, a separate application accompanied by sets of plans has not been lodged in respect of buildings on separate plots or subplots
    iii. The land or the proposed building or structure is not used for any purpose which might be calculated to depreciate the value of neighboring property or interfere with convenience or comfort of neighboring occupants
    iv. The proposed building or land use is unsuitable, injurious to amenities or detrimental in respect of appearance or dignity or fails to comply with physical planning requirements in regard to sitting, design, height, elevation, size, shape, structure or appearance

v. Roads of access, parking bays, vehicular and pedestrian circulation spaces or other services to the plot or premises are inadequate

vi. The building is not sited in a satisfactory position

vii. The system of drainage, including soil, waste and surface water of the plot, or subplot upon which the building is to or stand, is not satisfactory

viii. Provision has not been made for adequate natural light and ventilation, or any other physical planning issue Section 36 of the Act (Cap. 286) further compels that if in connection with a development application, a local authority is of the opinion that proposals for industrial location, or any other development activities (such as building developments) will have injurious impact on environment, the applicant will be required to submit together with application an environmental impact assessment report. The above provision compares well to Section 29 (a), which confers upon local authorities the powers to prohibit or control the use and development of land and buildings in the interests of proper and orderly development of its area.

The drawing (plans) of the proposed project has been submitted to the Muranga County Government for approved.

14.13. Local Government Act (Cap. 265)

This Act specifically sets out the procedures in administration of local authorities. Because of this, it clearly articulates the constitution as well as the conduct of all local authorities in Kenya. The Act empowers local authorities to control or prohibit all places of work that by reason of smoke, fumes, or chemical gases, dust smell, noise or vibration or other cause may be a source of danger, discomfort, or annoyance to the neighborhood, and to prescribe the conditions subject to which businesses, factories and workshops shall be carried on. Section 160 (a) underscores that every municipal council has the power to establish and maintain sanitary services for the removal and disinfection, or otherwise dealing with all kinds of refuse and effluent, such as spent oil, and where any such services is established, to compel the use of such services by persons to whom the service is available.

In compliance, EIA study report has proposed potential mitigation measures in the EMP and monitoring plan; and the environmental management Framework in the report.

14.14. Land Control Act (Cap 302)

Section 6(1) – Each of the following transactions;

(a) the sale, transfer, lease, mortgage, exchange, partition, or other disposal of or dealing with any agricultural land which is situated within a land control area;

(b) the division of any such agricultural land into two or more parcels to be held under separate titles, other than the division of an area of less than twenty acres into plots in an area to which the Development and Use of Land (Planning) Regulations, 1961 for the time being apply;

(c) the issue, sale, transfer, mortgage or any other disposal of or dealing with any share in a private company or co-operative society which for the time being owns agricultural land situated within a land control area; is void for all purposes unless the land control board for the land control area or division in which the land is situated has given its consent in respect of that transaction in accordance with this Act.

The proponent has already acquired all approvals for transfer of ownership to the buyers of the plots in the proposed development

14.15. Building Code 2000

In recognition of the role of local authorities as lead planning agencies, the adoptive by-law compels any potential developer to submit development application to relevant local authority for approval. The local authorities are empowered to disapprove any plan submitted if it is not correctly drawn or do not provide sufficient information that complies with the by-law. Any developer, who intends to erect a building such as a residential block, must give the concerned local authority a notice of inspection, before the erection of the structure. After erecting the building, a notice of completion shall be issued to the local authority to facilitate final inspection/approval. No person shall therefore occupy a building whose certificate of completion has not been issued by the local authority. As a precaution against fire breakout, the by-law states that the walls of any premise shall be non-combustible throughout, similarly, in every building, other than a small house, which comprises more than one storey, shall have fire resistance. The by-law, in Section 214 indicates that in any public building where floor is more than 20 feet

above the ground level, the council may recommend the provision of firefighting equipment that may include one or more of the following: hydrants, hose reels and fire appliances, external conations, portable fire appliances, water storage tanks, dry risers, sprinkler, drencher and water spray spring protector system.

All approvals will be sought before commencement of the work and regular monitoring will follow to ensure compliance with set standards and conditions.

14.16. Public Health Act- (Cap. 242)

Environmental degradation may pose a health hazard to the general public. This is among the factor considered by the Public Health Act to constitute "nuisance". For the interpretation of the Act, Section 15 (IX) indicates that any noxious matter or wastewater discharged from any premise, such as a building constitutes nuisance. Any premise not kept in a clean and free from offensive smell such as gases that are injurious to health such as those from commercial establishments shall therefore generate nuisance. The act therefore stresses that no person shall cause a nuisance to exist on any land or premise occupied by him. Because of the above, the Act acknowledge that it shall be the duty of all local authorities to take all lawful measures for maintaining its district at all times in a clean and sanitary condition for remedy of any nuisance or condition liable to be injurious to health. To safeguard against this, Part X of the Public Health Act states that where in the opinion of the Medical Officer of Health that food stuffs within a warehouse, or a building are insufficiently protected, the owner shall be compelled to observe the require regulations, else he shall be guilty of an offense.

For instance, the effluent will be discharged into septic tanks in every house and when full exhaustion will be by approved exhausters who will empty into designated sewers. The solid waste shall be handled by a professional garbage collector on regular basis and disposed appropriately as per the waste regulations. Sanitary facilities shall be in conformity with MOH standards and installation of standard fittings.

14.17. The Water Act, 2002

Part II, section 18, of the Water Act, 2002 provides for national monitoring and information systems on water resources. Section 73 of the Act allows a person with license (licensee) to supply water to make regulations for purposes of protecting against degradation of water sources. Section 75 and sub-section 1 allows the licensee to construct and maintain drains and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing pollution of water sources within his/her jurisdiction.

The proponent shall draw water from surface runoff within Makuyu area and will be collected in well-designed dams and reservoirs to a supply network and the individual developers will each construct a septic tank for sewerage. The proponent is also to drill boreholes in the proposed site to increase availability of water to the residents. There will be connection to the main water supply from Muranga County.

14.18. The Penal Code (Cap. 63)

The chapter on "Offences against Health and Conveniences" contained in the Penal Code enacted in 1930 strictly prohibits the release of foul air into the environment, which affects the health of other persons. Any person who voluntarily violates the atmosphere at any place, to make it noxious to health of persons in general dwelling or carrying out business in the neighborhood or passing along public ways is guilty of misdemeanor, i.e. imprisonment not exceeding two years with no option of fine. Under this code, any person who for the purpose of trade or otherwise makes loud noise or offensive awful smell in such places and circumstances as to annoy any considerable number of persons in the exercise of their rights, commit any offence, and is liable to be punished for a common nuisance, i.e. imprisonment not exceeding one year with no option of fine.

14.19. The World Commission on Environment and Development

The commission commonly referred to as "the Brutland Commission" focused on the environmental aspects of development, in particular, the emphasis on sustainable development that produces no lasting damage to biosphere, and to particular ecosystems. In addition, environmental sustainability is the economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability

occurs within available financial resources. While social sustainable development maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and well-being, adequate nutrition, and shelter, cultural expression and political involvement.

14.20. The Rio Declaration on Environment and Development

Agenda 21 – a programme of action for sustainable development worldwide, the Rio Declaration on Environment and Development was adopted by more than 178 governments at the United Nations Conference on Environment and Development, known as the Earth Summit, held in Rio de Janeiro, Brazil from 3rd to 14th June 1992.

Principle No. 10 of the declaration underscored that environmental issues are best handled with participation of all concerned citizens at all the relevant levels. Effective access to judicial and administrative proceedings, including redress and remedy shall be provided. The foregoing discussion is relevant to the proposed development because EMCA demands that the public must be involved before a proponent initiates any development project that is likely to have adverse impacts to the environment. The Act has further established Public Complaints Committee (PCC) where the issues raised by the public concerning any proposed development can be addressed.

14.21. Sessional Paper No. 6 of 1999 on Environment and Development

Every person in Kenya is entitled to a clean and healthy environment and has a duty to safeguard and enhance the environment (Kenya, 1999). As envisioned in Sessional Paper No. 6 of 1999 on Environment and Development, Kenya should strive to move along the path of sustainable development to meet the needs of the current generation without compromising the ability of the resource base to meet those of future generations. The overall goal is hence to integrate environmental concerns into the national planning and management processes and provide guidelines for environmentally sustainable development (Kenya, 1999). The policy paper emphasized environmental impact assessments must be undertaken by the developers as an integral part of a project preparation. It also proposed for periodic environmental auditing to investigate if developer is fully mitigating the impacts identified in the assessment report.

14.22. The National Environmental Action Plan (NEAP)

The NEAP for Kenya was prepared in 1994. It was a deliberate policy to integrate environmental considerations into the country's social and economic development process. The integration was achieved through multi-sectoral approach to develop a comprehensive framework to ensure that environmental management and conservation of natural resources is an integral part of societal decision-making process.

14.23. 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 for the proposed housing developers to invest in shelter.

This is the role the proponent wishes to contribute to by investing and providing shelter to people.

14.24. 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% by the year 2015; as well as strengthening the capabilities of the poor and vulnerable groups to earn income. It also aims to narrow gender and geographical disparities and create a healthy, better-educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for Social Development (WSSD) of 1995. The plan focuses on the four WSSD themes of the poverty eradication; reduction of unemployment; social integration of the disadvantaged people and the creation of an enabling economic, political, and cultural environment. This plan is to be implemented by the Poverty Eradication Commission formed in collaboration with Government ministries, community based organizations, and private sector such as the proposed development will create employment opportunities for Kenyans, hence contributing to poverty eradication.

14.25. The Poverty Reduction Strategy Paper (PRSP)

The PRSP has the twin objectives of poverty reduction and economic growth. The paper articulates Kenya's commitment and approach to fighting poverty; with the basic rationale that the war against poverty cannot be won without the participation of the poor themselves. The proposed project during and after implementation, will offer jobs to many Kenyans as a way of contributing to this noble objective of reducing poverty in the nation.

15. Institutional Framework

The environmental impact assessment for the proposed development is bound to be influenced by the operational interests of several lead agencies. These include, but not limited to the following key institutions:

15.1. County of Muranga

The County of Muranga is the principle lead agencies on all matters pertaining to planning within the proposed site. The County Governments' Act (Cap 265) clearly defines the functions of this key institution. Section 166 empowers the count to be responsible for local planning and development control in the region. The Physical Planning Act (Cap 286) also confers upon local authorities the powers to control development in their areas of legal jurisdiction.

16. Public Participation

A public meeting was held on the site of the proposed development. The meeting was attended by 20 participants all from the neighbourhood and comprising of men and women. Local administration was also represented by the area chief and assistant chief. The local member of the county assembly was present but the local Member of Parliament was absent with apology for he as travelling abroad during the time of the meeting.

Public consultation is crucial in any development agenda. EMCA, 1999 treats the environment as one entity as opposed to the previous situation where each segment of the environment had its own laws. This section has been based upon the principle that local communities have a right to participate in making decisions on matters that have significant effect on the environment. The information obtained from both field visits and public consultations formed the basis for

incorporation of public views into this report. In this public participation, a public meeting was held with the interested and affected parties by the proposed mixed use development works. The stakeholders were requested to express their views about the proposed project. The issues that were raised during the public participation were recorded as indicated below:

16.1. Issues raised

The following were the issues raised, recommendation proposed and general opinion of the public concerning the project.

16.1.1. Employment Opportunities

The stakeholders in the meeting were optimistic that the project will create numerous employment opportunities for both skilled and unskilled labor alike from the construction phase to the operational phase.

16.1.2. Noise and Vibration

There was concern over the possibility of high noise and vibration levels at the project site as a result of construction works. The stakeholders expressed fears of noise and vibrations from the project activities. The sources of noise pollution will include transport vehicles, construction machinery, metal grinding and cutting equipment. However, the proponent will take appropriate steps to minimize noise impacts including provision of appropriate protective equipment to construction workers, planning and minimizing the frequency of materials transportation, and ensuring that the neighbors are well informed through a notice as required by law. The contractor and/or the proponent should ensure that works are carried out during daytime i.e. from 8 Am to 5 Pm.

16.1.3. Waste disposal

The people expressed concern over possibility of generation of large volumes of solid waste during the construction and operation of the building. The proponent should ensure that the waste are collected at all times and disposed in appropriate manner to ensure a clean and healthy environment for all.

16.1.4. Increased security

The neighbors expressed their confidence that proposed project will lead to increased security in the area during its operational stages. Many security guards will be employed and hence the neighbors will benefit from such security. Furthermore, security lights and CCTV (Close Circuit Television) are likely to be put all over the site to enhance security within and of the neighboring areas.

16.1.5. Environmental concerns

Even though some of the trees and vegetation cover may be cleared to pave way for the proposed development on the site, this will create a negative impact to the environment. Most of the respondents propose that a major landscaping be done in the area hence leading to the beautification of the environment.

16.1.6. Air pollution

The area residents and the neighbors raised concerns that air pollution is likely to occur during the construction phase in form of dust particulate matter emissions and greenhouse gases from the construction machines. They suggested that dust covers to be used during the transportation of materials like cement and sand. The proponent will take all the appropriate measures to curb all forms of air pollution as much as possible.

Names of public participants

Name of Respondent	Gender	Contact
Hon.Danson Mburu Muchoki	Male	MCA Makuyu ward
Francis Waweru Wakaba	Male	0722734838
Danson Maina Njuguna	Male	0722831570
Rebeccah Mwangi	Female	0723068117
Peter Wamwea Ng'ang'a	Male	0708355830
Danson Njogu Mwangi	Male	0701263495
Lucy Mugure Wamwea	Female	0708355830
Moses Waweru Nyoike	Male	0710613411

Anthony Mwangi	Male	0733881809
Peter Mbugua Mungai	Male	0720676879
Simon Kinuthia (Chief)	Male	0720460610
Ngure Tito	Male	0700898124
Ndung'u Kiarie	Male	0731367692
Simon Ngige Njogu	Male	0723862080
Eunice Wacera	Femal	0700435708
Charity Nyawira	Female	0735788889
Susan Muthoni	Female	0731185992
Joyce Wangui	Female	0727337166
Kaluku Maina	Male	0728405550
Robert Kihiko	Male	0722233758

The public participation process affirmed support for the implementation of the proposed Mixed Use project. The major concern was with Construction time. It was recommended that the construction works be carried out during the day when people are out for work.

A photograph of participants of public participation meeting held on the project site.

A summary of percentages of respondents on different issues of the environment

Reponses	**Number of Respondents**	**Percentage**
The proposed project will increase population and enhance security	17	85
The proposed development will benefit the locals by the increased social amenities	20	100
The project will increase jobs and businesses as it will utilize locally available materials and labour	20	100
The project will beautify the environment as there will be more trees and managed landscapes	18	90
The development will stop wildlife from destroying crops in the human settled areas	15	75
The development will encourage people who have deserted their land to come back to the warmer neighbourhood.	8	40
While there are many positive impacts identified by the respondents the following were mentioned by all respondents: Increase in employment; improvement in roads	20	100

infrastructure; increase in business opportunities; and increase in land value.		
The development will increase demands for water that is already scarce.	7	35
The development will cause air pollution from dust and noise.	12	60
There will be a lot of solid and liquid waste from the residents	5	25
Among the mitigation measures suggested by the public are: a) Drill boreholes to tap ground water	6	30
b) Provide water to the community surrounding the development	18	90
c) provide water to wildlife at an appropriate location near the development	5	25
d) The areas not developed should be left intact with the present vegetation	14	70
e) The locals should be considered first during hiring for construction	20	100

Some of the findings as captured from the questionnaire were analyzed as shown below:

Perceived Negative Impacts

Respondents were asked to point out any negative impacts they think might arise from the proposes project

Question	Responses	%age
Perceived environmental impacts	Dust	31%
	Noise	23%
	Flooding	15%
	Loss of business	8%
	Traffic Congestion on the road	23%
Total		**100%**

A good percentage of respondents were concerned about dust emissions during construction especially from movement of heavy earth moving machineries.

Noise and traffic congestion also scored substantially high among the respondents.

Workshop participants were asked to propose ways mitigation measures to their environmental concerns can be taken to their satisfaction.

Mitigation measures proposed by respondents.

Question No	Responses	%age
Management of pollution	Keeping the area clean	18%
	Managing movement of vehicles	9%
	Pouring water on the construction areas	36%
	Using machine in good condition	36%
Total		**100%**

For the negative impacts that they anticipate, the respondents proposed that the project designers, planners and contractors should consider pouring water to reduce dust that will be produced in

the area. Use of new machines that will not produce a lot of noise, avoid accumulation of wastes (solid wastes) to the ground hence keep the area clean and manage vehicle movement in the project area and on roads leading to the project area

Workshop participants were asked how the positive measure could be enhanced. The table below shows the percentages of their responses.

Question No	Responses	%age
How to enhance positive impacts	Improve business	14%
	Improve security	29%
	Monitoring vehicle movement	29%
	manage wastes from the project area	14%
	Observing hygiene	14%
Total		**100%**

When the project will be completed, it will improve access to the area. The respondents recommended constant monitoring to ensure roads are preserved as well and traffic also regulated. When the project is done, the respondents suggested that the new residents / homeowners should maintain cleanliness through collection of garbage even after the developers finally leave the project.

All the respondents agreed that the project is necessary and will lead to development they were cautious that during the operational phase there will be some negative impacts such as presence of dust that was ranked the highest, noise and temporally inconveniences to customers a result of loss of parking space. Owing to the regular rainfall that is witnessed in the area, loss of business may be big even to owners of homes in the area depending on the time that the project is conducted.

17. Potential environmental impacts

This Section identifies both negative and positive impacts associated with the proposed development. These are identified according to the proposed project phases namely: Construction Phase, Operational Phase and the Decommissioning Phase.

17.1. Construction phase

17.2. Positive Impacts

17.2.1. New residential areas

With the coming up of the proposed project, cases of insecurity will reduce given that the project will attract more people hence scaring away ill minded people. The project will come along with security details, which will be a benefit to the society as well.

17.2.2. Immediate Impacts during construction

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

17.2.3. Employment Opportunities

There will be job opportunities especially to casual workers. Employment opportunities are a benefit both in economic and social sense. In the economic sense, it means abundant unskilled labor will be used in economic production. In the social sense, these young and energetic otherwise poor people will be engaged in productive employment other than remaining idle. Remaining idle may attract them into social ills like drug abuse and other criminal activities like robberies. Several workers including casual laborers, masons, carpenters, joiners, electricians and plumbers are expected to work on the site for a period that the project will start to the end. Apart from casual labor, semi-skilled and unskilled labor and formal employees are also expected to obtain gainful employment during the period of construction.

17.2.4. Gains in the Local and National Economy

There will be gains in the local and national economy. Through consumption of locally available materials including: concrete tiles, timber and cement. 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.

17.2.5. Provision of Market for Supply of Building Materials

The project will require supply of large quantities of building materials most of which will be sourced locally within Murang'a area and the surrounding areas. This provides ready market for building material suppliers such as quarrying companies, hardware shops and individuals with such materials.

17.3. Negative Impacts

17.3.1. Soil erosion

The site slopes gently and possibilities of soil erosion occurring during construction are high specifically during rainy and windy seasons. Soil erosion is an important problem both at its source and downstream of the development site. Lost soil will be deposited somewhere, and the location of the deposition could alter downstream hydrology and increase flooding. It may also pose a water quality issue directly because of siltation and indirectly from contaminants carried with or attached to soil particles.

17.3.2. Storm water

There is a likelihood of interference of the construction operation from the storm water runoff either from the site or from the neighboring compounds. The situation is made worse due to the site gradient with respect to the neighboring plots as pointed out in 6.1.2.1 above.

17.3.3. Noise pollution

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

17.3.4. Disposal of excavated soil

Site excavations shall be done to the satisfaction of the Principal Consultant's specification hence some materials shall be rejected as waste for disposal. In-judicial disposal of this category of waste may have adverse impacts on the receiving environment.

17.3.5. Oil spills

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

17.3.6. 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 the preparation of concrete for construction works and for wetting surfaces, curing or even cleaning completed structures.

17.3.7. Dust emissions

Particulate matter pollution is likely to occur during the site clearance, excavation and spreading of the topsoil. There is a possibility of PMB_{10} suspended and settle able particles affecting the site workers and even neighbors health.

17.3.8. Human feacal waste management

The construction workers will generate human feacal waste during their day-to-day operations. The generated waste needs proper handling to prevent disease, for example diarrhea, outbreak on the site.

17.3.9. Food kiosks and mushrooming of informal settlement

There is a likelihood of food kiosks starting to appear more so close to the project site due to the meal demands from the construction workers. Most of the foods sold at such places are cheap. The food kiosk owners will be looking for shortcut means to get easy money.

The proposed mixed-use development project may involve mushrooming of informal settlements in the surrounding area owing to workers preference to stay near their places of work. The long-term negative impact again will be the mushrooming of informal settlements in the neighborhood owing to the job opportunities that would be available in the domestic sector. It is common to see people camping outside the entrance of estates in different places in Kenya waiting to be contracted for a day's work in the domestic sector. Such people would be attracted to settle in the

neighborhood for that purpose. Such settlements often compromise security in the neighborhood. However, workers accommodation has been included in the development plan so that this issue is dealt with as far as is directly possible within the development.

17.3.10. Destruction of existing vegetation

The construction process will involve clearing of the existing vegetation cover. The developer intends to replace this with planting of many indigenous and other useful firewood and fodder trees and grass in all the gardens and strategic green areas as proposed in the landscape plan.

17.3.11. Generation of exhaust emissions

Exhaust emissions are likely to be generated by the construction equipment during the construction phase. Motor vehicles used to mobilize the work force and materials for construction would cause a potentially significant air quality impact by emitting pollutants through exhaust emissions. Because large quantities of building materials are required, some of which will be sourced outside Murang'a area, 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 because of frequent gunning of vehicle engines, frequent vehicle turning and slow vehicle movement in the loading and offloading areas.

17.3.12. Increased runoff from new impervious areas

Construction of houses, parking areas and paved roads could result in additional runoff through creation of impervious areas and compaction of soils. Impervious areas and compacted soils generally have higher runoff coefficients than natural area, and increased flood peaks are a common occurrence in developed areas.

17.3.13. Surface and ground water hydrology and water quality degradation

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

Project related excavation could lead to surface and ground water quality degradation. Contaminated soil or ground water in the path of the project could be disturbed by excavation resulting in a potential transfer of the contamination to surface waters. The excavated area, if linear could act as a conduit to extend groundwater contamination to new areas. Spills of hazardous materials in excavated areas during construction could introduce contaminants to ground water. Development activities such as residential construction as well as the spillover effects of development such as increased demand for drinking water and increased water use can impact water quality by contributing sediment, nutrients, and other pollutants to limit water supplies, increasing the temperature of the water, and increasing the rate and volume of runoff.

17.3.14. Workers accidents and hazards during construction

During construction of the mixed-use development project, it is expected that construction workers are likely to have accidental injuries and hazards because of handling hazardous waste. Because of the intensive engineering and construction activities including erection and fastening of roofing materials, 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 metal sheets and collapse of building sections among others.

17.3.15. Vector borne and water borne disease incidence

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

17.3.16. Possible exposure to workers to diseases

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

17.3.17. Solid waste generation

During construction, solid waste will be generated. These include papers used for packing cement, plastics and timber remains among others. Dumping around the site will interfere with the aesthetic status of the area. This has a direct effect to the surrounding community. Disposal of the same solid wastes off-site could also be a social inconvenience if done in the wrong places. The off-site effects could be aesthetic, pest breeding, pollution of physical environment, invasion of scavengers and informal recycling communities.

17.3.18. Loss of plant species and communities

Direct impact results from disturbances that cause changes in temperature, light, moisture and nutrient levels; removal activities (e.g. clear-cutting, bulldozing); impacts resulting from air and water pollution (e.g. turbidity, eutrophication). Indirect impacts result from changes in natural community processes or invasion of non-native plant species. Loss of plant communities also results in decreased water quality, increased erosion because of unstable soil, nutrient imbalances in the soil, and/or compaction of soil.

17.3.19. Extraction and use of building materials

Building materials such as hard core, ballast, cement, rough stone and sand required for construction of the project will be obtained from quarries, hardware shops and sand harvesters who extract such materials from natural resource banks such as rivers and land. Since substantial quantities of these materials will be required for construction of the buildings, the availability and sustainability of such resources at the extraction sites will be negatively affected, as they are not renewable in the short term. In addition, the sites from which the materials will be extracted may be significantly affected in several ways including landscape changes, displacement of animals and vegetation, poor visual quality and opening of depressions on the surface leading to several human and animal health impacts.

17.3.20. Energy consumption

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

18. Operation phase

18.1. Positive Impacts

18.1.1. Employment creation

Employment opportunities are one of the long-term major impacts of the development project that will be realized after construction and during the operation and maintenance of the mixed-use facility. These will involve security personnel, solid waste management staff, businesses that will be located within the project. Other sources of employment will involve direct service provision to the development services e.g. caretakers and cleaning services etc.

18.1.2. Individual investments

Economically the sale of the pieces of land is an investment good to the individual investor. Through selling the plots, the owner is able to earn some income. Property is also used as collateral as they are an assets to the investor mainly in this case first time buyers who are young professionals.

18.1.3. Optimal use of land

Being a state of the art mixed use development project there is a potential of greatly improving quality of services by constructing high quality buildings. Land is a scarce resource in Kenya and through construction of the proposed project will ensure optimal use of land to the great benefit of the country and its people.

18.1.4. Increased Recreational facilities

Recreational facilities including a gym, swimming pools, golf course will also be established in the area as part of the proposed project. This will enable local residents' access affordable recreational facilities without going too far.

18.1.5. Increased Security in the area

The proponent will put up several streetlights and employ several security guards during the operational phase of the project. This is expected to boost the general security of the area especially at night. The area will be opened up and made secure during the operational phase.

18.1.6. Increased Social Amenities

The proposed mixed-use facility and support infrastructure developments in the project will result in affordable amenity institutions established in the area. This will benefit the entire community, as some of nearby residents will visit such areas to shop and relax.

18.2. Negative Impacts

18.2.1. Increased population without commensurate services and facilities

With development of the facility and associated infrastructure such as communal facilities clearly means that many people are expected to visit and reside on the proposed site. This will increase the density of resident population in the area and if this population is not provided with the appropriate services and facilities then pressure on existing facilities is bound to increase.

18.2.2. Increased pressure on infrastructure

Development projects of this magnitude have a potential of increasing pressure on existing infrastructure such as roads, water supply system, waste handling facilities, electricity etc. This would be due to increased volumes on human and vehicle traffic along the access road.

18.2.3. Air pollution

Poor solid waste management could lead to blocking of drains especially when the project is in existence and this can lead to flooding and unsanitary conditions within the facilities. Blocked drains produce bad odor hence are environmentally unfriendly. The project management

proposes to have good controlled and well-managed waste management to avoid this from occurring.

18.2.4. Water pollution

If the sites for dumping solid wastes are not well taken care of, they may cause contamination to ground water sources and form breeding areas for mosquitoes; this may cause human diseases like malaria and cholera. 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.

18.2.5. Electricity consumption

The project shall consume large amount of electricity due to the number of the residential plots and other support infrastructure being proposed and the activities that will take place once the project is complete. Since electric energy in Kenya is generated mainly through natural resources, namely water and geothermal resources, increased use of electricity have adverse impacts on these natural resources base and their sustainability.

18.2.6. Insecurity/social crime

The project will introduce permanent and temporary residents on the proposed site. This implies increased operations that may make it more difficult to monitor and control. As mentioned earlier, the project may encourage development of informal settlements in the vicinity. However, measures have already been taken to deal with insecurity in the area. The developer will put measures to ensure there is security by engaging a reputable security firm to guard the area, undertake street lighting and install security lights that will benefit the surrounding areas.

18.2.7. Solid waste generation

The project is expected to generate enormous amounts of solid waste during its operation phase. The bulk of the solid waste generated during the operation of the project will consist of paper, plastic, glass, metal, textile and organic wastes. Such wastes can be injurious to the environment through blockage of drainage systems, choking of water bodies and negative impacts on animal health. Some of the waste materials especially the plastic/polythene are not biodegradable hence

may cause long-term injurious effects to the environment. Even the biodegradable ones such as organic wastes may be injurious to the environment because as they decompose, they produce methane gas, a powerful greenhouse gas known to contribute to global warming.

18.2.8. Increased storm water flow

The building roofs and pavements will lead to increased volume and velocity of storm water or run-off flowing across the area covered by the plots. This will lead to increased amounts of storm water entering the drainage systems, resulting in overflow and damage to such systems in addition to increased erosion or water logging in the neighboring areas.

18.2.9. Water use

Activities during the operation phase of the project will involve the use of large quantities of water as a result of activities that will take place and the large number of people that stay there.

19. Decommissioning phase

19.1. Positive Impacts

19.1.1. Rehabilitation

Upon decommissioning of 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 that will lead to improved visual quality of the area.

19.1.2. Employment opportunities

Several employment opportunities will be created for the demolition staff.

19.2. Negative Impacts

19.2.1. Solid waste

Demolition of the project buildings and related infrastructure will result in large quantities of solid waste. The waste will contain the materials used in construction including concrete, metal, drywall, wood, glass, paints, adhesives, sealants and fasteners. Although demolition waste is generally considered as less harmful to the environment since they are composed of inert materials, there is growing evidence that large quantities of such waste may lead to release of

certain hazardous chemicals into the environment. In addition, even the generally non-toxic chemicals such as chloride, sodium, sulphate and ammonia, which may be released because of leaching of demolition waste, are known to lead to degradation of groundwater quality.

19.2.2. Dust

Large quantities of dust will be generated during demolition works. This will affect demolition staff as well as the neighboring residents.

19.2.3. Noise and Vibration

The demolition works will lead to significant deterioration of the acoustic environment within the project site and the surrounding areas.

20. Mitigation Measures

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 analyzed under two categories: Construction and Operational.

20.1. Mitigation of construction related impacts

20.1.1. Air quality

Controlling dust during construction is useful in minimizing nuisance conditions. It is recommended that a standard set of feasible dust control measures be implemented for all construction activities. Emissions of other contaminants (NOx, CO_2, SOx, and diesel related PMB_{10B}) that would occur in the exhaust from heavy equipment are also included. The proponent is committed to implementing measures that shall reduce air quality impacts associated with construction. All personnel working on the project will be trained prior to starting construction on methods for minimizing air quality impacts during construction. This means that construction workers will be trained regarding the minimization of emissions during construction. Specific training will be focused on minimizing dust and exhaust gas emissions from heavy construction vehicles. Construction vehicles 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 construction areas as and when necessary to lay dust.
- Cover all trucks hauling soil, sand and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Pave, apply water when necessary, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.
- Sweep daily (with physical sweepers) all paved access roads, parking areas and staging areas at 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.
- Project will be undertaken in phases to cushion the cumulative effects of dust which would be great in case the project is done at once.

20.1.2. 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 permanent increase in ambient noise levels (more than five dBA) in the project vicinity above levels existing without the project.
- 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 minimize 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 substation construction activities in the 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.
- Construction/Demolition 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.

20.1.3. Minimize the effects of exhaust emission

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

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

20.1.4. Minimize traffic related impacts

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. By implementing the Traffic Management Plan, most of these impacts will be reduced significantly.

- *Warning signs*, aimed at both drivers and other road users, to highlight hazards will be erected along nearby road.
- *Demarcated pedestrian crossings* will be established at appropriate points along the route between the proposed project site and the nearby junctions.

- *Barriers* to separate vulnerable road users (pedestrians and cyclists) from vehicle traffic in high-risk areas will be considered in the project area.

20.1.5. Trip Reduction Measures

Reducing the amount of time spent travelling and the number of trips undertaken is an effective means of reducing exposure to risk. The proponent will implement systems aimed at achieving this, these will include:

- *Greater use of electronic means of communication as a substitute for delivering communication by road.*
- *Scheduled trips for regular business (including banking, purchasing, postage collection, etc.) to Nairobi City or Murang'a town to avoid unnecessary additional trips.*
- *Co-ordination of all trips to the town so as to ensure they are kept to a minimum.*
- *Management of commuter transport for employees to and from work to optimize the number of trips required.*

20.1.6. Encouraging Use of Safer Modes of Transport

Encouraging employees to utilize safer modes of transport will minimize their exposure to risk. Although cycling and walking can bear relatively high risks, cyclists and pedestrians pose less risk to other road users when compared to drivers. The proponent will encourage safer modes of transport by:-

- *Encouraging use of the contractor commuter transport in preference to public transport or private transport.*
- *Providing a secure and covered shelter for bicycles at the construction site.*
- *Assisting cyclists in acquiring reflective vests and suitable safety reflectors and lighting for their bicycles.*
- *Discouraging the use of bicycles and motorcycles on public roads where the proponent's commuter transport is available.*

20.1.7. Minimizing Disruption to Non-Project Road Users

The proponent is committed to minimizing the disruption caused to surroundings community members and non-project road users by its activities. To achieve this, the proponent will implement the following measures:-

- *All project vehicles will be required to adhere to speed limits determined by the proponent or the legal speed limit, whichever is lower, and these will be enforced and subject to monitoring.*
- *Reduced speed limits will be set for night driving*
- *Project vehicles will have electronic data recorders / transponders fitted which will, in addition to other data, be able to record vehicle speed. These will be analyzed regularly to determine adherence to Project speed limits and driving regulations.*
- *Dust suppression mechanisms, such as water spraying, will be in operation along the dirt access road from main roads to the site to reduce the amount of dust generated by Project vehicles using the road*
- *All project-related vehicles will have proponent's signage affixed on them.*
- *All project-related vehicles will be fitted with enhanced vehicle visibility aids.*

20.1.8. Self Safety Impact Assessments

The safety impact of the project's transport should give consideration to its effect on the road system in which it is operating. This can include strategies aimed at improving mobility, reducing congestion and improvements that are compatible with road safety. During operation of the project, periodic safety impact assessments should be carried out along the transport route. The purpose of the Safety Impact Assessments will be to collect data on the use of the road and the effectiveness of traffic management measures along the route.

With strict adherence to the proposed Traffic Management mitigation measures above, in close collaboration with the relevant Government Ministries and the Murang'a Traffic Department, the proponent will be able to handle all the traffic management issues related to the proposed project. However, regular monitoring and evaluation exercise should be carried out to check the effectiveness of the proposed plan.

20.1.9. 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 construction, and will include an emergency response programme to ensure quick and safe clean-up of accidental spills. The plan will identify areas where refueling and vehicle maintenance activities and storage of hazardous materials, if any, will be permitted.

Soil sampling and trial holes digging will be conducted before construction begins and soil information will be provided to construction crews to inform them about soil conditions and potential hazards. If hazardous substances are unexpectedly encountered during trenching, work will be stopped until the material is properly characterized and appropriate measures are taken to protect human health and the environment. If excavation of hazardous materials is required, they will be handled in accordance with applicable regulations. If suspected contaminated groundwater is encountered in the depths of the proposed construction areas, samples will be collected and submitted for laboratory analysis of petroleum hydrocarbons, metals, volatile organic compounds and semi-volatile organic compounds. If necessary, ground water will be collected during construction contained and disposed of in accordance with all applicable regulations. Appropriate personal protective equipment will be used and waste management will be performed in accordance with applicable regulations. Oil absorbent material, tarps and storage drums will be used to contain and control any minor releases of engine and other equipment oil.

20.1.10. Worker accidents and hazards when 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.

20.1.11. Populations of disease vectors

Disease vectors such as rats, flies, and cockroaches increase where refuse is exposed or uncollected and can be a hazard. Complete refuse collection and handling service will be provided by the proponent so that this is not a hazard in compliance with the Public Health Act and as also required in the Occupational Safety and Health Act, 2007 regarding hygiene at the workplace.

20.1.12. Increased runoff

Increased run off from paved grounds and expansive roofs causing extreme flooding and overflows of drainage systems shall be mitigated. Surface runoff and roof water shall be harvested and stored in underground reservoir 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.

20.1.13. Possible exposure of workers to diseases

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

20.1.14. Worker accidents during construction and operation

Workers accidents especially in deep trenching operations and from gas accumulation in sewers and other confined spaces 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.

20.1.15. Reduction of impacts at extraction sites and efficient use of raw materials

The proponent will source building materials such as sand, ballast and hard core from registered quarry and sand mining firms, whose projects have undergone satisfactory environmental impact assessment/audit and received NEMA approval. Since such firms are expected to apply acceptable environmental performance standards, the negative impacts of their activities at the extraction sites are considerably well mitigated.

To reduce the negative impacts on availability and sustainability of the materials, the proponent will only order for what will be required through accurate budgeting and estimation of actual construction requirements. This will ensure that materials are not extracted or purchased in excessive quantities. Moreover, the proponent will ensure that wastage, damage or loss (through run-off, wind, etc) of materials at the construction site is kept minimal, as these would lead to additional demand for and extraction or purchase 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 for raw materials extracted from natural resources as well as reducing impacts at the extraction sites.

20.1.16. Minimization of vegetation disturbance

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

Another important measure aimed at reducing disturbance of vegetation in the project area will be preservation of individual trees within the site. In addition, the proponent has committed 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 construction site be re-spread in areas to be landscaped to enhance plant health. The Proponent shall undertake the project in phases with areas completed re-vegetated as required in the site-landscaping programme.

20.1.17. 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 construction. These measures will include terracing and leveling the project site to reduce run-off velocity and increase infiltration of rainwater into

the soil. In addition, construction 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.

20.1.18. Minimization of construction waste

It is recommended that demolition and construction waste be recycled or reused to ensure that materials that would otherwise be disposed of as waste are diverted for productive uses. In this regard, the proponent is committed to ensuring that construction materials left over at the end of construction will be used in other projects rather than being disposed of. In addition, damaged or wasted construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects. Such measures will involve the sale or donation of such recyclable/reusable materials to construction companies, local community groups, institutions and individual residents or homeowners.

The proponent shall put in place measures to ensure that construction materials requirements are carefully budgeted and to ensure that the amount of construction materials left on site after construction is kept minimal.

It is further recommended that the proponent should consider the use of recycled or refurbished construction materials. Purchasing and using once-used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste.

Additional recommendations for minimization of solid waste during construction of the project include:-

i. Use of durable, long- lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time
ii. Provision of facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements
iii. Purchase of perishable construction materials such as paints incrementally to ensure reduced spoilage of unused materials
iv. Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste

v. Use of construction materials containing recycled content when possible and in accordance with accepted standards.

20.1.19. Reduction of energy consumption

The proponent shall ensure responsible electricity use at the construction site through sensitization of staff to conserve electricity by switching off electrical equipment or appliances when they are not being used. In addition, proper planning of transportation of materials will ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts. Complementary to these measures, the proponent shall monitor energy use during construction and set targets for reduction of energy use.

20.1.20. Minimization of water use

The proponent shall ensure that water is used efficiently at the site by sensitizing construction staff to avoid irresponsible water use. The proponent will install water-conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and qualified staff will fix faulty taps promptly.

20.1.21. Controlling oil spills during construction phase

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

20.1.22. 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. The workers, immediate neighbor and other stakeholders should be sensitized on the dangers and risk associated with the construction works for enhanced self responsibility on personal safety.

v. The proponent should ensure that the completed buildings are fitted with safety facilities including fire detectors, firefighting equipment, fire exits, adequate access and buffer between the residential premises.

vi. Disabled access features and safety signage should be placed strategically around and within the buildings.

vii. Appropriate sanitation conveniences should be provided at the site as required in the OSHA, 2007 and echoed in the Public Health Act.

20.2. Mitigation of operation phase impacts

20.2.1. Ensuring efficient solid waste management

The proponent will be responsible for efficient management of solid waste generated by the project during its operation. In this regard, the proponent will provide waste handling facilities such as waste bins and skips for temporarily holding domestic waste generated at the site. In addition, the proponent will ensure that such disposed of regularly and appropriately. It is recommended that the proponent put in place measures to ensure that the occupants of the mixed-use development units manage their waste efficiently through recycling, reuse and proper disposal procedures.

A lot of solid wastes will be generated from the proposed development project. An integrated solid waste management system is recommendable. First, the proponent will give priority to Reduction at Source of the materials. This option will demand a solid waste management awareness programme in the management and the residents. Secondly, Recycling, Reuse and compositing of the waste will be the second alternative in priority. This will call for a source separation programme to be put in place. The recyclables will be sold to authorized waste

buyers. The third priority in the hierarchy of options is combustion of the waste that is not recyclable in order to produce energy. Finally, sanitary land filling will be the last option for the proponent to consider. The proponent will adhere to the Environmental Management and Coordination (Waste Management), Regulations 2006.

20.2.2. Wastewater management

The proponent will ensure that there are adequate means for handling the large quantities of sewage generated at the residential houses. It will also be important to ensure that sewage pipes are not blocked or damaged so that the waste can be delivered to the recommended Bio Box Treatment System or biodigester since such vices can lead to release of the effluent, resulting in land and water contamination. Such blockages or damages will be fixed expeditiously. Wastewater shall be disposed in compliance with the provisions of the Environmental Management and Coordination (Water Quality), Regulations 2006.

20.2.3. Ensure efficient energy consumption

The proponent plans to install an energy-efficient lighting system at proposed facility. This will contribute immensely to energy saving during the operational phase of the project. In addition, occupants of the plots will be sensitized to ensure energy efficiency in their domestic operations. To complement these measures, it will be important to monitor energy use during the operation of the proposed estate and set targets for efficient energy use.

20.2.4. Ensure general safety within the premises

A perimeter fence will be erected round the plot, street lighting done and a security lighting system installed. A competent security firm may be engaged to ensure the general safety and security at all times within and around the premises.

20.2.5. Ensure efficient water use

The proponent will install water-conserving automatic taps and toilets. Moreover, any water leaks through damaged pipes and qualified staff will fix faulty taps promptly. In addition, the occupants of the residential maisonettes and school and community centre administration will be sensitized to use water efficiently.

20.2.6. Increased pressure on the existing infrastructure

It is recommended that the proponent should liaise closely with other development partners and Government/Council Departments to upgrade the existing shared facilities including roads, water distribution systems etc. The proponent should as well explore alternative means which are environmentally sound like employing the Green Energy Technologies when and where applicable like the use of Solar Panels in water heating among others. This will rather reduce the over dependence on fossils based energy sources which are arguably presently threatened with the idea of having a private borehole in itself being a way of relieving an existing water supply system.

20.3. Mitigation of decommissioning phase impacts

20.3.1. Efficient solid waste management

Solid waste resulting from demolition or dismantling works will be managed as described earlier

20.3.2. Reduction of Dust Concentration

High levels of dust concentration resulting from demolition or dismantling works will be minimized as described earlier

20.3.3. Minimization of Noise and Vibration

Significant impacts on the acoustic environment will be mitigated as described earlier.

21. Impacts Identification, Analysis and Mitigation Measures

21.1. Introduction

Construction activities involve a series of defined physical operations which include site preparation; excavation works, building works etc. All are potentially considerable sources of particular impacts both significant and insignificant. On completion, the activities during the operational phase also have potential impacts.

The project structures have already been designed which makes it easier to be specific on the particular impacts expected from their development. Recommendations from this study may result in alteration of some or all of the developments depending on the findings. Impacts are examined under two categories, i.e., negative environmental impacts and positive environmental impacts. The various impacts in these two categories are then examined in order of their level of importance and significance. They are also examined in categories of their time of occurrence (construction or operation phase).

For impact identification a checklist was employed to identify possible impact from the project development and a matrix to determine the significance of each identified impacts. A questionnaire with structured questions was used to get public opinions and concerns regarding the project at hand while expert opinion was used in interpreting the acquired information.

21.2. Environmental Impacts Matrix

An environmental impact identification matrix was developed which covered the main anticipated impacts (positive, negative, major, minor, long and short term and any cumulative, synergistic or secondary impacts) of the project. The matrix lists impact types under broad headings with more detailed project specific impact categories. These impacts are divided into the Site Preparation and Construction Phases and Operation Phase of the development. This is shown in the table below**.** It is assumed that mitigation measures will be implemented for all aspects of the development including those for the housing estate and the golf course.

21.3. Environmental impacts analysis criteria

Criteria for overall environmental impacts analysis	
Classification Criteria	Types of impact; causes and definitions
Character	Positive impacts: They represent environmental benefits; e.g. sanitation or recovery of degraded areas. Negative impacts: they cause harm or deterioration to a component or global environment.
Cause – effect relationships	Primary impacts: Usually placed directly and often associated with the construction, operation, and maintenance of a facility or activity. They are obvious and quantifiable. Secondary impacts: They are indirect or induced changes that could occur subsequently or in different places as a result of the implementation of the action.
Time of occurrence	Latent impact: it occurs some time after the beginning of the activity that caused the impact. Immediate impact: it is manifested at the beginning of the proposed activity. Critical time: period during which the highest degree of impact takes place.
Interrelationship of actions with alterations	Simple impact: it is manifested on a single environmental component, without inducing new alterations, accumulation, or synergy. Cumulative impact: it results from past, present, and reasonably expected future actions.
Extension	Specific impact: it produces a localized alteration. Partial impact: it implies an appreciable incidence in the area under study. Extreme impact: it is identified in a large part of the land area. Total impact: it is present throughout the environment under study.
Persistence	Temporary impact: it implies a non-permanent alteration and is usually brief Permanent impact: it entails an indefinite alteration.
Recovery capacity of the environment	Irrecoverable impact: it impedes environmental recovery. Irreversible impact: those that make it impossible or extremely difficult for the environment to revert to its original condition.

	Reversible impacts: those that allow a measurable recovery of the environment in short, medium, or long term due to natural process Fugitive impacts: those that allow immediate recovery once the activity is over, and do not require mitigation practices.

Overall Environmental Impacts Appraisal Criteria

Criteria Used to evaluate

Character (positive, negative, or neutral; the latter is the one below the acceptable threshold according to environmental regulations).

Level of disturbance in the environment (significant, regular, or limited).

Importance from the point of view of natural resources and environmental quality (high, medium, and low).

Risk of occurrence (very probable, probable, unlikely).

Extension of the area or land involved (regional, local, specific)

Duration (permanent throughout the project, average or during the project operation and short or during the project construction stage).

Reversibility to return to initial conditions (reversible if human assistance is not required, partial if human assistance is required, and irreversible if a new environmental condition needs to be generated).

Impact Classification (Positive impacts ranked from 1-5 = low to high: Negative indicated by –ve sign)

	Positive$^{(1-5)}$	Negative $^{(-1 \text{ to } -5)}$	Score	Overall assessment
Character	High^{4}	Unlikely $^{-1}$	3	Positive
Disturbance (D	Important$^{(2)}$	Regular$^{(-1)}$	1	Positive
Significance (S	High$^{(5)}$	Medium$^{(-2)}$	3	Positive
Occurrence (O)	Very Probable$^{(3)}$	Probable$^{(-1)}$	2	Positive
Extension (E)	Regional$^{(3)}$	Local$^{(-1)}$	2	Positive

Duration (D)	Permanent(3)	Average(-1)	2	Positive
Reversibility (R)	Irreversible(3)	Partial(-1)	2	Positive
TOTAL	23	-8	15	Positive

Impact Appraisal = C X (D + S + O + E + D + R)

Overall assessment CX = 15: Positive impacts outweigh negative by the ration of 23:8. The project is highly positive on environmental considerations

Interpretation of Impact analysis	
Negative(-)	
Severe	> (-) 15
Moderate	(-) 15 > (-) 9
Compatible	< (-) 9
Positive (+)	
High	> (+) 15
Medium	(+) 15 > (+) 9
Low	< (+) 9

22. Alternatives to the project

This section examines alternatives to using the land as proposed for construction of holiday homes, golf course, hotel, school, hospital and considers the possible environmental and social impacts each of the alternatives would have. The impacts of each alternative will be identified, discussed and compared with those of this development proposal.

22.1. No Project Alternative

No project alternative would mean that the site remains used as it is now, where the land has old abandoned coffee plantation. With coffee prizes fluctuations the previous owners of the land had to abandon the coffee plantation. In such a situation it is only wise to find an alternative land use. Use of the land as proposed in this project will create a variability of the common land use and will obviously benefit more people with decent houses in a secure place.

22.2. Alternative to site

Currently this is the site that the proponent has been able to acquire in the region and therefore there is no alternative site to implement the project. The location of the land is considered by the proponent to be appropriate for the proposed development. The proponent finds no reason to look for an alternative site. The residents of the area have shown an overwhelming support for the project and are eagerly looking forward for the development.

22.3. Alternative design, layout and technology

All designs made for this project have been done professionally taking into account the topography, soil types and structure and with all environmental considerations to make sure that the developments do not negatively affect the surrounding environments and the people in the area. The architectural designs, structural engineering of the proposed buildings and roads are specially designed and the construction will use modern technologies that are in accordance to sustainable development and green economy.

The project lay out has been done in the most economical design utilizing the topography and the landscape. Areas with depressions will be used as water reservoirs and recreations for water

sports. Areas on very steep slopes will be use for afforestation to preserve the beauty and sceneries of the area. The golf course will be maintained green with a permanent all year round green cover.

22.4. Alternative land use

The proposed land use is considered the most beneficial both economically and environmentally because currently the site is highly degraded through soil erosion. The proposed use of the land will maintain more greenness that is currently in the area. The previous land use was abandoned largely because of being uneconomical. There are no restrictions on how the land can be used in the area. However, since the land has been previously used as agricultural land, the proponent will have to have a change of user approved by the relevant authority.

22.5. The comparison of alternatives

Under the proposed development alternative, the project will create more varied and standard housing stock and would provide employment directly and indirectly to the public. It would provide jobs for the workers during construction. After completion more jobs will be generated during occupation. Under the No Action Alternative, there would be no development at all. There would be no benefits from the site and neither would there be the insignificant environmental impacts. Layout redesign may perhaps give an optimal design and should be explored for optimization of the benefits and environmental enhancement.

Provided the environmental impact mitigation measures are implemented as well as adoption of sound construction management practices, negative impacts will be avoided/ minimized. However, commitments related to development alternative would ensure that potential impacts are minimized to levels of insignificance as envisaged in the ESMP.

23. Environmental Management Plan (EMP)

23.1. Introduction

The proponent of the proposed project acknowledges the fact that the proposed project activities will have some impacts on the biophysical environment, health and safety of its employees, stakeholders, interested parties and socio economic well-being of other members of the public. Thus, the 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 6, 7 and 8 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.

Construction Phase Environmental Management Plan

The necessary objectives, activities, mitigation measures, and allocation of costs and responsibilities pertaining to prevention, minimization and monitoring of significant negative impacts and maximization of positive impacts associated with the construction phase the proposed project are outlined in **Table 6 below**.

Table 6: Construction Phase Environmental Management Plan for the Proposed Residential, School and community centre Development

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
1. Curb project associated conflicts and Lost Time Injuries (LTI) e.g. land ownership disputes.				
Project implementation disputes	Sufficient planning for adequate resources required i.e. financial, personnel and equipment	Proponent & Contractor	Project planning phase	-
	Land transfer agreements should be formalized before the project start as per the laws of the land	Proponent/Government of Kenya and City County Government	Project planning phase	Done
	Community support mobilization and sensitization through consultative forums or questionnaire methods	Proponent & EIA Experts	Project planning phase	Done
2. Minimize extraction site impacts and ensure efficient use of raw materials in construction				
High Demand of Raw material	Source building materials from local suppliers who use environmentally friendly processes in their operations	Project Manager & Contractor	Throughout construction period	
	Ensure accurate budgeting and estimation of actual construction material requirements to ensure that the least amount of material necessary is ordered	Project Manager & Contractor	Throughout construction period	100,000

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Ensure that damage or loss of materials at the construction site is minimal through proper storage.	Project Manager & Contractor	Throughout construction period	80,000
	Use at least 5%-10% recycled, refurbished or salvaged materials to reduce the use of raw materials and divert material from landfills	Project Manager & Contractor	Throughout construction period	0
3. Minimize vegetation disturbance at and or around construction site				
Vegetation disturbance	Ensure proper demarcation and delineation of the project area affected by construction works.	Contractor, Civil engineer & Project Manager	1 month	50,000
	Specify locations for trailers and equipment, and areas of the site which should be kept free of traffic, equipment, and storage	Civil Engineer, Architect and Project Manager	1 month	50,000
	Designate access routes and parking within the site	Civil Engineer, Architect and Project Manager	1 month	500,000
	Introduction of vegetation (trees, shrubs and grass) on open spaces and their maintenance	Architect & Landscape specialist	Monthly to Annually	800,000

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Design and implement an appropriate landscaping programme to help in re-vegetation of part of the project area after construction	Architect & Landscape specialist	2 months	700,000
4. Reduce storm-water, runoff and soil erosion				
Increased storm water, runoff and soil erosion	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 structure will be designed	The Civil Engineer, Mechanical Engineer and Project Manager	1 month	100,000
	Apply soil erosion control measures such as levelling of the project site to reduce run-off velocity and increase infiltration of storm water into the soil.	The Civil Engineer, Mechanical Engineer and Project Manager	1 months	
	Ensure that construction vehicles are restricted to existing graded roads to avoid soil compaction within the project site	The Civil Engineer, Mechanical Engineer and Project Manager	Throughout construction period	
	Ensure that any compacted areas are ripped to reduce run-off.	The Civil Engineer, Mechanical Engineer and Project Manager	2 months	

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Open drains all interconnected will be provided on site	Civil Engineer	Throughout construction period	50,000 per unit
5. Minimize solid waste generation and ensure efficient solid waste management during construction				
Increased solid waste generation	Use of an integrated solid waste management system i.e. through a hierarchy of options: 1. Source reduction 2. Recycling 3.Composting and reuse 4. Combustion 5. Sanitary land filling	Project Manager & Contractor	Throughout construction period	100,000
	Through accurate estimation of the sizes and quantities of materials required, order materials in the sizes and quantities they will be needed rather than cutting them to size, or having large quantities of residual materials	Project Manager & Contractor	One-off	0
	Ensure that construction materials left over at the end of construction will be used in other projects rather than being disposed off.	Project Manager & Contractor	One-off	0

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Ensure that damaged or waste construction materials including cabinets, doors, plumbing and lighting fixtures, marbles and glass will be recovered for refurbishing and use in other projects	Project Manager & Contractor	One-off	0
	Donate recyclable/reusable or residual materials to local community groups, institutions and individual local residents or homeowners.	Project Manager & Contractor	One-off	0
	Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated over time	Project Manager & Contractor	Throughout construction period	–
	Provide facilities for proper handling and storage of construction materials to reduce the amount of waste caused by damage or exposure to the elements	Project Manager & Contractor	One-off	200,000
	Purchase of perishable construction materials such as paints should be done incrementally to ensure reduced spoilage of unused materials.	Project Manager & Contractor	Throughout construction period	0

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Use building materials that have minimal or no packaging to avoid the generation of excessive waste	Project Manager & Contractor	Throughout construction period	0
	Use construction materials containing recycled content when possible and in accordance with accepted standards.	Project Manager & Contractor	Throughout construction period	0
	Reuse packaging materials such as cartons, cement bags, empty metal and plastic containers to reduce waste at the site	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	0
	Dispose waste more responsibly by dumping at designated dumping sites or landfills only.	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	20,000/ month
	Waste collection bins to be provided at designated points on the site	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	20,000/ month
	Private waste disposal company to be contracted to transport and dispose the solid waste from site	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Running educational campaigns amongst employees, e.g. through use of posters, to encourage reuse or recycling of the solid waste	Project Manager, Mechanical Engineer & Contractor	Throughout construction period	
6. Reduce dust emissions				
Dust emission	Ensure strict enforcement of on-site speed limit regulations	Project Manager & Contractor	Throughout construction period	10,000/ month
	Avoid excavation works in extremely dry weathers	Project Manager & Contractor	Throughout construction period	
	Sprinkle water on graded access routes when necessary to reduce dust generation by construction vehicles	Project Manager & Contractor	Throughout construction period	
	Personal Protective equipment to be worn always when at work place	Project Manager	Throughout construction period	
7. Minimization of exhaust emissions				
Exhaust emission	Vehicle idling time shall be minimized	Project Manager & Contractor	Throughout construction period	0

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Alternatively fuelled construction equipment shall be used where feasible equipment shall be properly tuned and maintained	Project Manager & Contractor	Throughout construction period	0
	Sensitize truck drivers to avoid unnecessary racing of vehicle engines at loading/offloading points and parking areas, and to switch off vehicle engines at these points	Project Manager & Contractor	Throughout construction period	0
8. Minimization of noise and vibration				
Noise and vibration	Sensitize construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used.	Project Manager & Contractor	Throughout construction period	0
	Sensitize construction drivers to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas such as churches, residential areas and hospitals	Project Manager & Contractor	Throughout construction period	0
	Ensure that construction machinery are kept in good condition to reduce noise generation	Project Manager & Contractor	Throughout construction period	25,000/ month

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Ensure that all generators and heavy-duty equipment are insulated or placed in enclosures to minimize ambient noise levels	Project Manager & Contractor	Throughout construction period	200,000
	The noisy construction works will entirely be planned to be during daytime when most of the neighbors will be at work.	Project Manager & all site foremen	Throughout construction period	0
	Comply with the provisions of Noise Prevention and Control Rules 2005, Legal notice no. 24 regarding noise limits at the workplace	Project Manager & all site foremen	Throughout construction period	0
9. Minimization of energy consumption				
Increased energy consumption	Ensure electrical equipment, appliances and lights are switched off when not being used	Project Manager & Contractor	Throughout construction period	0
	Install energy saving fluorescent tubes at all lighting points instead of bulbs which consume higher electric energy	Project Manager & Contractor	Throughout construction period	50,000

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Ensure planning of transportation of materials to ensure that fossil fuels (diesel, petrol) are not consumed in excessive amounts	Project Manager & Contractor	Throughout construction period	50,000
	Monitor energy use during construction and set targets for reduction of energy use.	Project Manager & Contractor	Throughout construction period	5,000
10. Minimize water consumption and ensure more efficient and safe water use				
High water demand	Install water conserving taps that turn-off automatically when water is not being used	Project Manager & Contractor	One-off	10-40 % higher
	Promote recycling and reuse of water as much as possible	Project Manager & Contractor	Throughout construction period	2,000
	Install a discharge meter at water outlets to determine and monitor total water usage	Project Manager & Contractor	One-off	2,000
	Promptly detect and repair water pipe and tank leaks	Project Manager & Contractor	Throughout construction period	5000 per month

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Sensitize staff to conserve water by avoiding unnecessary water use	Project Manager & Contractor	Throughout construction period	0
	Ensure taps are not running when not in use	Project Manager & Contractor	Throughout construction period	1,500
11. Minimize release of liquid effluent				
Generation of wastewater	Ensure that liquid effluent generated by construction workers is directed to the existing sewerage treatment plant.	Mechanical Engineer & Project Manager	One-off	15,000
	Conduct regular checks for pipe blockages or damages since such vices can lead to release of the effluent into the land and water bodies	Mechanical Engineer & Project Manager	Throughout construction period	3,000/ month
	Monitor effluent quality regularly to ensure that the stipulated discharge rules and standards are not violated	Mechanical Engineer & Project Manager	Throughout construction period	3,000/ Month
12. Minimize occupational health and safety risks				

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
Approval of building plans	Ensure that all building plans are approved by the Local Authority and the local Occupational Health and Safety Office	Developer	One-off	5,000
Registration of the premises	Registration of the premises under the Occupational Safety and Health Act, 2007 Laws of Kenya is mandatory	Developer	One-off	5,000
General register	A general register should be kept within the facility as stipulated in Sec 122&123 of the Occupational Safety and Health Act, 2007.	Project Manager & Contractor	One-off	0
Posting of abstract of Act, rules and notices	There shall be displayed at prominent places within the site the prescribed abstract of the OSHA and the relevant notices as stipulated in section 121 of the OSHA, 2007.	Project Manager & Contractor	One-off	2,500
Incidents, accidents and dangerous occurrences.	Ensure that provisions for reporting incidents, accidents and dangerous occurrences during construction using prescribed forms obtainable from the local Occupational Health and Safety Office (OHSO) are in place.	Project Manager, Developer & Contractor	Continuous	5,000/ month

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Enforcing adherence to safety procedures and preparing contingency plan for accident response in addition safety education and training shall be emphasized.	The Contractor, Project Manager& Site Safety Officer	Continuous	11,600
Insurance	Ensure that the premises are insured as per statutory requirements (third party and workman's compensation)	Developer	Annually	_
Safety, health and environment (SHE) policy	Develop, document and display prominently an appropriate SHE policy for construction works	Project Manager, Developer & Contractor	One-off	2,300
Health and safety committee	Provisions must be put in place for the formation of a Health and Safety Committee, in which the employer and the workers are represented	Project Manager	One-off	5,500
Sanitary conveniences	Suitable, efficient, clean, well-lit and adequate sanitary conveniences should be provided for construction workers	Project Manager	One-off	9,000
Medical examination	Arrangements must be in place for the medical examination of all construction employees before, during and after termination of employment	Project Manager, Developer & Contractor	Continuous	500 per examination

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
Machinery/equipment safety	Ensure that machinery, equipment, personal protective equipment, appliances and hand tools used in construction do comply with the prescribed safety and health standards and be appropriately installed maintained and safeguarded	Project Manager, Developer & Contractor	One-off	–
	Ensure that equipment and work tasks are adapted to fit workers and their ability including protection against mental strain	Project Manager, Developer & Contractor	Continuous	–
	All machines and other moving parts of equipment must be enclosed or guarded to protect all workers from injury	Project Manager	One-off	–
	Arrangements must be in place to train and supervise inexperienced workers regarding construction machinery use and other procedures/operations	Project Manager	Continuous	5,000 per training
	Equipment such as fire extinguishers must be examined by a government authorized person. The equipment may only be used if a certificate of examination has been issued	Project Manager	Continuous	5,000 per examination

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	Reports of such examinations must be presented in prescribed forms, signed by the examiner and attached to the general register	Project Manager	Continuous	3,000 per examination
Storage of materials	Ensure that materials are stored or stacked in such manner as to ensure their stability and prevent any fall or collapse	Project Manager	Continuous	5,000
	Ensure that items are not stored/stacked against weak walls and partitions	Project Manager	Continuous	_
Safe means of access and safe place of employment	All floors, steps, stairs and passages of the premises must be of sound construction and properly maintained	Project Manager & Contractor	Continuous	_
	Securely fence or cover all openings in floors	Project Manager & Contractor	One-off	_
	Provide all staircases within the premises with suitable handrails on both sides	Project Manager & Contractor	One-off	
	Ensure that construction workers are not locked up such that they would not escape in case of an emergency	Project Manager & Contractor	Continuous	_

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
	All ladders/scaffolds used in construction works must be of good construction and sound material of adequate strength and be properly maintained	Project Manager & Contractor	One-off	_
Emergency preparedness and evacuation procedures	Design suitable documented emergency preparedness and evacuation procedures to be used during any emergency	Project Manager & Contractor	One-off	4,000
	Such procedures must be tested at regular intervals	Project Manager & Contractor	Every 3 months	4,000
	Ensure that adequate provisions are in place to immediately stop any operations where there in an imminent and serious danger to health and safety and to evacuate workers	Project Manager & Contractor	One-off	6,000
	Ensure that the most current emergency telephone numbers posters are prominently and strategically displayed within the construction site	Project Manager & Contractor	One-off	2,000
	Provide measures to deal with emergencies and accidents including adequate first aid arrangements	Project Manager & Contractor	Continuous	5,000

EXPECTED NEGATIVE IMPACTS	RECOMMENDED MITIGATION MEASURES	RESPONSIBLE PARTY	TIME FRAME	COST (KSHS)
First Aid	Well stocked first aid box which is easily available and accessible, should be provided within the premises	Project Manager & Contractor	One-off	5,000
	Provision must be made for persons to be trained in first aid, with a certificate issued by a recognized body.	Project Manager & Contractor	One-off	5,000
13. Ensure the general safety and security of the site and surrounding areas				
Increased Pressure on Infrastructure	Coordinate with other planning goals and objectives for the region	Architect, Project Manager, Contactor and the Developer	Continuous	18,000
	Upgrade existing infrastructure and services, where feasible.	Architect, Project Manager, Contactor and the Developer	Continuous	
Insecurity	Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the construction site.	Security Officer, Project Manager & Police	Continuous	15,000
	Body search the workers on entry, to avoid getting weapons on site, and leaving site to ensure nothing is stolen.	Security Officer	Continuous	

	Ensure only authorized personnel get to the site	Security Officer	Continuous	
	Security alarms will be installed	Security Officer	Continuous	
14. Environmental monitoring of the project				
Environmental concern during the construction phase	Due to the magnitude of the project the proponent will liaise with the environmental consultants throughout the construction phase and ensure that the conditions of approval are adhered to.	Proponent, Contractor and Environmental consultant	Throughout construction phase	

24. Conclusions and Recommendations

The EIA study has established that the proposed development project by Resorts and Cities Limited is a worthy investment by the proponent and broadly with no doubt, will contribute significantly to the improvement of living standards among the investors and by extension spur economic development. This will be achieved through the prior discussed positive impacts namely; growth of the economy, boosting of the informal sector during the construction phase, provision of market for supply of building materials, employment generation, increase in government revenue and optimal use of land.

However, the EIA study has established that the proposed project will also come along with some negative impacts. The negative environmental impacts that will result from establishment of the proposed project which include pressure on the existing traffic and parking facilities, hydrology and water quality degradation, noise pollution, dust emissions, solid waste generation, increased water demand, increased energy consumption, generation of exhaust emissions, workers accidents and hazards during construction, possible exposure of workers to diseases, increased storm water among others can however be sufficiently mitigated.

The proponent of the proposed project shall be committed to putting in place several measures to mitigate the negative environmental, safety, health and social impacts associated with the life cycle of the project. It is recommended that in addition to this commitment, the proponent shall focus on implementing the measures outlined in the EMP as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects. It is expected that the positive impacts that emanate from such activities shall be maximized as much as possible as exhaustively outlined within the report. These measures will go a long way in ensuring the best possible environmental compliance and performance standards.

It is our recommendation that the project be allowed to go on provided the mitigation measures outlined in the report are adhered to, Environmental Management Plan (EMP) is implemented and the developer adheres to the conditions of approval of the project.

25. References

1. Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009, Government Printer, Nairobi
2. Kenya Gazette Supplement Acts 2000, Environmental Management and Coordination Act Number 8 of 1999. Government printer, Nairobi
3. Kenya Gazette Supplement Acts Building Code 2000, Government Printers, Nairobi
4. Kenya Gazette Supplement Acts Local Authority Act (Cap. 265), Government Printers, Nairobi
5. Kenya Gazette Supplement Acts Penal Code Act (Cap.63) Government Printers, Nairobi
6. Kenya Gazette Supplement Acts Physical Planning Act, 1999, Government Printers, Nairobi
7. Kenya Gazette Supplement Acts Public Health Act (Cap. 242) government printer, Nairobi
8. Kenya Gazette Supplement Acts Water Act, 2002, Government Printers, Nairobi
9. Kenya Gazette Supplement Number 56. Environmental Impact Assessment and Audit Regulations 2003, Government Printers, Nairobi
10. Kenya Gazette Supplement Number 57, Environmental Management and Coordination (Controlled Substances) Regulations, 2007, Government printer, Nairobi
11. Kenya Gazette Supplement Number 68, Environmental Management and Coordination (Water Quality) Regulations, 2006, Government printer, Nairobi
12. Kenya Gazette Supplement Number 69, Environmental Management and Coordination (Waste management) Regulations, 2006, Government printer, Nairobi
13. Noise Prevention and Control Rules 2005, Legal Notice no. 24, Government Printers, Nairobi
14. Pollution prevention and abatement handbook – Part III, (September, 2001)
15. World Bank (1991), Environmental Assessment sourcebook volume I: Policies, procedures and cross-sectoral issues. World Bank, Washington.

26. Appendices

The following documents or plans are attached as appendices to this document

1. Water treatment Plan
2. Wetland Management Plan
3. Proposed type houses
4. Land title Deeds
5. Information on Change of User
6. Copy of receipt of payment to NEMA